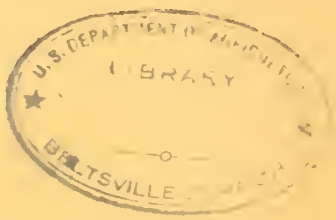
...CHANGES IN

American Farming

By SHERMAN E. JOHNSON • Bureau of Agricultural Economics



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PREFACE

This study was undertaken in the belief that a first requisite for intelligent action on our peacetime production problems is an understanding of the nature and strength of the forces that have shaped the course of agricultural production in recent years. These forces will continue to influence production in the years to come. But new forces will be injected. Some of these are already on the horizon—the mechanical cotton picker is an example. Others cannot be foreseen. But constant change must be expected; and agriculture must adapt itself to changes that are inevitable and, for the most part, desirable.

The revolutionary changes in farm production since World War I are not reversible. Policies developed for the present and for the prospective production situation, therefore, should reflect recent developments and those that can now be foreseen. They cannot be fashioned from the pattern that prevailed before the age of mechanical power and before other fundamental changes had taken place.

The background data used for this analysis are largely the statistics contained in the crop and livestock reports and other production releases of the Bureau of Agricultural Economics.

Many workers participated in this study. Several reports were issued that deal with changes in specific commodities, or with other phases of changes in farming. Basic to this summary report is the special study reported in Farm Production in War and Peace, by Glen T. Barton and Martin R. Cooper, issued by this Bureau. Others who worked on specific parts of the study are: Neil W. Johnson, C. W. Crickman, Carl P. Heisig, E. L. Langsford, Donald B. Ibach, Olav Anderson, R. D. Jennings, S. W. Mendum, E. G. Strand, Weber Peterson, W. D. Goodsell, R. W. Jones, J. R. Ferrell, E. R. Ahrends, L. Jay Atkinson, R. W. Hecht, A. P. Brodell, K. L. Bachman, and Della E. Merrick who assembled and helped to prepare materials for the entire project. Paul L. Koenig, R. K. Smith, and the late J. B. Shepard were especially helpful in appraising background data.

Changes in American Farming

By Sherman E. Johnson, *Assistant Chief, Bureau of Agricultural Economics*

CONTENTS

SIGNIFICANCE OF RECENT CHANGES

RECORD FARM OUTPUT

Farmers in the United States achieved a remarkable production record in the war years. The increase in total farm output from 1935–39 to 1944 was twice as large as during the entire period from 1919–23 to 1935–39. This was accomplished without significant expansion in the acreage of cropland, and despite scarce supplies of labor, machinery, and farm materials. The high level reached during the war has been maintained in the early postwar years, and the 1948 output was an all-time record.

The output of farm products available for human use for the three full war years 1942–44 averaged 128 percent of the prewar years 1935–39. In 1946 the level was 133 percent of prewar. Despite a short corn crop the output in 1947 averaged 129 percent of prewar. If the corn crop had been as large as might have been expected with average weather the total output in 1947 would have been about 132 percent of prewar. With a bumper corn crop in 1948 farm output reached the record total of 140 percent of 1935–39 (fig. 1, p. 2).[1]

This increase in output constitutes an unprecedented break from previous trends. Usually, changes in farming develop very slowly. They are often unnoticed until the record over a period of years is examined. Even such major innovations as the tractor and complementary machines adapted for mechanical power were introduced so gradually that they escaped special attention until their cumulative effects became unusually pronounced.

Sometimes extremely favorable or unfavorable weather brings large year-to-year changes in production. For example, 1934 was a year of catastrophic drought, and farm production was much lower than in the preceding years. In 1942, growing conditions were unusually favorable. In fact, consistently good weather was experienced in the three war years 1942–44 compared with the average of the years 1935–39. But those prewar years reflect weather conditions that were less favorable to farm production than is the expectancy over a period of years. And although weather factors were more favorable in 1942–44 than longer-time expectancy, other forces were responsible for most of the increase in production.

Considering the average of the years 1942–44, it appears that about one-fourth of the total increase in production can be accounted for by weather conditions that were more favorable than in the prewar years 1935–39. This means that with normal weather farm output in 1942–44 would have averaged about 120 percent of 1935–39.

Obviously then, only a rather small part of the wartime increase in production can be explained by favorable weather. And it follows that average weather alone would not bring a return to prewar production levels. Extremely unfavorable weath-

[1] For a detailed explanation of how this index measure of physical production is constructed see Glen T. Barton and Martin R. Cooper, "Farm production in war and peace," U. S. Bur. Agr. Econ. F. M. 53, 85 pp., illus. 1945. [Processed.] (Supply exhausted.)

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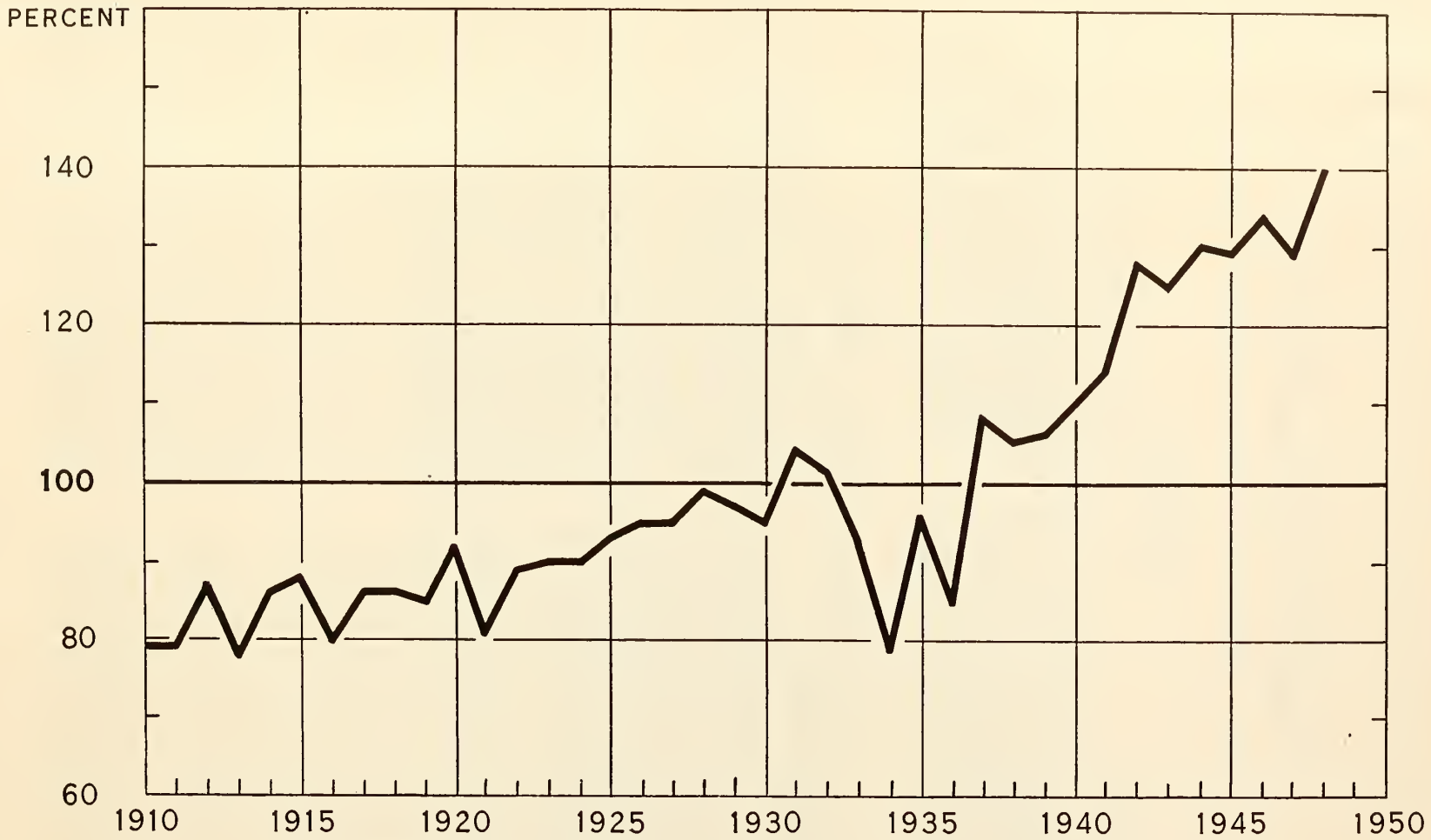


FARM OUTPUT MEASURES PRODUCTION OF PRODUCTS FOR HUMAN USE
DATA FOR 1947 AND 1948 ARE PRELIMINARY.

FIGURE 1.—FARM OUTPUT, UNITED STATES, 1910–48. (INDEX NUMBERS 1935–39=100.)

Farm output in the war years 1942–44 was 28 percent higher than in the prewar years 1935–39. The output in 1948 was 40 percent above prewar.

er would reduce output temporarily. But agriculture experienced a production revolution during the war years, and a large part of the change is irreversible. It will persist under peacetime conditions. To understand what has taken place it is necessary to analyze what happened in the war and early postwar years, to compare this experience with the record in World War I, and to trace the foundation for production increases that was laid in the interwar years.

THE WAR YEARS

COMBINATION OF FORCES BACK OF HIGHER OUTPUT

War and wartime needs for food, and the doubling of the prices received by farmers for their products, furnished the driving force for increased production, but a combination of favorable physical circumstances made the large-scale increase possible. Potential production capacity had been built up over the several years previous to the outbreak of World War II. This increased capacity had its origin in several factors, and each contributed to the higher wartime output. By a fortunate conjuncture of circumstances widespread progress in mechanization, greater use of lime and fertilizer, cover crops, and other conservation practices, use of improved varieties, a better balanced feeding of livestock, and more effective control of insects and disease, had all gathered momentum over the several years preceding World War II. Their current effects were obscured by the drought and depression of the 1930's, but developments had reached a stage where these improvements could be effectively combined and used in an all-out production effort. The result was an unprecedented increase in output.

The joint effects of these technological improvements on the volume of production may be illustrated by comparing them with the effects of the flow of water in its several tributaries on the water level of a large river. If water rises to flood stage in one of the tributaries this will, of course, increase the water level in the main stream, but if the tributary is small the effect may be scarcely noticeable when its flood reaches the main channel. Similarly, the effect of single improvements in farm production, that are important by themselves, are scarcely perceptible in their effect on total production. But if all the tributaries of a large river reach flood stage at the same time, the water in the main channel also rises to flood stage, and the change in the water level does not escape notice. In a sense this is the effect that adoption of the accumulation of technological improvements had on farm production in the years of World War II.

But one might make the comparison somewhat differently, and more correctly, by saying that the production-increasing potentialities of improvements that were made over a decade, and that normally would have been diverted gradually into the production stream, were held back by the drought and depression of the 1930's. It was the breaking of these restraints that caused the flood of production in the war years—in the same way that a simultaneous breaking of dams on several tributaries will cause a river to reach flood stage from water that was accumulated from a normal flow at the source.

ACCUMULATION OF POTENTIAL CAPACITY

As this accumulation of potential production capacity had escaped notice, the increase that was achieved was much larger than could have been forecast from past trends. It was much greater than the expansion that took place in World War I, because there was no similar accumulation of potential improvements at that time. Perhaps none familiar with the South would have been so rash as to forecast, in the fall of 1941, that the acreage of peanuts picked and threshed in 1942 would be 177 percent of 1941, and that production for the years 1942–44 would average 175 percent of 1935–39. Likewise, none from the Corn Belt would have dared to forecast in 1941 that the production of soybeans harvested for beans in the years 1942–44 would be 338 percent of the production in 1935–39. Figure 2 shows the average 1942–44 production compared with prewar for some products in which major changes occurred. An optimistic advance estimate of wartime production probably would have averaged less than half of the increase that actually was achieved.

Mechanization was one of the most influential factors back of the increased output of farm products. The number of tractors on farms had gradually increased from less than 250,000 in 1920 to nearly 2,500,000 in 1945. Use of mechanical power and complementary equipment usually means more total production, but its most important effect is that a much larger share of the product goes to market. As mechanical power is substituted for draft animals, the land formerly used for horse and mule feed becomes available for producing commodities for human use. The shift to mechanical power from 1918 to 1945 made available about 55,000,000 crop acres, or about 15 percent of the available cropland, for the production of marketable commodities. In World War I this large area of cropland and millions of acres of pasture had to be used for producing feed for horses and mules.

Greater use of fertilizer and lime was another influential factor in stepping up farm output.

Measured in plant nutrients (N,P_2O_5, K_2O), the total consumption of commercial fertilizer in 1945 was 95 percent above the quantity used in the prewar years, 1935–39. Application of liming materials was more than three times as large as in the prewar years. Based on estimates of additional output from increased use, it appears that the increased production resulting from the additional use of lime and fertilizer in 1945 accounted for about 15 percent of the total increase in output since 1935–39.

Crop improvements were another notable source of increased output. Use of hybrid seed increases the yield expectancy of corn about 20 percent.

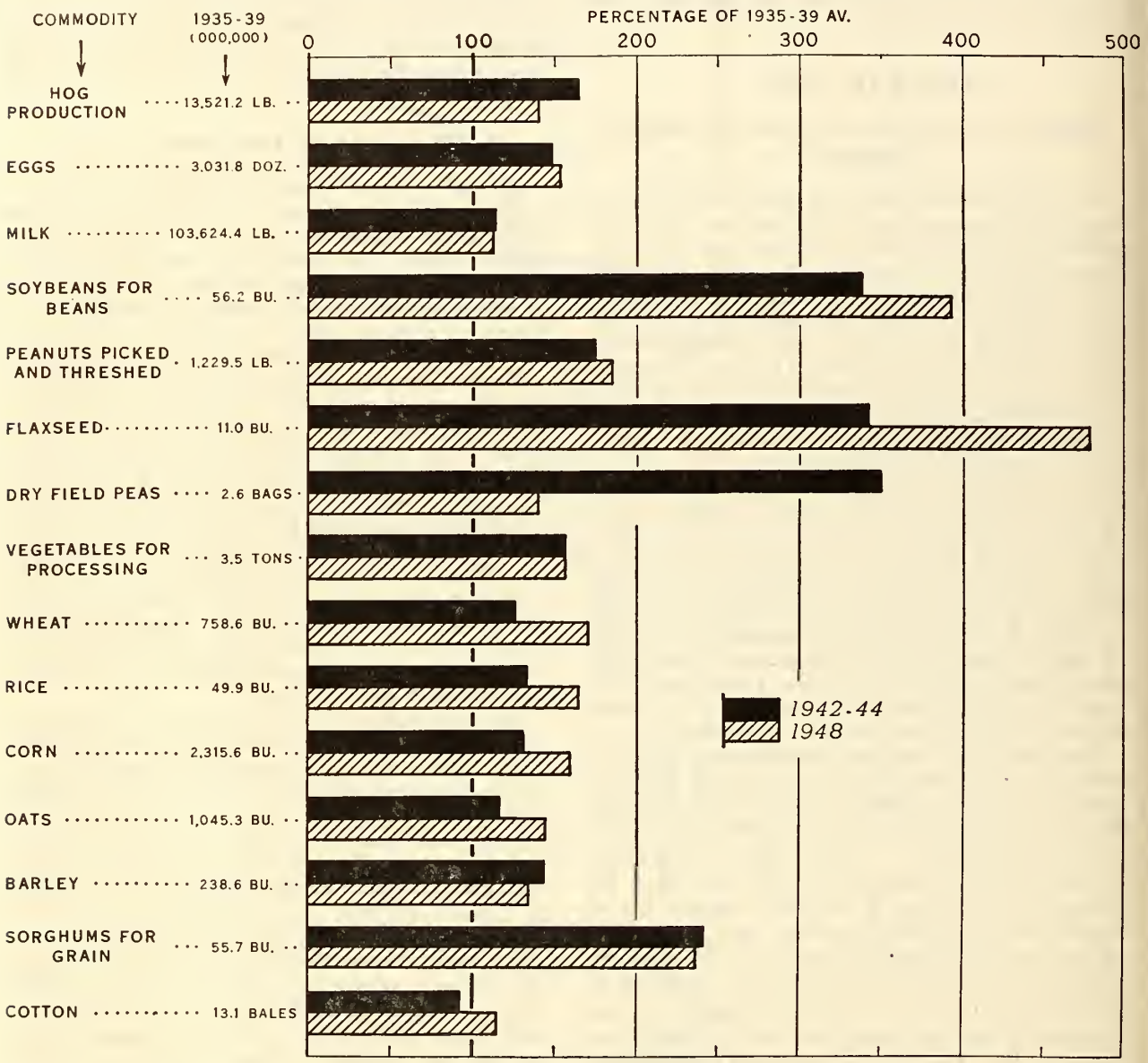


FIGURE 2.—PRODUCTION OF SELECTED AGRICULTURAL COMMODITIES IN THE UNITED STATES. PREWAR (1935–39 AVERAGE) AND WARTIME (1942–44 AVERAGE) AND 1948.

Production of nearly all the principal agricultural commodities increased in the war years. The sharp advances in oil crops reflect responses to the acute need for fats and oils. The phenomenal increase indicated for dry field peas is of less over-all importance than some of the smaller percentage increases registered from a larger prewar base such as those for eggs and milk. The expansion of wheat production has occurred mostly in the postwar years.

New varieties of oats adapted for use in the Corn Belt and Lake States, and rust-resistant improved winter varieties for the Southern States, were widely adopted in the later war years. Continued progress was made in shifting to the higher yielding and more nutritious legume hays.

Total land used for intertilled crops increased by about 6,000,000 acres, or 4 percent, from 1935–39 to 1944. Meanwhile, the total cropland used for crops increased about 9,000,000 acres, or 3 percent. This is a rather small change and is therefore a minor factor in increased output.

The building up of both livestock numbers and feed supplies in the years immediately preceding the war, and in 1942, made possible larger marketings of livestock and livestock products, especially in 1943 and 1944. Livestock production was increased also by the feeding of accumulated supplies of wheat, and of some imported wheat and feed grains. But feeding of both the accumulated supplies and the larger imports accounted for only about 10 percent of the total concentrates fed to livestock in the year ended October 1, 1944. Thus by far the largest proportion of the livestock output came from current production of grain, forage, and pasture; and from an increase of more than one-half in oilseed meals for livestock feed.

Fortunately there were no major outbreaks of either plant or animal diseases or of insect damage in the years of World War II. That no livestock diseases reached epidemic proportions despite record-breaking inventories of livestock was not only good fortune; it was an indication of the effectiveness of modern control methods, and of the vigilance of both farmers and technicians in controlling sporadic outbreaks. Insect damage was held to low levels despite shortages of such important insecticides as rotenone and pyrethrum.

With financial and patriotic incentives as encouragement, and with education and persuasion centered on virtually all-out production of strategic products, farmers and their families worked long hours and often utilized, to the best of their knowledge, every possible means of increasing output. Their efforts bore fruit so well that, even though about one-fourth of the food output went to military and other war-emergency uses, there was food enough in 1944 and 1945 to provide our civilians with a per capita food consumption 12 to 14 percent higher than took place in the prewar years, 1935–39. In somewhat different terms, the output of food in 1944 was enough to feed about 50,000,000 more people than were fed by the average quantity produced in 1935–39, assuming the same dietary levels for both periods.

UNFAVORABLE FACTORS MINIMIZED

That more people could be fed resulted partly from a change in the production pattern—more oil crops, beans, and peas, and less cotton—and from a more complete utilization of the output. But the shifts in production that were necessitated by war needs, made increases in the total volume of production more difficult (fig. 2, p. 4). Production per acre or per animal is usually lowered when a product is grown on land that is less suited for its production, or by growers who have insufficient experience.

The wartime increases in production were achieved with a constantly shrinking labor supply. The total farm population dropped from 30,000,000 in 1940 to 25,000,000 in 1945. In many small farm areas the decrease in farm population represented a correction of under-employment on farms that existed before the war; but in most of the commercial farming areas the result was a labor shortage.

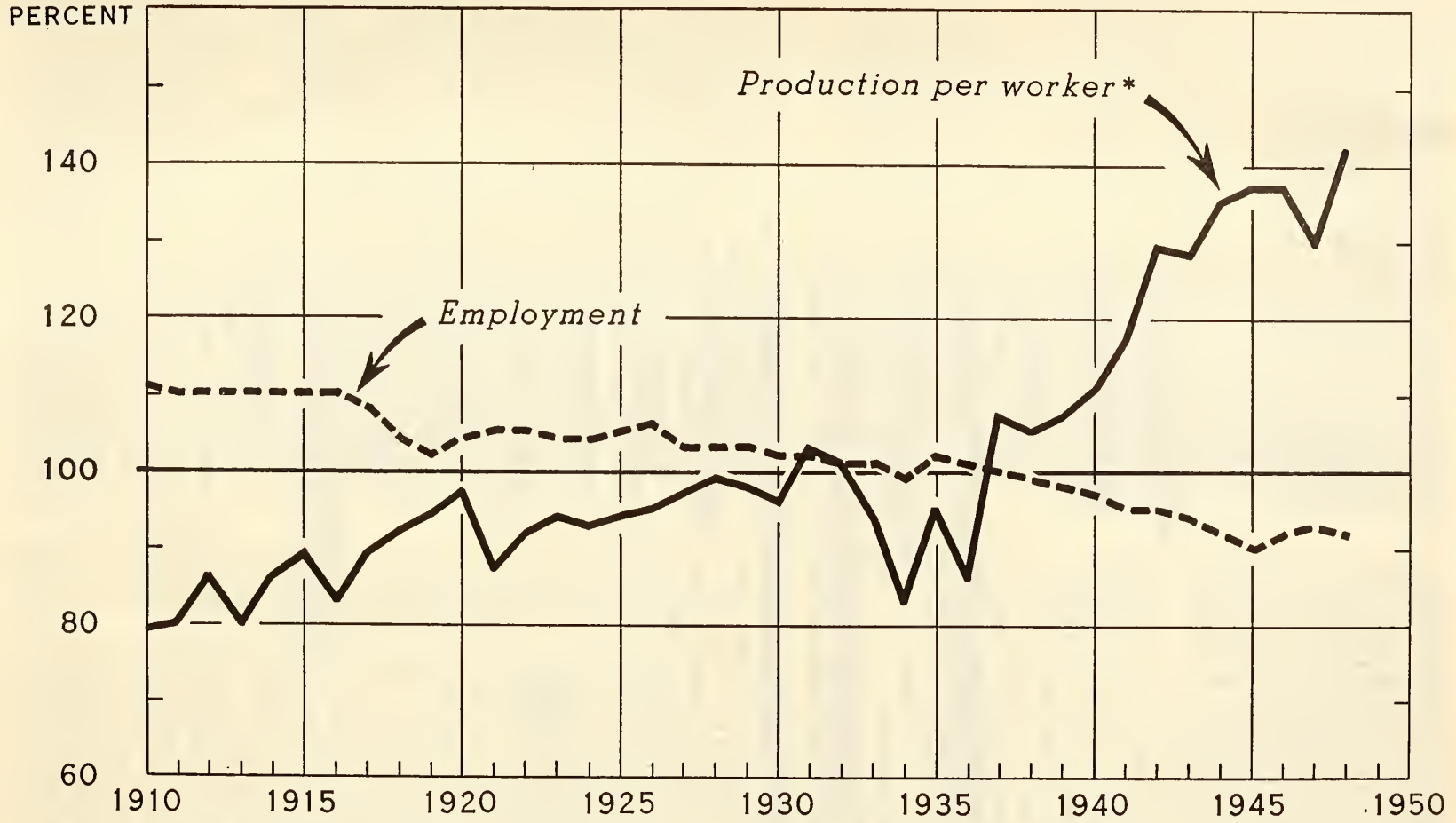
Figure 3, page 6, shows the downward trend in farm employment and the contrasting sharp upward trend in production per worker. In 1944 farmers had 8 percent fewer workers than in 1935–39. Many of the hired workers who were available did not have the strength and skill that are usually considered necessary for farm work. But farmers and their families worked longer hours and, somehow the job was done.

HIGHER PRODUCTION PER UNIT OF RESOURCES

Figure 4, page 7, shows the changes in production per acre in relation to the changes in acreage of total cropland. The effects of all the forces that have resulted in higher production per acre are combined in this index. Similarly, the line showing production per animal unit of breeding livestock, in figure 5, page 8, combines into one summary figure all the forces that have increased livestock production per animal. It shows the trend in production per unit of breeding stock. The shift to mechanical power and the increase in production per acre have made it possible also to increase the number of animal units of productive livestock. Thus the total increase in livestock production is derived both from larger numbers of breeding stock and from the higher output per unit of breeding stock as shown in figure 5. On the other hand, figure 4 shows that increased crop production is largely the result of higher production per acre because changes in the acreage of cropland have been relatively small.

The higher output per acre and per animal, combined with mechanization, made possible the larger output per worker. The three series—production per acre, per animal, and per worker—summarize the startling changes that have taken place in farming since the years of World War I.

During the time that progress in technology has increased output per man so greatly in agriculture, the same phenomenon has occurred in industry.

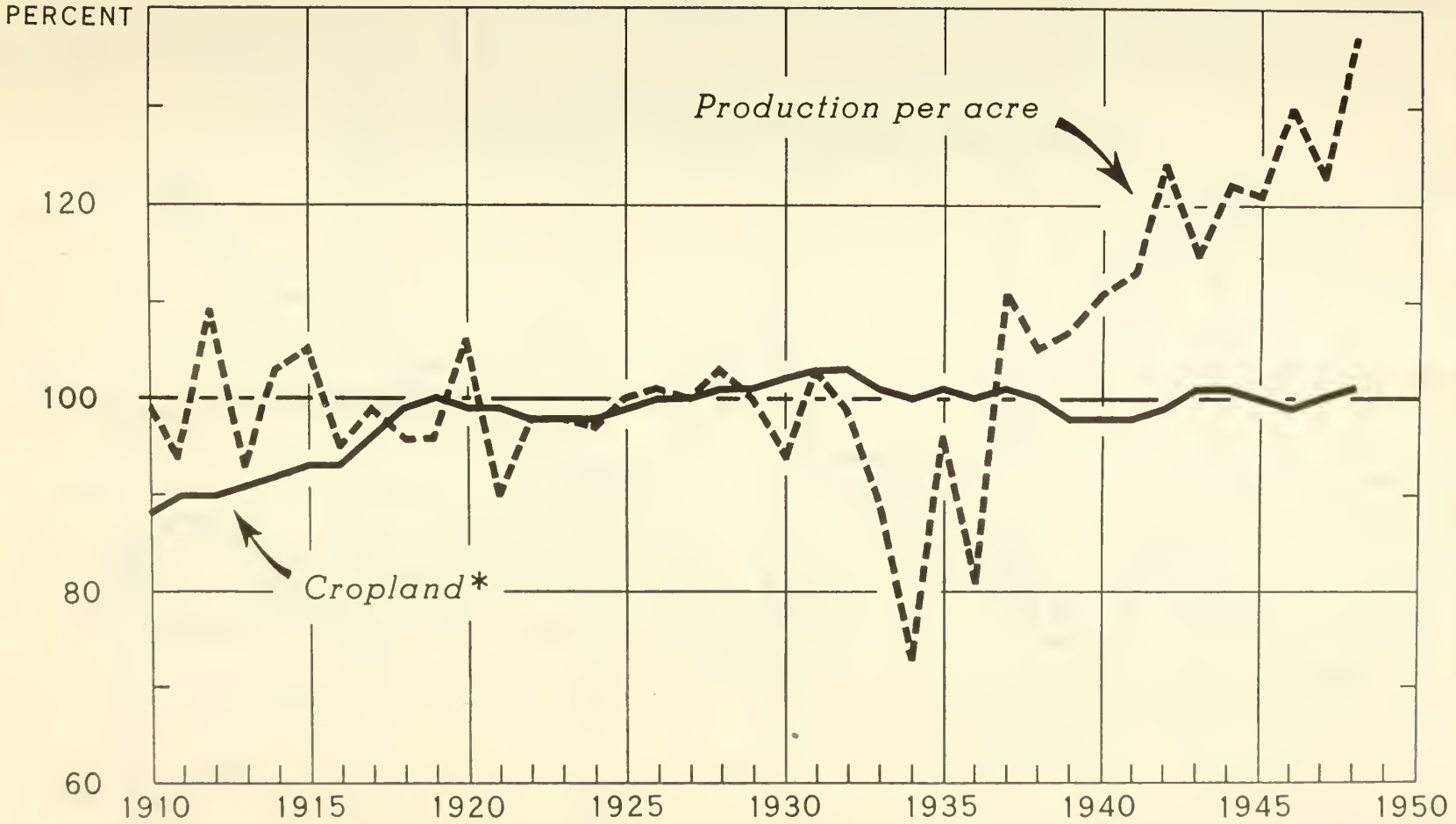


*GROSS FARM PRODUCTION MEASURES THE TOTAL PRODUCT OBTAINED FROM FARM LAND AND FARM LABOR RESOURCES IN EACH CALENDAR YEAR. FARM-PRODUCED POWER, WHICH IS MEASURED BY THE COST IN 1935-39 AVERAGE DOLLARS OF RAISING AND MAINTAINING FARM HORSES AND MULES, IS INCLUDED IN GROSS FARM PRODUCTION BUT IS EXCLUDED IN MEASURING FARM OUTPUT.

DATA FOR 1947 AND 1948 ARE PRELIMINARY.

FIGURE 3.—FARM EMPLOYMENT, AND GROSS FARM PRODUCTION PER WORKER, UNITED STATES, 1910–48. (INDEX NUMBERS 1935–39=100.)

Acceleration during the war of the long-time downward trend in farm employment, coupled with marked wartime increases in farm production, resulted in record levels of production per farm worker.



*TOTAL CROPLAND IS THE SUM OF THE ACREAGE OF LAND FROM WHICH ONE OR MORE CROPS WERE HARVESTED PLUS ACREAGES OF CROP FAILURE AND SUMMER FALLOW

DATA FOR 1947 AND 1948 ARE PRELIMINARY

FIGURE 4.—TOTAL CROPLAND, AND CROP PRODUCTION PER ACRE, UNITED STATES, 1910–48. (INDEX NUMBERS 1935–39=100.)

Increased crop production per acre was by far the most important single factor responsible for record wartime farm production. Total cropland has changed very little during the entire period.

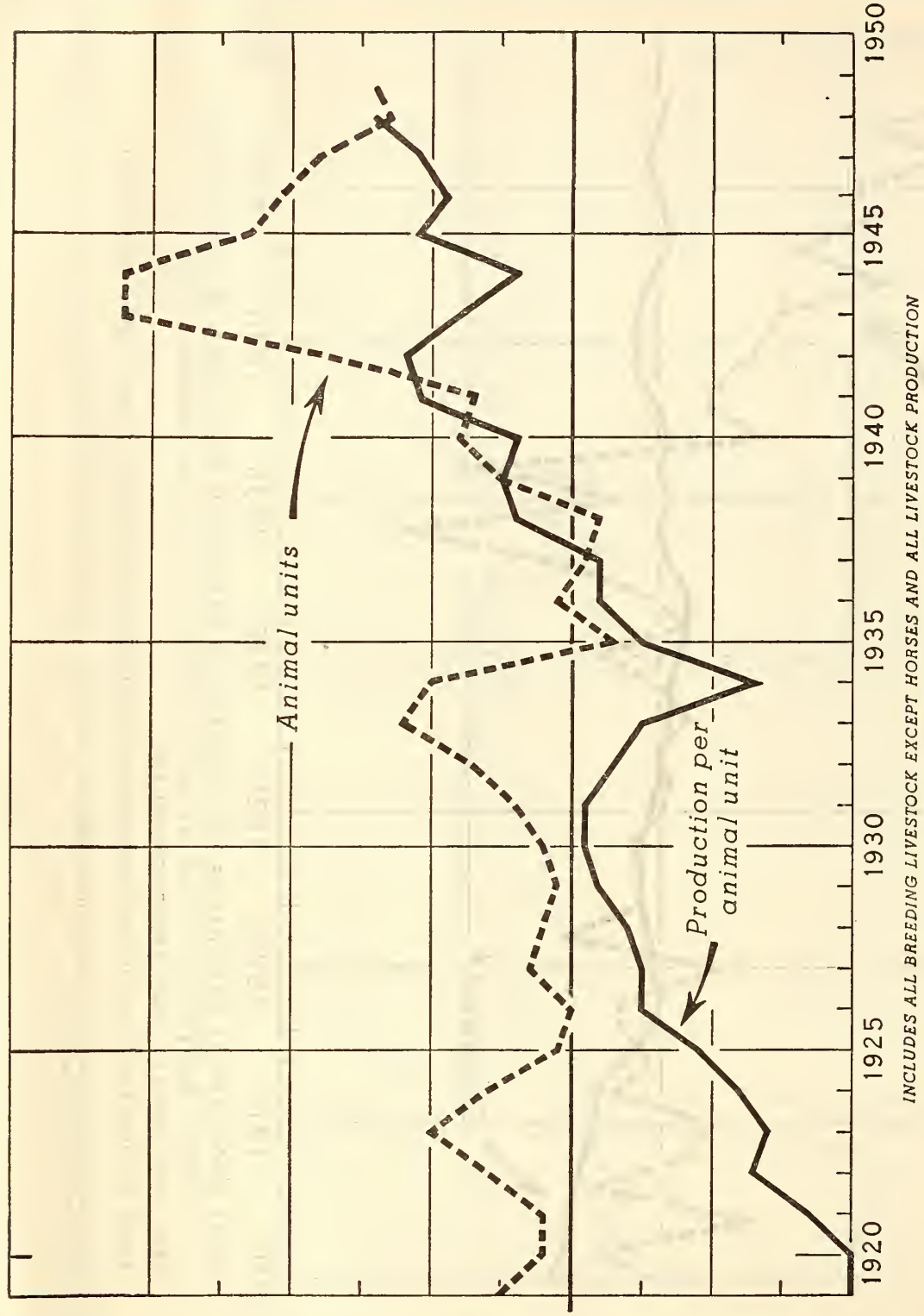


FIGURE 5.—ANIMAL UNITS OF BREEDING LIVESTOCK AND LIVESTOCK PRODUCTION PER BREEDING UNIT, 1919–48. (INDEX NUMBERS 1935–39=100.)

Livestock production per animal unit of breeding stock has shown an upward trend since 1920, and the animal units of breeding livestock also have increased. The larger volume of livestock production therefore has resulted both from increases in number of breeding animal units and in production per unit.

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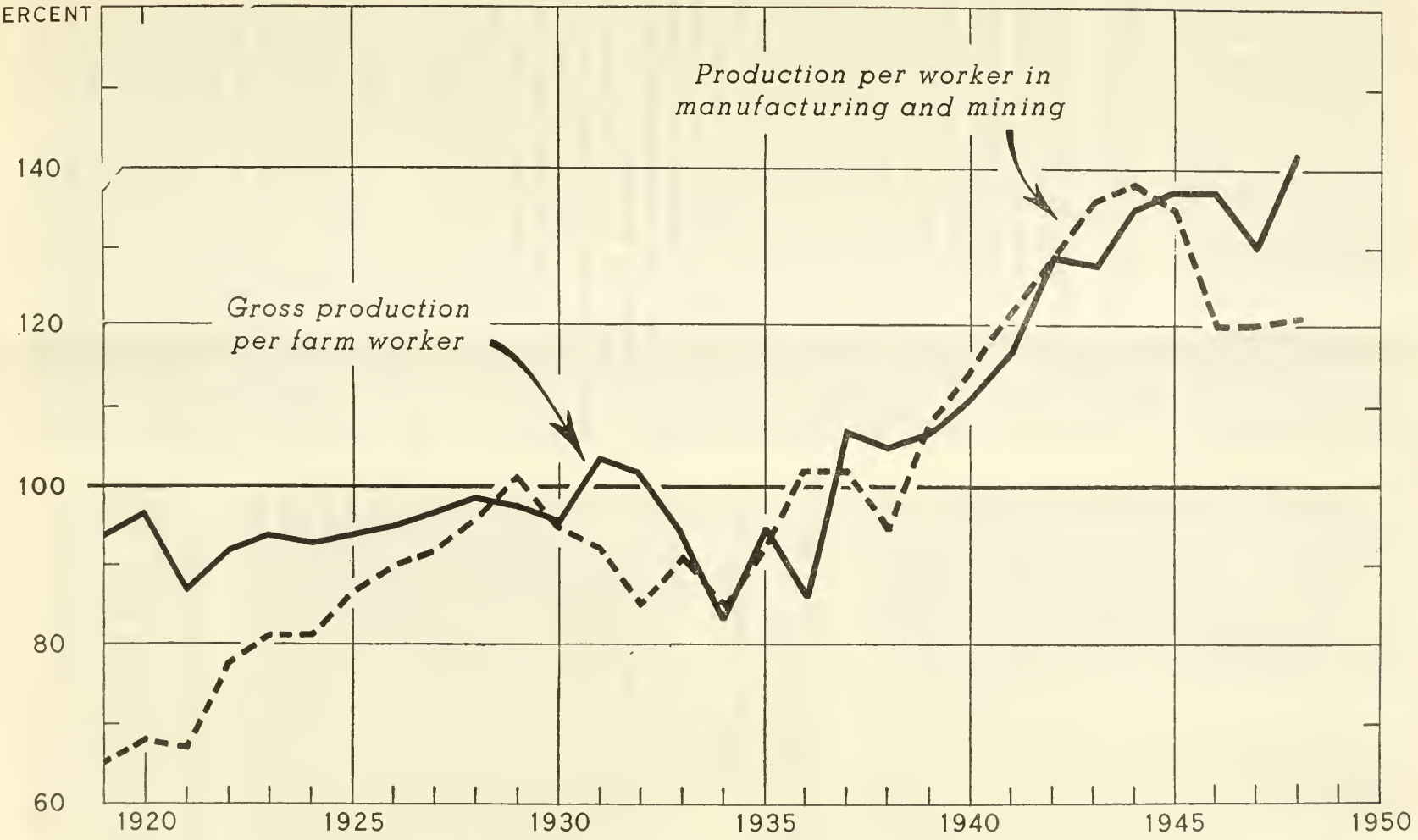

FIGURE 6.—PRODUCTION PER WORKER IN INDUSTRY AND AGRICULTURE, UNITED STATES, 1919–48. (INDEX NUMBERS 1935–39=100.)

Increases in production per worker in agriculture matched those of industrial workers during the war, and have remained at a relatively higher level; but production per worker in industry has risen more rapidly than that of farm workers over the last quarter-century.

Figure 6, page 9, shows a somewhat more rapid increase in production per worker in the manufacturing and mining industries than in agriculture over the last quarter-century. But if data were available for the service industries they probably would show a less rapid climb. Increases have occurred in all sectors, however.

This poses a key question for the postwar years. Will peacetime industry and service occupations expand sufficiently to absorb at satisfactory wage levels (1) the workers currently displaced by technological progress in both agriculture and industry and (2) the net supply of new workers (after allowing replacements for death and retirement) that enter the labor market each year? This is a crucial question. But before it is discussed in relation to peacetime agricultural production it is necessary to examine our wartime and early postwar records more closely. And first of all, it seems desirable to compare changes that took place in World War II with those of World War I, because production responses were so different despite the similarity of incentives to increase farm output.

WORLD WAR II INCREASES COMPARED WITH WORLD WAR I

WORLD WAR I FOLLOWED PERIOD OF EXPANDING MARKETS

World War I followed a period of expanding agriculture, but the markets for farm products had caught up with the expanded production before that war started in Europe in 1914. The export market had been large and profitable over a period of years, and the increasing population in this country had gradually absorbed a larger proportion of the total farm output. Machinery suitable for use with animal power was fairly well stabilized. Tractors were only in the early stages of adaptation for farm use. Most of the good virgin lands had been occupied before the beginning of the war. Criticisms of the high cost of living with special reference to food and fiber were being heard in the cities. A back-to-the-land movement was advocated by many people. Some of the current literature emphasized the importance of increasing output per acre in view of the fact that little new land was available for settlement and exploitation.[2]

INCENTIVES FOR HIGHER OUTPUT

Prices and income incentives in World War I were favorable to the expansion of output. Taking the years 1910–14 as a base, prices received by farmers for farm products in 1918 were 204 percent of those prewar years. By 1919 they were 215 percent. Prices of products bought by farmers also increased during the war, but at slower rates; and in 1918 and 1919 net incomes to farm operators reached new high levels. But with financial and patriotic incentives similar to those of World War II, and with the need for food just as urgent, the volume of output for human use increased only about 5 percent from the prewar years 1910–14 to 1918–19.

What are some of the reasons for the differences in the increases of production in the two war periods?

Although the most productive virgin lands had been brought into cultivation by the beginning of World War I, some new land was available for exploitation. Harvested cropland increased more than 32,000,000 acres from the years 1910–14 to the years 1918–19. This is more than twice as large an increase in harvested cropland as occurred from the prewar years 1935–39 to the war years 1942–44. It should have resulted in greater output at that time if other factors had been favorable.

The foods receiving most emphasis in World War I were wheat and meat. In World War II there was much less emphasis on wheat until after the end of hostilities, and relatively more on oil seeds, beans, and peas; and on meat, eggs, and dairy products. Many of the products emphasized in World War II were new products on many farms, so increases were somewhat more difficult to achieve than expansion of the products that are normally produced.

In World War I the wheat acreage was expanded to new lands in the drier wheat-producing areas, and it was substituted for other crops on the older lands of the humid areas in the Corn Belt and the Eastern States. The acreage of wheat harvested in the five major Corn Belt States in the years 1917–19 was 129 percent of the 1910–14 figure. A new peak of harvested wheat acreage in the United States was reached in 1919, with 73.7 million acres.

Cattle numbers were at the low point of a cycle before the beginning of World War I in 1914, and steps were taken to encourage expansion of cattle production, both on eastern farms and on the ranges of the Western States. The Forest Service was requested to increase the numbers allowed under grazing permits in the national forests. Under the stimulus of high prices and other incentives, cattle numbers on January 1 increased from a low of 56,000,000 in 1912 to a high point of 73,000,000 in 1918. For World War II the high point in cattle numbers was reached January 1, 1945, with 86,000,000 on farms and ranches. But in comparing the two periods one must recall that the decrease in horse and mule numbers had re-

[2] See SPILLMAN, W. J. SOIL CONSERVATION, U. S. Dept. Agr. Farmers' Bul. 406, 15 pp. 1910.

leased land equivalent to the acreage needed for maintaining 16,500,000 head of cattle and calves.

Hog production was stimulated in World War I, partly by a promise to maintain prices of hogs at a fixed ratio to corn, at Chicago. In 1919 the number of all hogs on farms January 1 had increased 21 percent—from 53,000,000 in 1914 (a low point in the hog cycle) to 64,000,000. In World War II, numbers on January 1 increased 68 percent from 50,000,000 in 1939 to a high point of 84,000,000 in 1944.

Despite the emphasis on wheat and meat in World War I, and the substitution of these products for other products in the farm economy, wheatless and meatless days were proclaimed. Adequacy of basic food supplies remained a critical war problem.

FORCES THAT RETARDED EXPANSION

Weather was not so favorable during the years of World War I as in World War II. The wheat crop of 1916 was reduced by adverse weather and damage by black stem-rust. In 1917 the crop was even smaller than in 1916 because of severe winter killing of winter wheat and of drought in some spring-wheat areas. Carry-over reserves were badly depleted by exports to Allied Nations. The wheat crops were nearly a third larger in 1918 and 1919 than in 1917, but these gains in production became available chiefly after the end of the war.

Although manufacture of farm machinery was not limited by Government order as in World War II—in fact, its manufacture was encouraged until the fall of 1918—mechanical power was still of minor importance. Tractor power contributed only 2 percent of the combined work-animal and tractor-power units on farms, in 1919. Farming principally with animal power meant that much land that now produces marketable products was needed for horse and mule feed, and that reserve power for long hours of field work, and for timeliness of operations, was not available.

Because potash fertilizers had been imported from Germany, there was a serious shortage of this plant nutrient during World War I. The available supply in 1918 was only about one-fourth of that used annually in the immediate prewar years. Nitrogen supplies were also short. In fact, total use of fertilizer was considerably reduced in the early part of that war and, though it increased somewhat in 1918–19, it did not reach the levels of 1914 at any time during those war years.

Plant and animal diseases and insect pests took a proportionately greater toll of potential production in World War I than in World War II. The boll weevil caused extensive damage to cotton in all of the years of the first war. Black-stem rust seriously affected wheat production in 1916. Outbreaks of hog cholera were numerous from 1911 to 1915 and again in 1919.

The situation in World War I as compared with World War II can be summarized in this way. More sod land that could be broken up and put to use was available: but on the intensive side (increases in output per acre and per animal) production was limited by shortage of fertilizer, lack of mechanical power, damage by plant and animal pest and disease, and somewhat unfavorable weather. There were no innovations such as hybrid corn that could be seized upon to increase production quickly. The background of agricultural research was more limited, and organized extension teaching was in its early stages in most States. In other words, the same favorable conjuncture of circumstances for agriculture that prevailed in World War II did not develop in World War I.

It should be emphasized that, aside from weather, all of the physical conditions more favorable to increased production in World War II have grown out of invention and research, and have been spread by the education and operations programs of the interwar and World War II years. The cumulative value of agricultural research and of extension teaching in making possible the increase in farm output in World War II can hardly be overestimated. And the stimulation given by operations programs to conservation practices and increased use of lime and fertilizer must not be overlooked.

THE EARLY POSTWAR YEARS

IMPACTS OF FOOD RELIEF PROGRAMS

The record now includes the first three production years following the end of hostilities. During the first two of these years the pressure on supplies of food grain intensified, and wheat again took first place in meeting the food needs of hungry people. In 1948 both Europe and North America had favorable growing weather. And farmers in Western Europe produced a much larger crop than in 1947. This resulted in a lessening of pressure on available food supplies and in accumulation of stocks of food and feed grains in this country.

In view of the urgency regarding food relief at that time it was fortunate indeed that growing conditions in this country were exceptionally favorable for both food and feed grains in 1946. Wheat and corn production made new records. In 1947 the wheat crop exceeded even the high record established in 1946; the total outturn was 1.4 billion bushels. But the corn crop was nearly a billion bushels smaller than in 1946. The relative shortage of feed grains severely limited livestock production for 1948. But the 1948 corn crop was an all-time record of 3.6 billion bushels, and a

wheat crop of 1.3 billion bushels was the second largest on record.

Farm prices moved upward rapidly in 1947. In January 1948 they were nearly three times as high as in the prewar years 1935–39. After some decline in February and March they recovered nearly to January levels in July 1948. But another drop began in the summer of 1948 and continued without interruption to March 1949. For the year 1948 farm prices averaged 268 percent of 1935–39, which was 42 percent above the level in 1945.

Prices paid for goods and services used in farm production also climbed rapidly in 1946 and 1947. For the year 1948 they averaged 201 percent of 1935–39. This was 47 percent higher than in 1945. There was a slight decline in the summer of 1948, but this was largely the result of lower feed prices. Other production expenses remained at higher levels.

The margin between costs and selling prices was favorable to most producers in 1946 and 1947 and net incomes to farm operators reached successive peak levels in those years. In 1948 the margin became less favorable and net income to farm operators went down for the first time in 10 years. Although the 1948 net income was a little over 2 percent less than in 1947, it was still the second highest on record. It is apparent that income incentives to high-level production were good in the three postwar years 1946–48, and more farm labor was available than in 1945. Supplies of farm machinery and commercial fertilizer were larger than in previous years, although supplies were not sufficient to meet all demands.

POTENTIAL PRODUCTION CAPACITY

Supplies of production goods are now much more plentiful than they were during the war and early postwar years. If income incentives remain definitely favorable, are we likely to see a further increase in output in the next 3 to 5 years? Or are we now on a high plateau with greater prospects of a downward slide than of a further rise? These are vital questions in relation to market outlets for certain farm products. And they become extremely significant if we do not make progress in achieving a stable peace.

The corn crop of 1947 indicates the potential effects of weather on farm output. If we should have a drought comparable to that of 1934 the output might drop as much as 20 percent in any one year. Moreover, such a disaster would necessitate the selling of breeding livestock which would affect output in later years.

Given average weather and sufficient time to make the changes that would be necessary in the farm-production plant, the only practical limit to our farm output would be the labor and capital that we consider profitable to use in agricultural production. In peacetime this depends mainly upon decisions of individual farmers, which in turn are based upon their confidence in continued favorable market outlets for farm products.

Supply problems are emerging in some farm products. The transition toward peacetime production in the next 4 to 5 years seems likely to require changes in the direction of raising less wheat, corn, and soybeans, and more emphasis on hay and pasture, in the interest of conservation and of producing more meat and milk.

FOUNDATION FOR INCREASED PRODUCTION

SIGNIFICANCE OF INTERWAR YEARS

An examination of production changes in the interwar years clearly indicates that the foundation for the wartime and early postwar increases in production was built up in the 20-year period between the two World Wars. It was built on the tremendous improvements that have been made in mechanization, in land use, in conservation, fertility, and cultural practices, in development of new crops and new varieties, and in increasing the efficiency of livestock production.

The cumulative effect on the total volume of production was not realized because of drought and because markets were not available for larger quantities of farm products. We have seen that although farm output increased slowly during the 1920's, it dropped precipitously during the drought of the early 1930's (fig. 1, p. 2). Later, production reached its new peak in 1937 and remained relatively high in 1938 and 1939.

Except for the severe drought years, farmers obviously could have produced more in the 1930's if markets had been available at profitable prices. But despite the brake placed on increases in production by the low prices and resulting crop-adjustment programs, it seems evident that the total volume would have risen sharply in the early 1940's even without the incentive of wartime prices and needs. The production potential was built up in the late 1930's to the point where accelerated increases in production were almost inevitable.

The stimulation of war needs—the patriotic urge to increase production, the doubling of farm prices, and the tripling of net incomes to farmers—pushed production faster and farther than it would have gone under peacetime conditions. But this greater acceleration was physically possible

only because of the foundation that had been laid in the interwar years.

CHANGES IN THE USE OF FARM MACHINES

EFFECTS OF SHIFTS TO MECHANICAL POWER

The rapid shift from animal power to mechanical power for farm production in the interwar period constituted one of the most important changes that has ever taken place in American agriculture. It was a cornerstone in the foundation for increased production.

One result of this change was a transfer of resources from the production of power on the farm to the production of livestock and crops for sale in the market. This transfer released about 55,000,000 acres of cropland for the production of marketable farm products. That, of course, is the most startling effect that mechanization has had on American farms.

But other effects are also striking. The shift to mechanical power and complementary equipment brings an increased output per worker both by enabling him to do the job faster and by doing a better job of tillage or other operation, and in that way realizing more benefit from other improved practices. The physical burden of farm work is lessened because the drudgery of hand labor is eliminated. Fewer workers are needed in farm production. Physical strength becomes relatively less necessary, and mechanical skill becomes more necessary, in the performance of farm work.

CONTRIBUTION TO TIMELINESS IN FARM OPERATIONS

The effects of the greater timeliness in farm operations that is possible by mechanization are difficult to measure, but obviously the result is both greater total production and higher quality of farm products. As power equipment can cover more acres per hour and can be used longer hours if necessary, it has enabled farmers to do critical jobs without the delay that frequently occurred when horse equipment was used. For example, the quick coverage possible in spraying potatoes with a multiple-row power sprayer may salvage a crop that otherwise would be seriously damaged.

Perhaps the best illustration of the contribution of mechanical power to timeliness of operations is the experience in the Corn Belt with unfavorable weather at planting time in each of the years 1943 to 1945 and again in 1947. The spring of 1943 was exceptionally wet, so planting was seriously delayed in many areas. Illinois usually receives 4.10 inches of precipitation in the month of May, but in 1943 it had 8.75 inches that month—more than twice the average rainfall. Rainy weather prevailed throughout the month and so retarded field work that only about 15 percent of the corn had been planted at the end of May, when planting is usually completed.

With a tractor and power equipment 3 acres of land can be prepared and planted to corn during the time that 1 acre is planted with work animals. If the tractor is put on a 24-hour schedule, which is not feasible with work animals, the preparation and planting job can be done seven times as fast as with animal power. By utilizing all available mechanical power and equipment (sometimes on a 24-hour schedule) farmers were able to complete their preparation of land and planting of corn in record time during the early days of June, in 1943. It was estimated that 85 percent of the Illinois corn acreage was planted by June 15.

If tractor power had not been available some of the corn would never have been planted because the job could not have been done before it was too late to obtain a crop that year. Tractor power saved the day and, with favorable weather during the rest of the season, Illinois produced 419,000,000 bushels of corn, one of the largest crops for that State on record.

Weather conditions similar to those experienced in 1943 prevailed in many areas of the Corn Belt in 1944 and again in 1945, yet the yields were large. The late wet spring in 1947 delayed corn planting, but this was followed with a late-season drought, and the combined result was a short corn crop. It is apparent that the contribution to production of greater timeliness is one of the real benefits of mechanization, even though it can scarcely be measured in quantitative terms. But the experience in 1947 also indicates that it does not furnish adequate insurance against drought.

RATE OF PROGRESS IN MECHANIZATION

The rate of adoption of mechanical power and auxiliary equipment has varied considerably in different periods. The number of tractors on farms increased sharply during World War I, despite the fact that these tractors were cumbersome, slow moving, and expensive to operate (fig. 7, p. 14). They were adapted only for the heavy tillage and harvesting and for belt work. Farmers had to keep work animals for other farm operations, which meant a considerable duplication of power. After 1920, the rate of increase in tractors on farms slowed down for 2 or 3 years, until the general-purpose tractor was introduced. That was suitable for the cultivation of row crops and for other farm tasks as well as for the tillage and harvesting work.

This revolution in tractor design, along with improvements that were made in standard wheel tractors and crawler tractors for heavy operations on large farms, brought a considerable spurt in

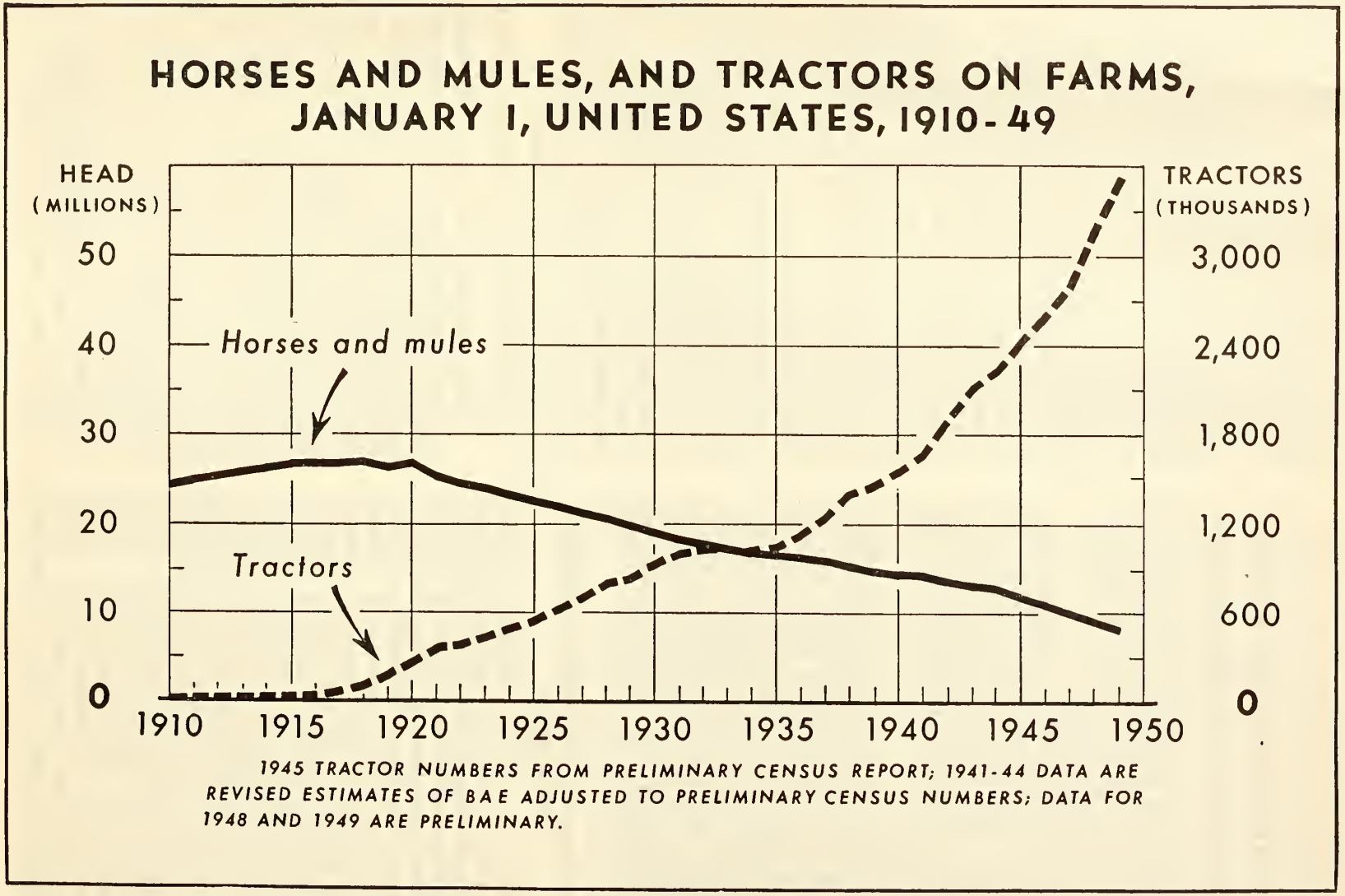

FIGURE 7.—TRACTORS HAVE RAPIDLY BEEN REPLACING ANIMAL POWER FOR FARM PRODUCTION. THE NUMBER OF TRACTORS ON FARMS INCREASED SHARPLY DURING WORLD WAR I AND IN THE 1920'S. THIS TREND WAS INTERRUPTED IN THE DROUGHT AND DEPRESSION YEARS 1931–35, BUT WAS RESUMED IN THE LATE 1930'S AND HAS CONTINUED IN THE 1940'S.

tractor purchases, and a rapid increase in tractors on farms from 1925 through 1930. The numbers increased only slowly from 1930 to 1932 and in the drought and depression years of 1933 and 1934 actually were below the 1932 numbers. With the beginning of the agricultural recovery in 1935, the number increased very rapidly. The sharp upward climb has continued since that time; although war limitations on the manufacture of tractors slowed down the rate of increase, especially from 1943 to 1944. But the numbers on farms increased each year during the war, and on January 1, 1945, they totaled 2,422,000. The estimated number on January 1, 1948 was 3,150,000. The preliminary 1949 estimate is about 3,500,000 tractors on farms.

Introduction of rubber tires for tractors and complementary equipment, during the 1930's, started a rapid and steady advance. It greatly facilitated the use of tractor power for many farm tasks and lowered the cost of tractor operation. Perhaps an even more valuable development in the 1930's was the redesigning of farm machinery for use with tractor power. When tractors were introduced, the machinery that had originally been designed for use with horsepower was adapted to tractors by making special hitches and some other minor changes. The complete changes in design of equipment to facilitate use with tractor power have come only within the last few years.

In summary, the three most important technical developments that stimulated mechanization in the interwar years were: (1) Introduction of the general-purpose tractor adapted for use on smaller farms and for a wide variety of farm jobs, (2) use of rubber tires for tractors and other machines, and (3) design of equipment for use with tractors. These developments accelerated the shift to tractor power and stimulated adoption of combines, corn pickers, and other tractor-drawn machines. Improvements in construction of both tractors and complementary equipment have enabled farmers who are relatively unskilled at mechanical work to operate power equipment without serious disadvantage.

Substitution of tractors for horses and mules has not taken place at uniform rates over the entire country. The rate of adoption has been more rapid in the Corn Belt, the Great Plains, the Mountain, and Pacific States, than in the East and South. Figure 8, page 16, showing the distribution of tractors on farms in 1945, indicates the relatively greatest concentration of tractors in the Midwest and in smaller areas in other parts of the country. Table 1 shows the number of tractors on farms by regions in 1940, 1945, and 1948. The Southern States, excluding Oklahoma and Texas, were far behind the rest of the country in the shift to tractor power up to the beginning of World War II. But purchasing power in the South was built up during that war, and labor shifted heavily to nonfarm work. Both of these developments accelerated the purchase of tractors and complementary equipment. Table 1 shows the consequent upward spurt in tractor numbers in the Southern States from 1940 to 1945 and 1948. In the Southeastern States there were more than 3½ times as many tractors on farms in 1948 as in 1940.

TABLE 1.—*Number of tractors on farms, Jan. 1, 1940, 1945, and May 1, 1948*

Region [1]	Jan. 1, 1940 [2]	Jan. 1, 1945 [2]	May 1, 1948 [3]	Increase 1940–48
	Thousands	*Thousands*	*Thousands*	*Percent*
Northeast	168. 0	283. 1	387. 0	130. 3
Corn Belt	463. 0	667. 2	886. 0	91. 4
Lake States	252. 8	386. 0	486. 0	92. 2
Plains	259. 5	349. 6	444. 0	71. 1
Southeast	29. 4	66. 9	111. 8	280. 3
Appalachian	52. 2	109. 9	163. 2	212. 6
Delta	32. 7	65. 2	104. 0	218. 0
Oklahoma and Texas	144. 3	232. 8	300. 0	107. 9
Mountain	75. 2	120. 5	168. 0	123. 4
Pacific	90. 3	140. 5	200. 0	121. 4
United States	1, 567. 4	2, 421. 7	3, 250. 0	107. 4

[1] Northeast: New England States, New York, New Jersey, Pennsylvania, Delaware, Maryland. Corn Belt: Ohio, Indiana, Illinois, Iowa, Missouri. Lake States: Michigan, Wisconsin, Minnesota. Plains: North Dakota, South Dakota, Nebraska, Kansas. Southeast: South Carolina, Georgia, Florida, Alabama. Appalachian: West Virginia, Kentucky, Tennessee, North Carolina, Virginia. Delta: Mississippi, Louisiana, Arkansas. Mountain: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada. Pacific: Washington, Oregon, California.

[2] U. S. Bureau of the Census. United States Census of Agriculture, 1945, 2 v. Washington, D. C.

[3] Bureau of Agricultural Economics.

Continued rapid shift to tractor power can be expected on southern farms. The new small tractors are well adapted to small farms and rolling land. And farmers are learning how to use power equipment to advantage.

The number of tractors on farms will also increase in other areas. As the tractors increase, the over-age horses and mules will be disposed of. There were only 8.3 million horses and mules of all ages on farms January 1, 1949, compared with 14.5 million in 1940. The colts that are being raised are not enough to maintain horse and mule numbers of working age at present levels. Additional land will be released for growing marketable products.

In considering the importance of mechanical power on farms one must not forget the use of automobiles and motortrucks to speed up the

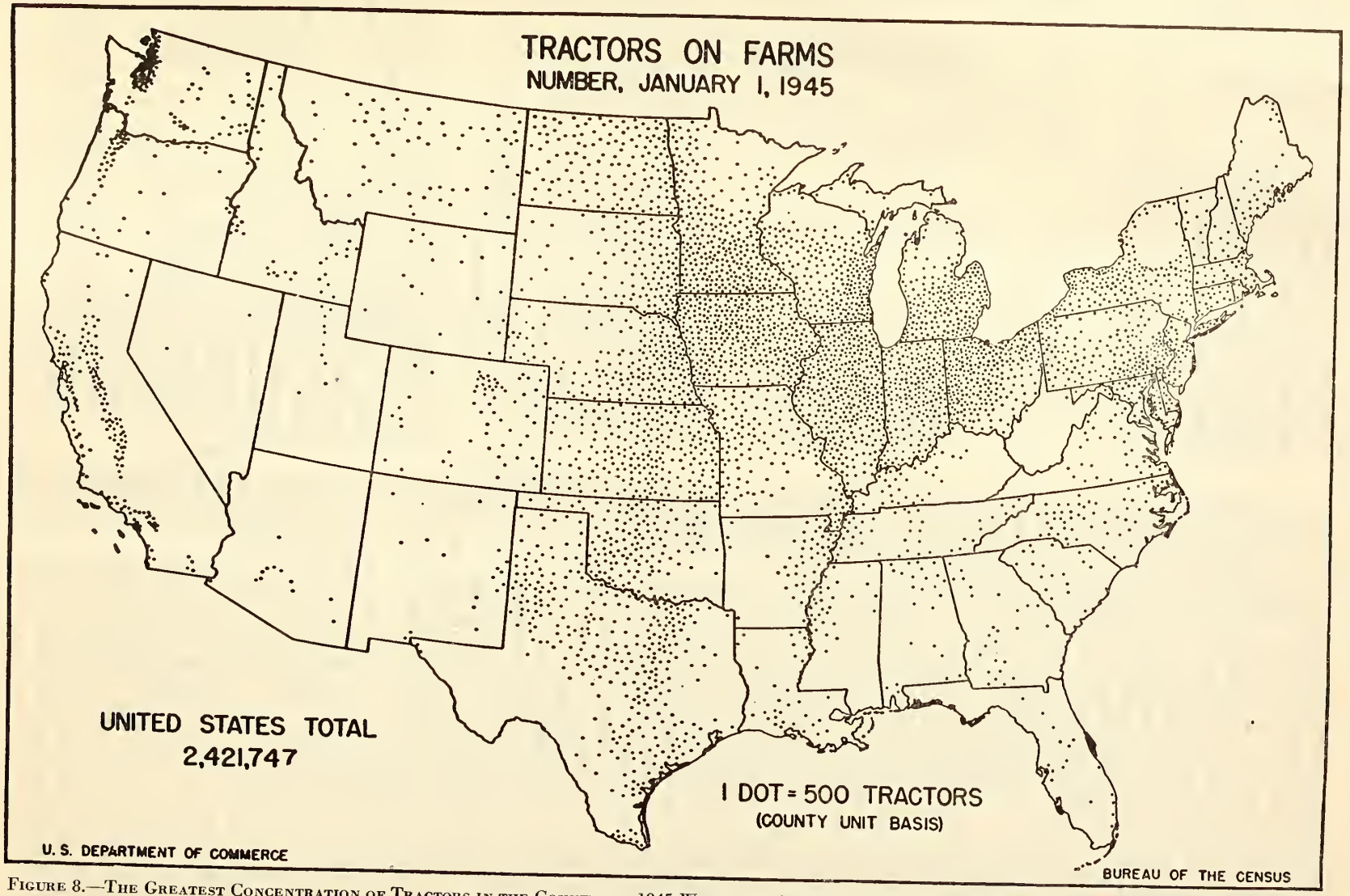

FIGURE 8.—THE GREATEST CONCENTRATION OF TRACTORS IN THE COUNTRY IN 1945 WAS IN THE MIDWEST; SOME SMALLER AREAS IN OTHER PARTS OF THE COUNTRY ALSO SHOWED HEAVY CONCENTRATION OF TRACTORS.

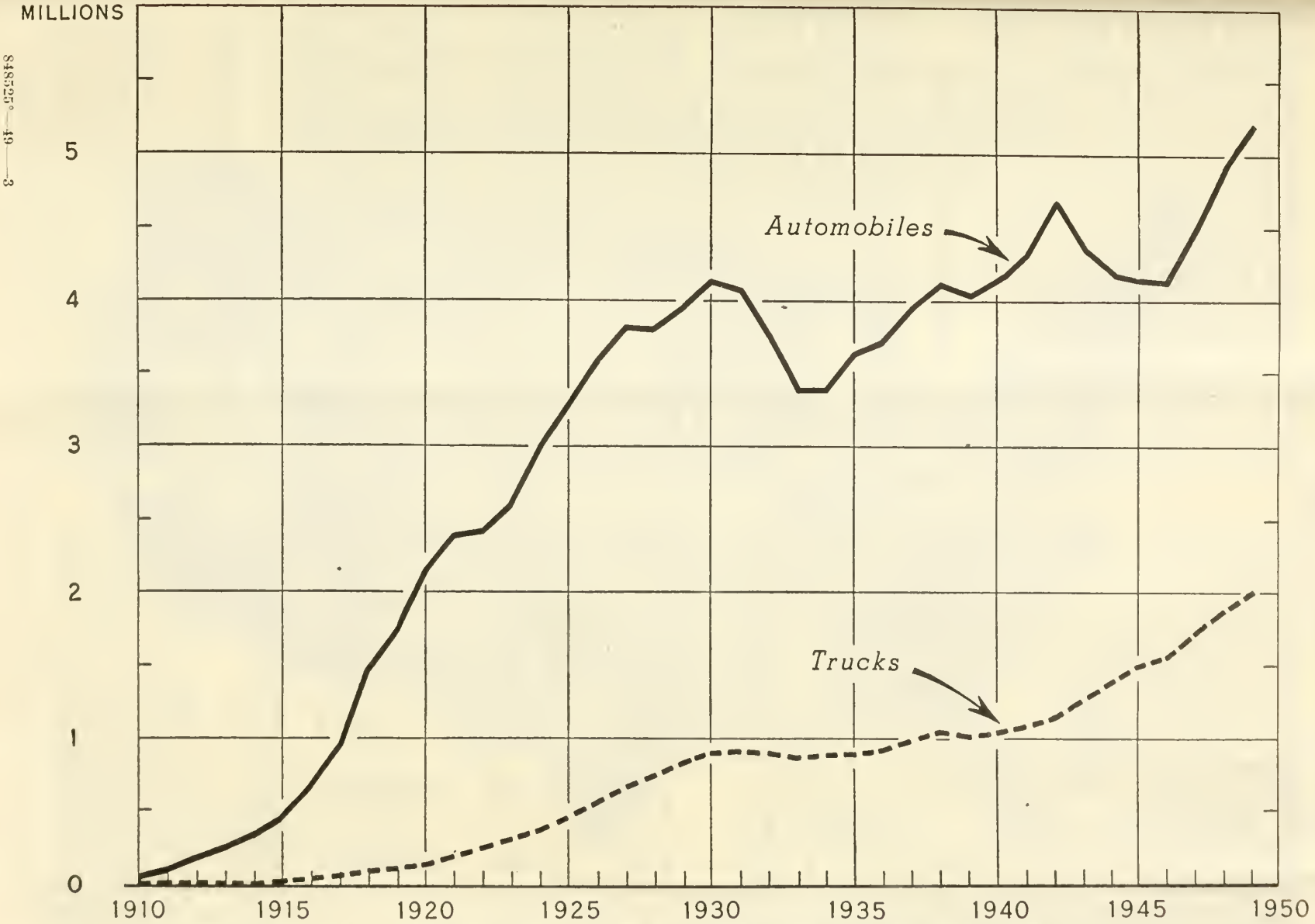

FIGURE 9.—AUTOMOBILES AND TRUCKS: NUMBER ON FARMS JANUARY 1, UNITED STATES, 1910–49.

Automobiles and trucks on farms have increased in the same way as tractors, except for the depression years and for the decline in numbers of automobiles during World War II.

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transportation job both on the farms and from farms to market. Figure 9, page 17, shows the increase in numbers of trucks and automobiles, 1910–49. It is apparent that automobiles and trucks on farms have increased in about the same way as tractors, except for larger dips in the depression years of the early 1930's, and for a shrinkage in the numbers of automobiles during the war.

Wartime scarcity of labor stimulated the attempts by farmers to buy more and more labor-saving equipment. In spite of limitations on the manufacture of tractors and other farm machines there were notable increases in labor-saving equipment on farms during the war. For example, the number of tractors on farms increased 57 percent from 1940 to 1945. In the same period the number of grain combines increased 97 percent; corn pickers, 53 percent; and milking machines, 109 percent (table 2). If more new machinery had been available during the war the process of mechanization would have been more complete, especially in the southern States, and farm output would have gone even higher, or more workers could have been released for war industry.

TABLE 2.—*Number of tractors and other specified machines on farms, United States, Jan. 1, 1910–49*

Year	Farm tractors	Farm motor-trucks	Farm automobiles	Grain combines	Corn pickers	Milking machines
	Thousands	*Thousands*	*Thousands*	*Thousands*	*Thousands*	*Thousands*
1910	1	0	50	1	------	12
1920	246	139	2, 146	4	10	55
1930	920	900	4, 135	61	50	100
1940	1, 545	1, 047	4, 144	190	110	175
1941	[1] 1, 675	[1] 1, 095	4, 330	225	120	210
1942	1, 885	1, 160	4, 670	275	130	255
1943	2, 100	1, 280	4, 350	320	138	275
1944	2, 215	1, 385	4, 185	345	146	300
1945	2, 422	1, 490	4, 152	374	168	365
1946	2, 585	1, 550	4, 150	415	200	465
1947	2, 800	1, 730	4, 520	450	225	580
1948	3, 150	1, 920	4, 930	520	300	640
1949	3, 500	2, 000	5, 250	590	365	685

[1] 1941–44 data are revised estimates of Bureau of Agricultural Economics, adjusted to census numbers; 1945 numbers are from census report; 1946 through 1949 are estimated.

With removal of the wartime limitations on manufacture of machinery farmers stepped up their purchases of all types of farm equipment. And although more machinery was manufactured for domestic use in 1946, 1947, and 1948 than in any prewar year, farmers would have bought a larger volume if it had been available. Tractors, combines, corn pickers, grain elevators, pick-up balers, and heavy disks were among the machines that were in short supply in relation to farmers' desire to buy them during all or part of this period. In the spring of 1949 the supply of most machines was adequate to meet demand at prevailing prices.

Annual purchases of farm machinery are usually closely related to net farm incomes so it is not surprising that demand for new machinery was high in the years 1946–48. Investment in new machinery in good years is one way of building up capital reserves to carry over the years of lower farm incomes. Other accelerating factors in the demand for farm machinery were the high farm wage rates and the favorable experience during the war with the new labor-saving machines.

RAPID PROGRESS IN ELECTRIFICATION

Farm use of central-station electric power expanded rapidly, even during the war. From 1941 to 1945 there were more than 600,000 new installations on farms. In June 1948 about 69 percent of the farms in this country had central-station electric power, compared with 26 percent in 1940 and 9 percent in 1930. Figure 10, page 19, shows the percentage of the total number of farms in each State that had central-station electric power in June 1948. It is expected that many more farms will be electrified within the next 5 years.

Use of electricity in farm production is mainly as a source of stationary power around the farmstead, but the contribution of electric lights and heat to the production of poultry and hogs and to some other enterprises should not be minimized. The use of electric power increases as farmers gain experience with its possibilities. Recent studies indicate a close relation between the number of years a farm has been electrified and the amount of current utilized.

Home uses of electricity are of major importance. For example, in one area in Iowa recently studied about 80 percent of the energy used was for household purposes. Electric power for lighting the home and for cooking, washing, ironing, and other household work, lightens the workload for the housewife. And such home equipment as refrigerators and deep-freeze units supplement farm production by providing for better utilization of farm products, both for home use and for sale.

MECHANICAL-POWER PHASE COMPARED WITH EARLIER DEVELOPMENTS

The impact of mechanical power and complementary equipment on the transformation of agricultural production in the interwar, war, and early postwar years, may well be compared with the agricultural revolution that followed the introduction of improved machinery for use with ani-

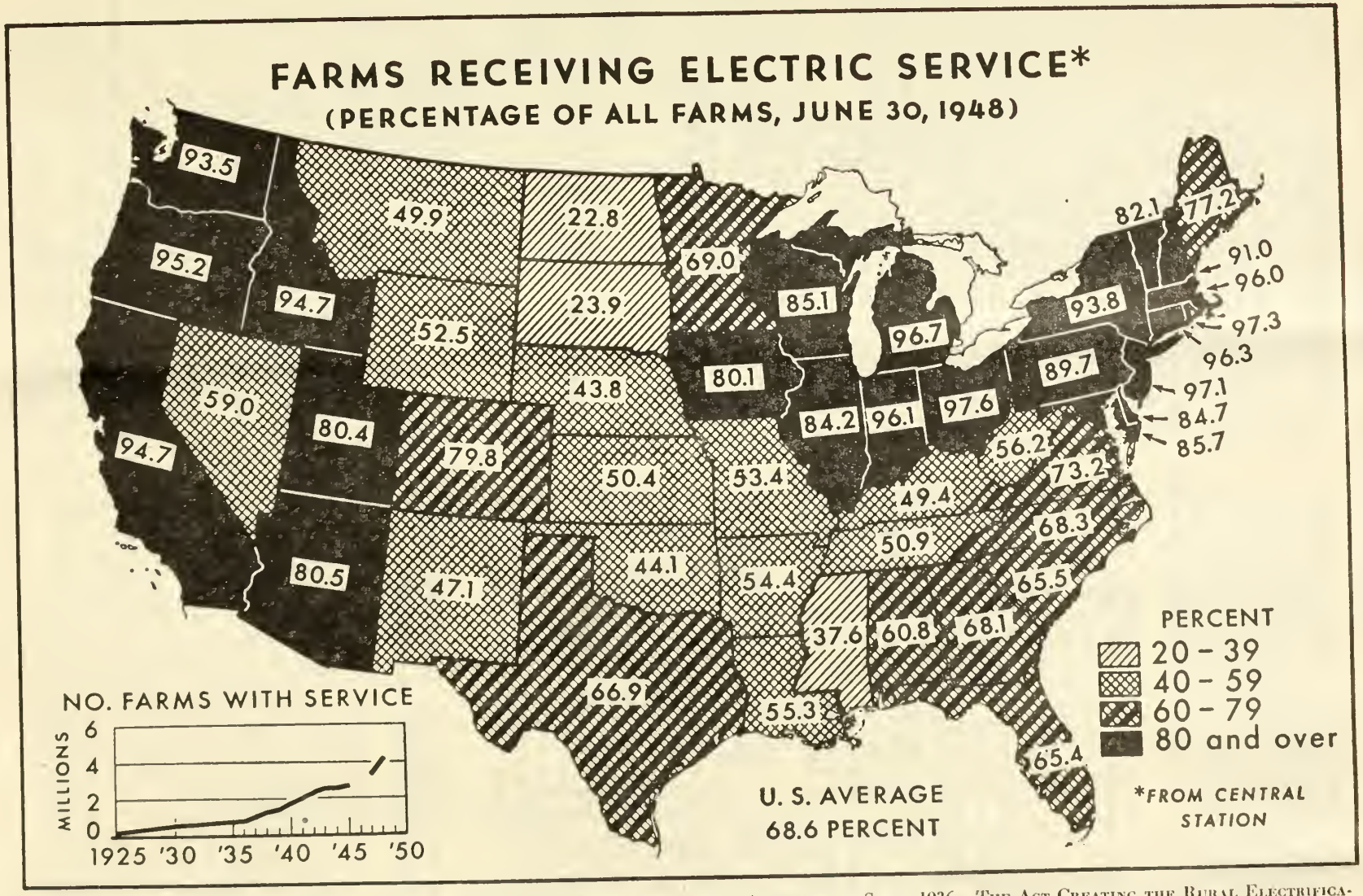


FIGURE 10.—EXTENSION OF CENTRAL-STATION ELECTRIC SERVICE HAS BEEN GREATLY ACCELERATED SINCE 1936. THE ACT CREATING THE RURAL ELECTRIFICATION ADMINISTRATION WAS PASSED IN MAY OF THAT YEAR.

mal power. The steel plow, the mower, the reaper, and later the self binder, were the primary developments in the animal-power phase of mechanization, which began about 1830 and was well stabilized by the beginning of World War I. The mechanical-power phase had then begun, but it did not gain full momentum until the war was over. And the really noteworthy effects have come in recent years.

In fact, the mechanical-power phase of farm mechanization has not yet been stabilized. Wheat production is almost completely mechanized and corn production is well on the way in the main producing areas. Hay harvesting is in a state of flux, with several radically different methods competing for adoption in all the chief hay-producing areas. Mechanization of the cotton harvest is only in its beginning stages, and tobacco is still a hand-labor crop. Considerable progress has been made in labor-saving equipment for the dairy enterprise but relatively less attention has been given to improvements in housing and other equipment for the livestock enterprises than for crop production. Advances in this domain give promise of yielding substantial savings in capital investment as well as in labor.

A look at the new mechanical developments that are already on the horizon leads to the conclusion that the future impacts of mechanization on agricultural production will be just as influential in the decade 1949–58 as were those of the preceding decade. Two of the major developments will be the increase in number of tractors, especially the small sizes fitted with equipment suitable for use on small farms, and the fairly rapid adoption of mechanical cotton pickers and strippers. These developments, along with many others, will have far-reaching repercussions on production and on the number of workers that will be needed in agriculture.

CHANGES IN LAND USE, CONSERVATION, AND FERTILIZER PRACTICES

SHIFTS IN LAND USES

Many changes in the use of cropland and permanent pasture took place between the World Wars. In the early part of this 20-year period the rather extensive abandonment of land in the Eastern States was offset by the development of new lands in the Western States. Total cropland acreage in the United States was a little lower in the early 1920's than in 1919, but it rose slowly from 1927 to 1931 (fig. 11, p. 21). From 1932 to 1939 the trend was downward. Total cropland remained at about the low point reached in 1939 until the war year of 1943; then the total increased to within about 1 percent of the 1928–32 peaks.

Acreages of harvested cropland have been more erratic (fig. 11). The effects of the droughts of 1934 and 1936 are especially apparent. The drought's impact was most severe in the Great Plains and Intermountain States, where much of the sod land that had been broken out in the 1920's was abandoned in the 1930's. Some of it was again brought into use during the war, and by 1947 much more of the land formerly in cultivation was back in crop production. There was also new breaking of native sod lands that over a period of years are best suited for permanent pasture.

Changes in harvested acreages of principal crops in the Northern Great Plains and the Pacific Northwest States are apparent in figure 12, page 22. These States contain the chief wheat-producing areas of the country. It is evident that "the plow that broke the Plains" broke much of it in the decade following World War I. In these States the crop acreage was considerably lower in World War II than in the years preceding the drought and depression of the 1930's. But the crop acreage rose rapidly in the early postwar years.

Changes in the principal uses of cropland from 1928–32 to 1935–39 and to 1944 and 1945 are shown in table 3. These cropland figures include rotation

TABLE 3.—*Changes in the principal uses of cropland in the United States—1928–32, 1935–39, 1944, and 1945*

Use of cropland	Average, 1928–32 [1] [2]	Average, 1935–39 [2]	1944 [2]	1945 [2]	Percentage 1945 is of—	
					1928–32	1935–39
	Million acres	*Million acres*	*Million acres*	*Million acres*	*Percent*	*Percent*
Intertilled crops [3]	176. 6	163. 0	168. 8	157. 6	89	97
Close-growing crops [3]	132. 6	133. 0	129. 8	132. 4	100	100
Sod crops [3] [4]	77. 3	73. 5	80. 2	82. 5	107	112
Total cropland used for crops	386. 5	369. 5	378. 8	372. 5	96	101
Summer fallow and idle cropland	41. 3	56. 9	47. 3	54. 4	132	96
Total cropland [5]	427. 8	426. 4	426. 1	426. 9	100	100

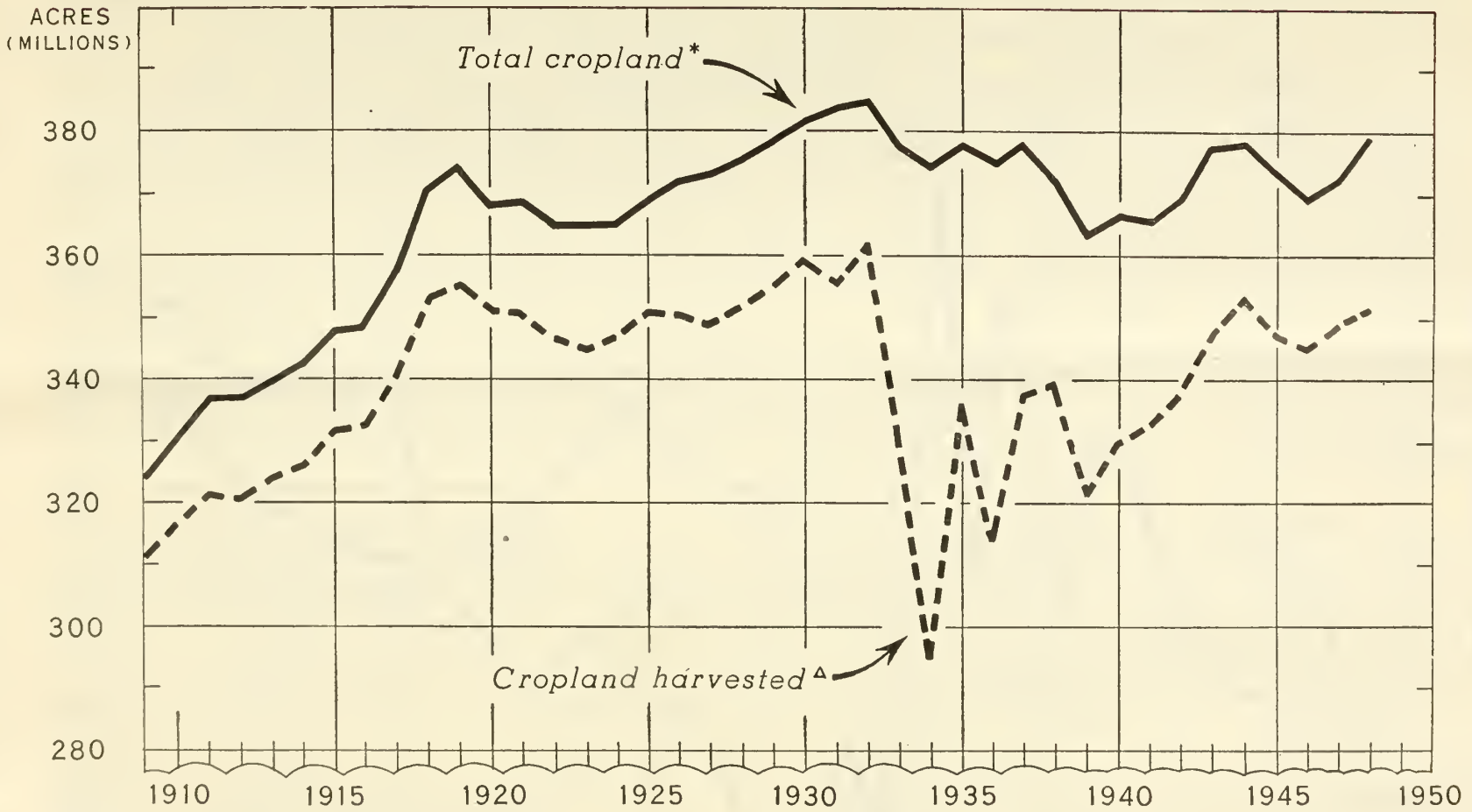
[1] The data on which the 1928–32 estimates are based are less complete than for later periods.

[2] Planted acres so far as available; all others harvested acres.

[3] Adjustments made for multiple use of land by considering first use in the crop year as the primary use.

[4] Including acres in tame hay, hay and cover-crop seeds, and in rotation pasture.

[5] Includes rotation pasture, but does not include wild hay, orchards, vineyards, and farm gardens.



*CROPLAND HARVESTED + FAILURE AND FALLOW LAND. DOES NOT INCLUDE ROTATION PASTURE.

△CROPLAND HARVESTED, ADJUSTED FOR MULTIPLE USE.

FIGURE 11.—TOTAL CROPLAND AND CROPLAND HARVESTED, UNITED STATES, 1909–48.

Total cropland acreage increased substantially in the decade preceding World War I, and moderately in the first postwar decade. During World War II cropland acreage was approximately the same as in World War I.

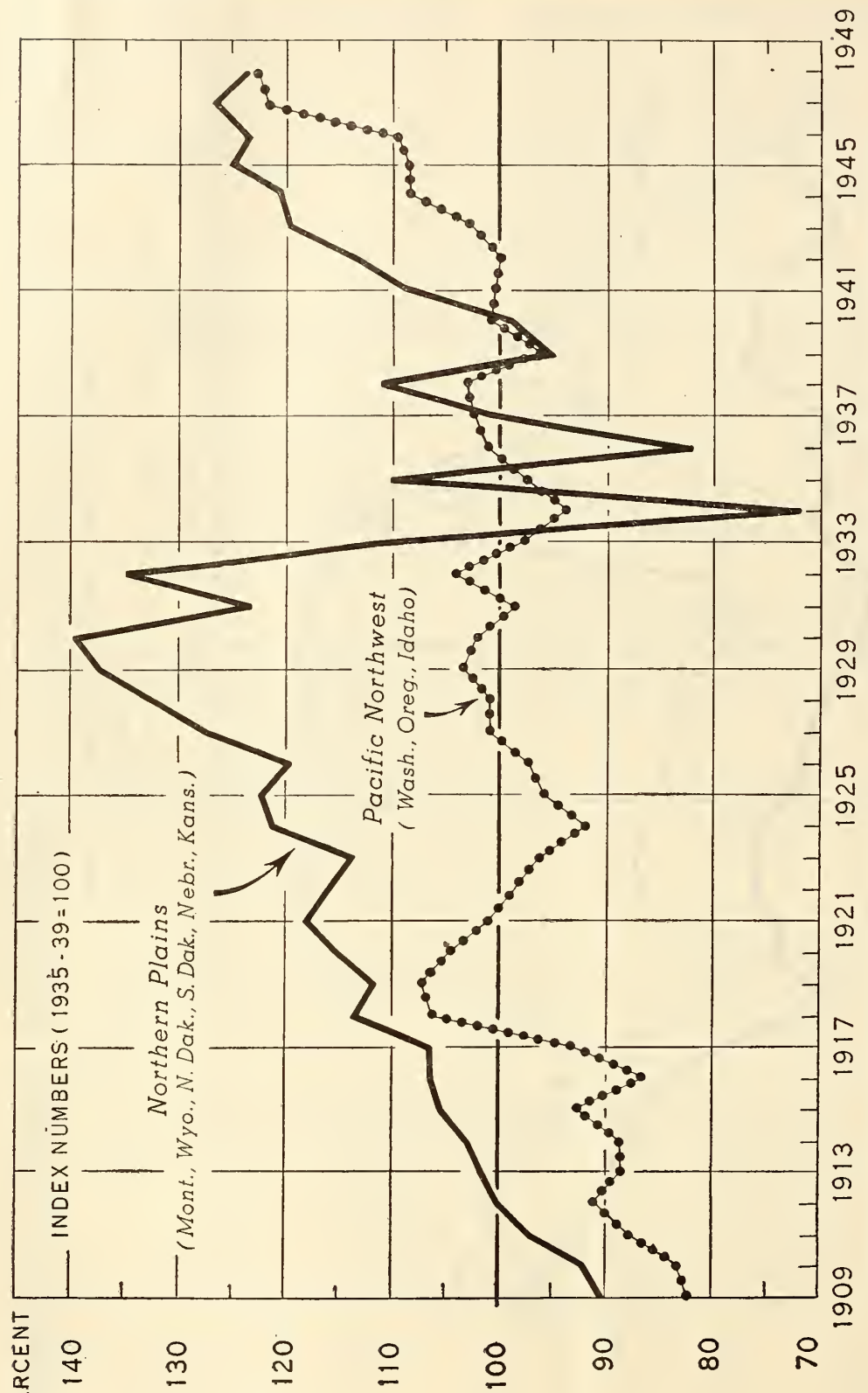


FIGURE 12.—PRINCIPAL CROPS IN NORTHERN PLAINS AND PACIFIC NORTHWEST: HARVESTED ACREAGES, 1909–48.

The acreage of principal crops in the Northern Plains States was higher following World War I than the levels reached at any time during World War II.

pasture but do not include wild hay, orchards, vineyards, and farm gardens. It is apparent that the acreage of intertilled crops decreased, while the close-growing crops held about the same level in the years 1928–32 and 1935–39. The acreage in sod crops decreased from 1928–32 to 1935–39 because of drought and loss of seedings. There was a 4-percent increase in the acreage of intertilled crops from 1935–39 to 1944. The acreage of close-growing crops was decreased, but the sod crops (hay, hay and cover-crop seeds, and rotation pasture) more than held their own.

The acreage in intertilled crops dropped considerably in 1945. There was a steady decrease in intertilled crops in the Southern States during the war, chiefly because of reduced acreage in cotton. But until 1945 that decrease was more than offset by the large increases in corn, soybeans, and other intertilled crops planted in the Corn Belt and Lake States.

The total acreage of land used for crops also dropped from 1944 to 1945. Again the downturn is accounted for chiefly by decreases in the Southern States. The larger wheat acreage is reflected in the somewhat higher acreage of close-growing crops in 1945. By 1947 the planted wheat acreage was 9.1 million acres greater than in 1945, with a large part of the increase occurring in the Great Plains States.

With subsidence of emergency food needs it would be in the interest of permanent agriculture to shift between 8,000,000 and 9,000,000 acres of intertilled crops in the Corn Belt and Lake States into hay and rotation pasture. A part of this shift to sod crops may take place in the next few years, as farmers realize the importance of hay and pasture in a soil-maintaining system of farming. But specific programs may be needed to encourage more rapid progress in that direction. In the humid areas, crop rotations that contain a combination of intertilled, close-growing, and sod crops are more likely to maintain fertility and to sustain high crop yields over a series of years than does single cropping, or a too-great concentration on intertilled crops. Only a part of the evidence of the sacrifice made in postponing crop rotations during wartime is found in the larger acreage of intertilled crops. The five principal Corn Belt States apparently had at least 1.5 times as many acres of intertilled crops that were repeated two or more years on the same land as they had in the immediate prewar years. A cropping program designed to maintain soil resources should reduce considerably this succession of intertilled crops.

In many areas of the Great Plains, the Intermountain, and the Pacific States a part of the cropland acreage should be in summer fallow, as a means of storing moisture and of controlling weed growth. In the wheat areas of the Pacific Northwest the practice of summer fallowing has been followed for more than half a century. In the Palouse area proper, where annual precipitation is 18 inches or more, summer fallowing has not been necessary for moisture storage, and dry field peas are now grown on much of the acreage that formerly would have been summer fallowed. Interest in summer fallowing in the Great Plains was not extensive until the early 1920's. It apparently started in Montana, Wyoming, and Colorado, and extended farther east in the late 1920's and early 1930's, under the pressure of recurring droughts.

Accurate estimates of the acreage of summer fallow by States are not available but table 4 is believed to indicate the general trend. For the seven Western States the fallow acreage has remained substantially the same since 1928–32. Substitution of field peas for fallow in the Pacific Northwest has apparently been offset by moderate increases in wheat acreage in the drier areas where fallowing is necessary to produce a crop. In the Great Plains States, however, summer fallowing reached a peak of 17.4 million acres in 1939—more than six times greater than the average acreage of the years 1928–32. With increased need for wheat, and with more rainfall, fallow acreage dropped by 1944 to around 11,000,000 acres.

TABLE 4.—*Estimated acreage in summer fallow for selected States and periods*

Period	7 Western States [1]	10 Great Plain States [2]	Total 17 States
	Million acres	*Million acres*	*Million acres*
1928–32 [3]	5. 5	2. 8	8. 3
1939 [4]	5. 4	17. 4	22. 8
1942 [5]	5. 3	14. 4	19. 7
1943 [5]	5. 6	12. 2	17. 8
1944 [5]	5. 5	10. 8	16. 3

[1] Washington, Oregon, Idaho, California, Nevada, Utah, and Arizona.

[2] Montana, Colorado, Wyoming, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas.

[3] Based largely on an unpublished study of the Bureau of Agricultural Economics, 1939.

[4] Agricultural census data for idle and fallow acreage with fallow estimated by applying ratios from rural-carrier survey made for the Bureau of Agricultural Economics.

[5] Estimates of Production Adjustment Committees in each State.

Although no comparable estimates are available for later years, the evidence indicates a further drop in summer fallow of at least 2 million acres. Some reduction was justified as an emergency ex-

pedient but widespread resumption of the practice of continuous cropping to wheat would result in a smaller total wheat crop in years of low rainfall. The seedings of wheat for the 1947, 1948, and 1949 harvests were so large in the Great Plains and some other dry land areas that the operators cannot expect to maintain that acreage for several years without reducing their yields. As to permanent soil damage, we have not yet developed crop rotations in the Great Plains that will maintain the soil. Crop farming in that region is therefore to some extent soil mining. But farmers can avoid many of the weather hazards by summer fallowing, stubble mulching, strip cropping, contour farming, and other practices adapted to specific areas. A return to these practices means fewer acres in wheat, but not necessarily fewer bushels of wheat, especially in the drier years.

Since 1936, payments have been made under the Agricultural Conservation Program to cooperating farmers for each acre of protected summer fallow. In some States the payment was made for ordinary summer fallow, provided the surface was ridged or provided stubble mulch was left to prevent erosion. In others, strip fallowing across the direction of prevailing winds or on the contour were the only practices recognized for payment. Most farmers in most wheat-producing areas of limited rainfall are now convinced of the value of these practices.

CONSERVATION PRACTICES

In addition to payments for summer fallow the Agricultural Conservation Program has paid cooperating farmers in all regions for carrying out a wide variety of soil-maintaining or soil-building practices. Among the more important are contour tillage, strip cropping, terracing, and use of green manure and cover crops.

Steady growth is indicated in the adoption of contour operations, the big bulk of which has occurred in the South. Contouring not only lessens the damage from water erosion but is likely to bring increased crop yields, particularly in areas where lack of sufficient moisture often limits the production.

Seeding of green-manure and winter cover crops are practices that protect against erosion losses, contribute in some instances to the supply of available pasture, and increase crop yields through the return of substantial quantities of organic matter to the soil. They are particularly valuable in the more humid areas where a fall-harvested intertilled crop would otherwise leave the land bare, and subject to soil washing in the winter. As yields are maintained or increased through such practices, their rapid extension has no doubt contributed significantly to total agricultural production. The acreage of winter cover crops in the Southern States was about four times larger in 1944 than in prewar years.

Terracing has been done most extensively in the South. The rate of construction of new terraces declined moderately during the war. It is possible for a farmer to build his own terraces with simple equipment, but technical assistance is necessary in laying out the contour lines, and much of the earth moving is done more satisfactorily with heavy mechanized equipment. Using this more costly method may be considered as a capital improvement and, as such, it was delayed by many farmers until after the war. Changes in farming systems in the South which result in a smaller proportion of intertilled crops may permit the development of rotations that will make terracing less necessary in some areas.

Nearly three-fourths of the farms in the United States are now included within the boundaries of soil-conservation districts. By the end of 1948 farmers and technicians had jointly developed long-time conservation plans on about 680,000 of these farms, containing more than 185,000,000 acres. The principal practices applied on these farms are contour cultivation, terracing, strip cropping, crop-residue management, and grass planting. Not all farmers in soil-conservation districts will formulate definite conservation plans. But the farms on which such plans are applied will serve as demonstrations to their neighbors, and conservation practices that prove their worth will spread voluntarily to other farms.

Changes in permanent pasture are much more difficult to trace than changes in cropland. Considerable improvement of permanent-pasture areas was begun in the middle 1930's and has continued. Liming, fertilization, and establishment of new pasture, are the main improvements in the humid areas. In the range areas attention has centered on stockwater development, reseeding, and rotation grazing.

Relatively favorable weather for forage growth made it possible to sustain a large livestock population on the western ranges during the war and early postwar years. If years of lower precipitation should come it would be necessary to reduce the numbers, but in the areas where major improvements have been carried out the long-time carrying capacity has been increased.

In many humid areas the possibilities for further improvement of permanent pasture are great. It seems probable that much of this improvement will be undertaken in the years ahead—part of it in response to the stimulations furnished by conservation programs.

LIMING AND FERTILIZING PRACTICES

Use of lime and commercial fertilizer was greatly accelerated in the immediate prewar and

war years, and has continued to increase. A considerable part of the larger farm production can be attributed to the greater use of these materials. But of about equal importance is the potential contribution of lime and fertilizer to the establishment of stable and soil-maintaining systems of farming.

Information on use of liming materials is not available for the years before 1929, when the tonnage of lime used was about 60 percent of the 1935–39 level. The tonnage used annually was nearly doubled from 1935 to 1936, the year when lime was first included in the Agricultural Conservation Program. Figure 13, page 26, indicates that the use of liming materials in the later war years was more than three times the prewar levels, despite the difficulties in obtaining labor and trucks for crushing and hauling. In 1947 more than four times as much lime was used as was used annually in the years 1935–39. Less lime was used in 1948 mainly because of reduction in the program for conservation materials.

Annual use of lime must be increased even more if all of the land in the humid regions that needs lime for soil-improving crop rotations is to receive an initial application, and if adequate maintenance applications are to be made thereafter. It has been estimated that the tonnage of lime applied annually should be about double the 1947 level, to maintain the soil properly and to facilitate desirable shifts toward more grasses and legumes.[3]

On many soils in the humid regions it is necessary to apply lime in order to get full use of commercial fertilizer, especially the phosphates. And lime and phosphate applications are required for successful stands of the legumes and grasses that are so necessary in a good crop rotation, and for soil maintenance. Some of the increase in use of commercial fertilizer is accounted for by the greater use of phosphates in combination with liming materials for hay and pasture improvement. Nearly all the fertilizer distributed by public agencies has been applied on legumes and on hay and pasture lands. But even the relatively large wartime distribution of fertilizer by public agencies accounted for only 10 percent of the total value of the fertilizer that was used.

The increase in consumption of fertilizer is actually an acceleration of a long-time upward trend that was interrupted in the severe depression of the early 1930's (fig. 14, p. 27). The largest part of the increase has been applied to the cash crops, although a growing proportion of the fertilizer now goes on legumes and grasses.

During the war many farmers learned how to use commercial fertilizer to increase their production. It was used in areas and on crops where it had not been used before. This experience is likely to mean a much higher level of use in the coming years. Lower prices for farm products undoubtedly would mean some decrease in purchases of fertilizer for cash crops, but it does not seem at all probable that sales would drop back to prewar levels.

From the standpoint of maintenance of land resources the Nation is vitally interested in the use of lime and fertilizer for the establishment of crop rotations that contain enough acreages of grasses and legumes. Greatly increased consumption of lime and fertilizer for this purpose would help to achieve more stable systems of farming, and would lessen the emphasis on those staple cash crops which seem likely to press most heavily on market outlets.

State committees that were studying postwar adjustments suggested that, under favorable price conditions, it would pay farmers to use about twice the quantity of plant nutrients in the form of commercial fertilizer that was used in the war year 1944.[4] A much larger proportion of it would be used for small grains other than wheat, however, and for legumes, hay, and pasture. These uses would be more than tripled from their wartime levels. If such a program were carried out it would make a substantial contribution to farming stability, and to maintenance of land resources. But the suggested shift in the use of fertilizer toward much greater use on grassland and legumes would not take place without strong educational and other programs that are designed to accelerate the use of lime and phosphate fertilizer in soil-improving rotations.

In common with most other improved practices, greater use of lime and fertilizer, especially on cash crops, increases the volume of farm products that goes to market, which in turn might reduce the prices of the products that are produced in greater volume. But the farmers who use the fertilizer have lower costs per unit of product and a larger quantity for sale as an offset to lower prices. And it is to be remembered that, so far as the increased use of these materials promotes soil-building rotations, the emphasis is shifted away from the staple cash crops that are likely to be overproduced. Such shifts might actually aid in avoiding market gluts of some products. Moreover, part of the increase in lime and fertilizer constitutes a capital investment in permanent soil im-

[3] See U. S. Department of Agriculture, Interbureau Committee on Postwar Programs, and The Land-Grant Colleges. PEACETIME ADJUSTMENTS IN FARMING—POSSIBILITIES UNDER PROSPERITY CONDITIONS. U. S. Dept. Agr. Misc. Pub. 595, 52 pp., illus., 1945 for one estimate of lime needs; a later estimate is somewhat higher.

[4] See publication referred to in Footnote 3. The estimated use of nitrogen fertilizer in 1948 was nearly as large as the profitable use indicated in this report; and farmers would have bought more had it been available.

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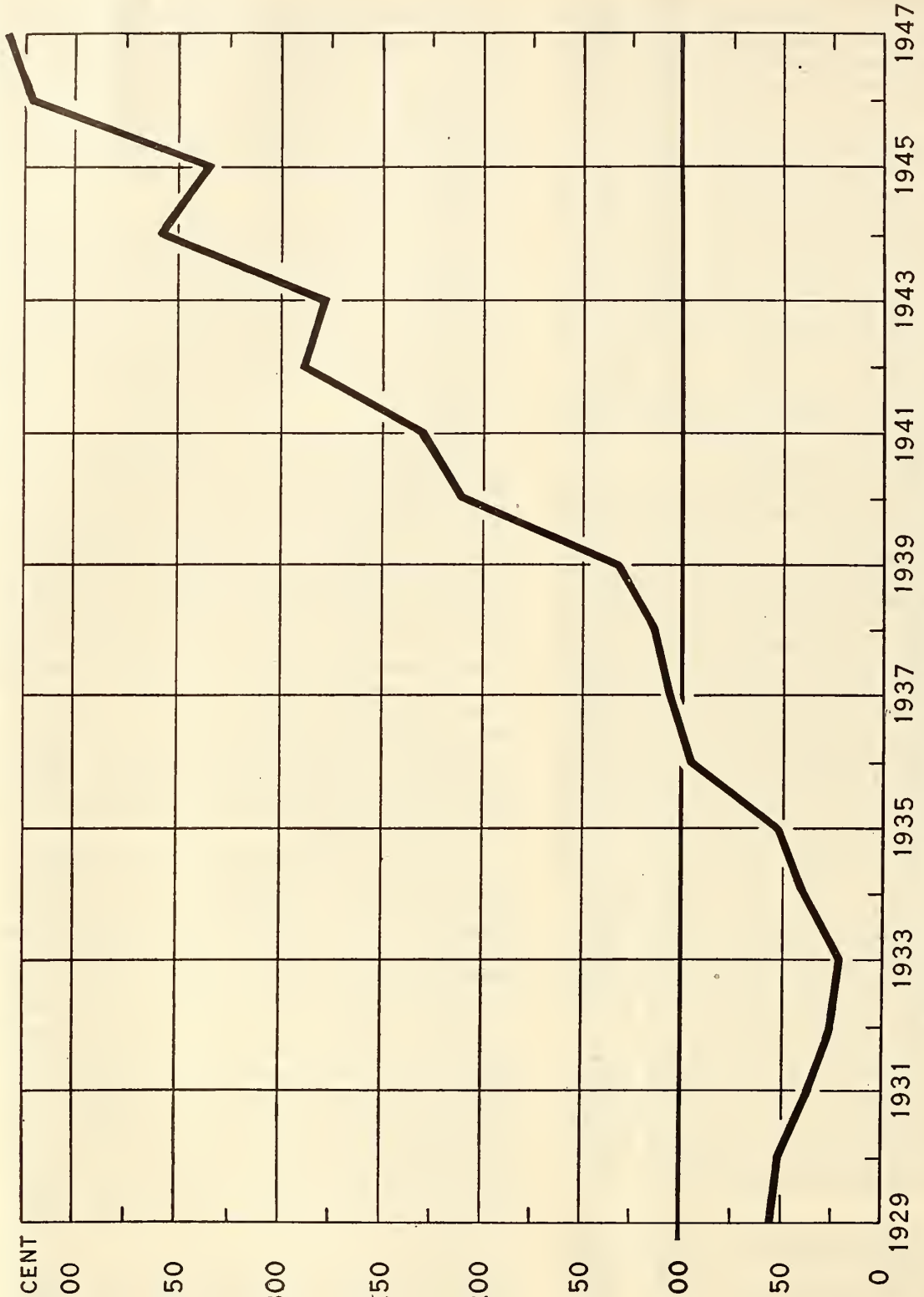

FIGURE 13.—CONSUMPTION OF LIME IN THE UNITED STATES, 1929–47. (INDEX NUMBERS 1935–39=100.)

Application of liming materials had risen to predepression levels by 1935. Most of the increase in the use of lime since 1936 can be attributed to the stimulation provided by its inclusion as a conservation material in the Agricultural Conservation Program.

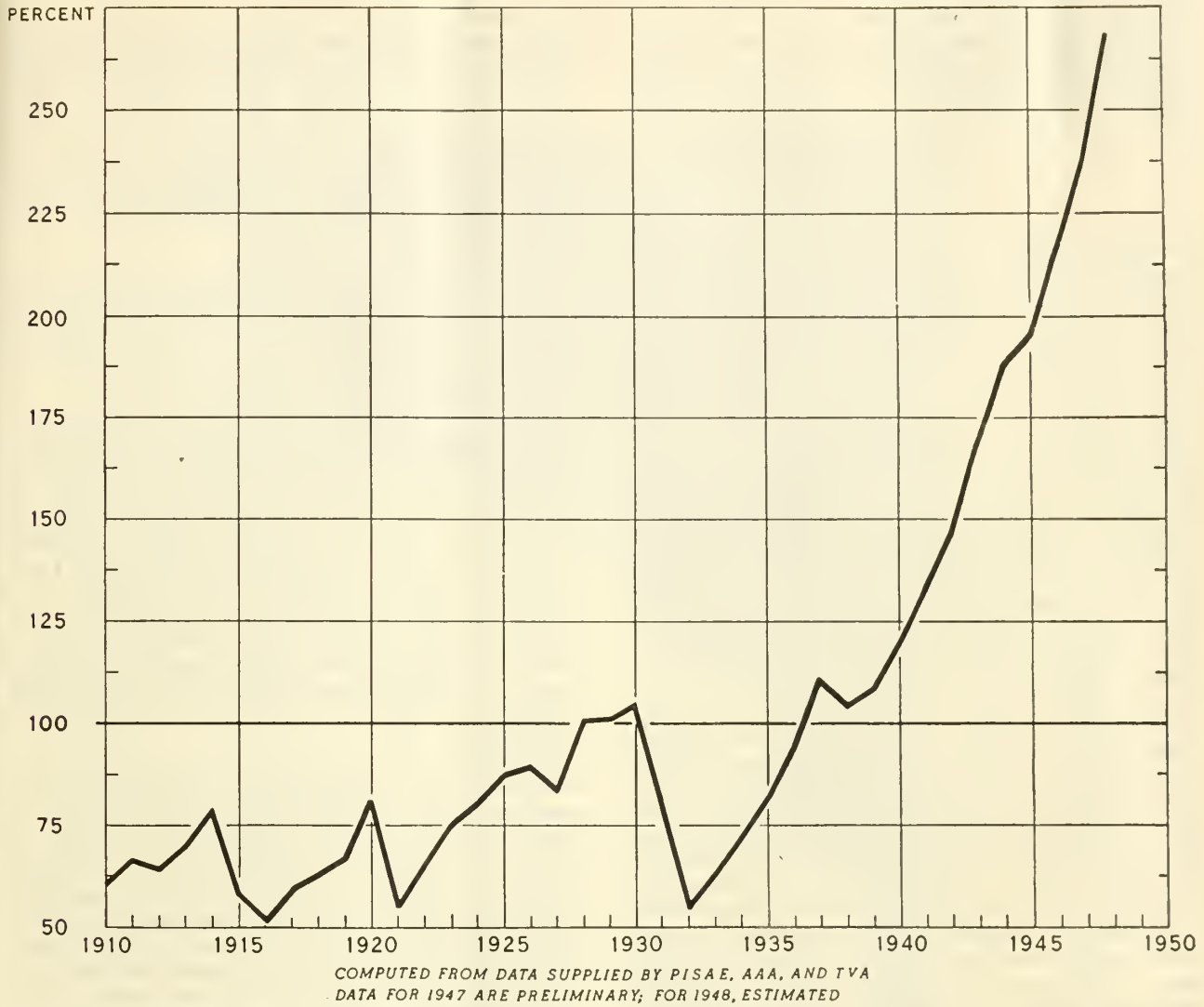

FIGURE 14.—CONSUMPTION OF FERTILIZER IN TERMS OF NITROGEN, PHOSPHORIC ACID, AND POTASH, CONTINENTAL UNITED STATES, 1910–48. (INDEX NUMBERS 1935–39=100.)

Use of nitrogen, phosphoric acid, and potash as fertilizer during World War II reached a level nearly double that of the 1935–39 average, and the use has continued to increase since the end of the war. The highest consumption before 1937 occurred in 1930, when the level reached was 5 percent above the average of the years 1935–39.

provement that is in the interest of future welfare, both for individual citizens and for the Nation as a whole.

CHANGES IN CROPS

The greatest contribution of the changes in crops and varieties made to speed up wartime production was the interwar development of improved seeds that greatly increased the yields per acre of our most important crops. Hybrid seed corn is an outstanding example.

SPECIAL WAR CROPS

During the war the most significant expansion of the strictly war crops was in hemp for hard fiber. Its harvested acreage was increased from 1,248 acres in 1935–39, grown mainly in Wisconsin and Kentucky, to 146,200 acres in 1943 when hemp was grown in several Midwestern States. A Government corporation was organized to contract for acreage in suitable areas, and to construct and operate hemp-processing plants in the new producing localities. Different kinds of vegetable seeds, mung beans, castor beans, and some phar-

maceutical plants were grown to alleviate or to protect against war shortages. These were important war crops. But they were concentrated in small areas, they occupied only small acreages, and they constituted a rather insignificant part of the total volume of agricultural production.

INCREASES IN OIL CROPS

On the other hand, large contributions to wartime production were made by stepping up production of some crops that were of minor importance in the interwar years. Soybeans were outstanding among this group. They are one of the oldest of the cultivated crops but their production in this country has occurred mainly in the twentieth century, and commercial production of soybeans has been developed mostly since 1920. The acreage grown for all purposes increased from about 50,000 in 1907 to 460,000 acres in 1917. But in the latter year the output of most of the acreage harvested for beans was used for seed. The acreage harvested for beans to be used both for seed and for crushing expanded from 448,000 in 1924 to 10.2 million in 1944. The acreage harvested for beans in 1944 was 237 percent of the acreage in 1939. About half of this increase represented a shift from harvesting soybeans for hay to harvesting for beans.

Most of the increase in soybean acreage took place in the Corn Belt. Large percentage increases occurred also in the Mississippi Delta and in the Atlantic Seaboard States of North Carolina, Virginia, Maryland, and Delaware. A somewhat reduced acreage in 1946 was followed by a record acreage in 1947. Although the 1948 acreage was smaller than in 1947 it was still at wartime levels.

In the Corn Belt the crops replaced by soybeans were mostly small grains, hay, and rotation pasture. During the interwar years some of the land previously devoted to corn had been shifted to soybeans, but during World War II corn and soybeans increased concurrently. On the whole, soybeans have replaced crops that have lower volumes of output per acre, so the shift has added to the total volume of production.

Figure 15, page 29, shows the growth in acreage of soybeans harvested for beans from 1924 to 1948. It brings out the preeminence of the Corn Belt in the soybean enterprise. But the acreage trends are only part of the story. The trend in yield per acre has been upward, and by far the highest yields have been obtained in the Corn Belt. Thus in the years 1940–44 the five Corn Belt States had 83 percent of the acreage harvested for beans and 88 percent of the total production.

New varieties of soybeans, especially the Lincoln, give promise of further increases in yield per acre within the next few years. The levels of wartime acreage are not likely to be maintained as other sources of oil become more readily available, but it seems probable that both acreage and production will remain at much higher levels than they reached before the war. Soybeans in the Corn Belt have a nearby market for meal, which usually equals or exceeds the value of the oil, so the oil may become the byproduct from soybeans grown chiefly to supply high-protein concentrates. On this basis they can compete more readily with other sources of edible oil.

Peanuts were given special emphasis during the war, and they made a significant contribution to the wartime food supply. Only relatively small proportions of the peanuts have been crushed for oil, however; most were used for nuts or in other direct food products as in peanut butter.

Figure 16, page 30, shows the acreage of peanuts grown for all purposes, the acreage picked and threshed, the yield per acre, and production for the years 1909–48. The acreage of peanuts picked and threshed nearly doubled from the prewar years 1935–39 to 1944. But as the acreage expanded, into new areas and on farms of new growers in old areas, the average yield per acre decreased. In many areas new producers obtained relatively low yields until they had become familiar with the crop. In the Oklahoma-Texas area the acreage was 3.8 times the prewar levels in 1943 but in 1944 it dropped back to 3.1 times the average acreage in 1935–39.

The market for edible peanuts may remain relatively high in the postwar years. But as an oil crop, peanuts are likely to face keen competition that can be met only if prices for oil uses are in line with those for comparable oils. Perhaps more mechanized practices of production can help to give competitive strength to peanut production. But if peanut acreage is maintained at high levels, a large proportion of the total would go into other uses than edible peanuts. Perhaps more of the crop will be hogged off as time goes by.

Flaxseed was the third oil crop that was greatly expanded during the war (fig. 17, p. 31). The 6.2 million acres planted in the peak year, 1943, was more than three times the average of 1935–39, but the acreage planted in 1944 dropped back to less than half that of the previous year, and in 1945 special acreage payments increased the planted area to 4.0 million acres. In 1947 a support price of $6 per bushel resulted in a planted area of 4.2 million acres. This support level was continued in 1948 when 4.9 million acres were planted.

Most of the flax is produced in the spring-wheat States where it was formerly grown as a new-land crop in Minnesota, North Dakota, South Dakota, and Montana. Weed-free land is needed for successful production, but the new weed sprays have proved reasonably effective in controlling weeds in flax fields. Flax is considered a hazardous crop compared with its alternatives. In the drought

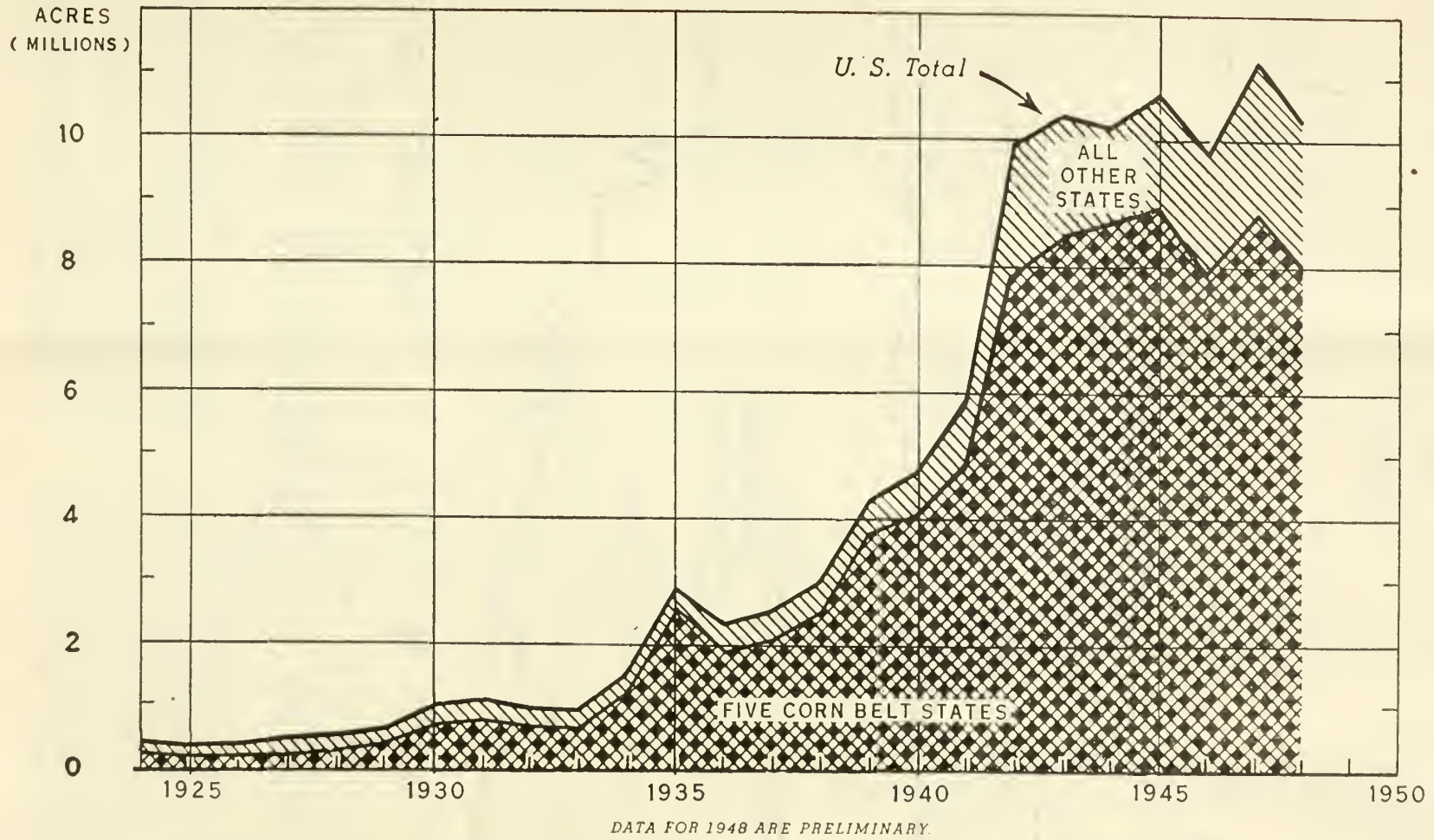

FIGURE 15.—ACREAGE OF SOYBEANS HARVESTED FOR BEANS, UNITED STATES AND FIVE CORN BELT STATES, 1924–48.

The acreage of soybeans harvested for beans in the United States increased gradually from less than a half-million acres in 1924 to about a million acres in the early 1930's, and then rose sharply. The wartime level exceeded 10,000,000 acres.

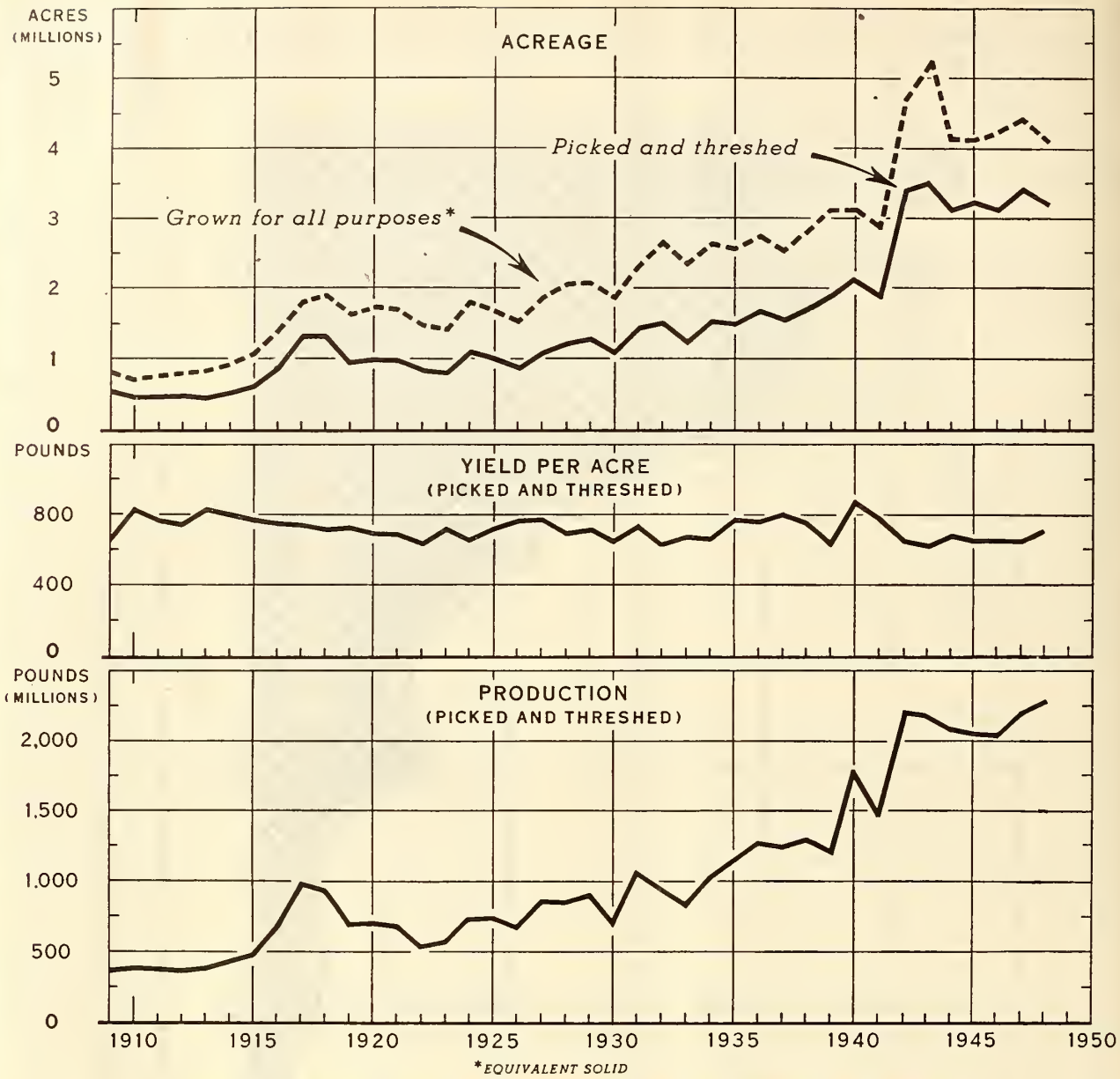

FIGURE 16.—ACREAGE, YIELD, AND PRODUCTION OF PEANUTS, UNITED STATES, 1909–48.

The acreage of peanuts, picked and threshed, nearly doubled during World War II, following the more gradual upward trend of the interwar years. Wartime production did not rise quite so much as acreage because yields declined slightly with expansion into new areas, and on farms of new growers in old areas.

year of 1936 more than 80 percent of the planted acreage was abandoned in the Dakota-Montana area. As compared with the opportunity to grow an unlimited acreage of wheat at loan-rate prices, farmers in the spring-wheat States would have hesitated to take a chance on flax without the special financial inducements that were offered.

Flax yields per harvested acre were higher during the war than in 1935–39. In 1943 and 1944 they were more than 50 percent higher in the Dakota-Montana area. Flaxseed production, on the larger acreage and with the higher yields, in the years 1940 and 1945 ranged from two to nearly five times the 1935–39 level. In 1943 the Dakota-Montana area produced more than eight times as much flax as in 1935–39.

It does not seem likely that the acreage in flax will be maintained at the 1948 figure without spe-

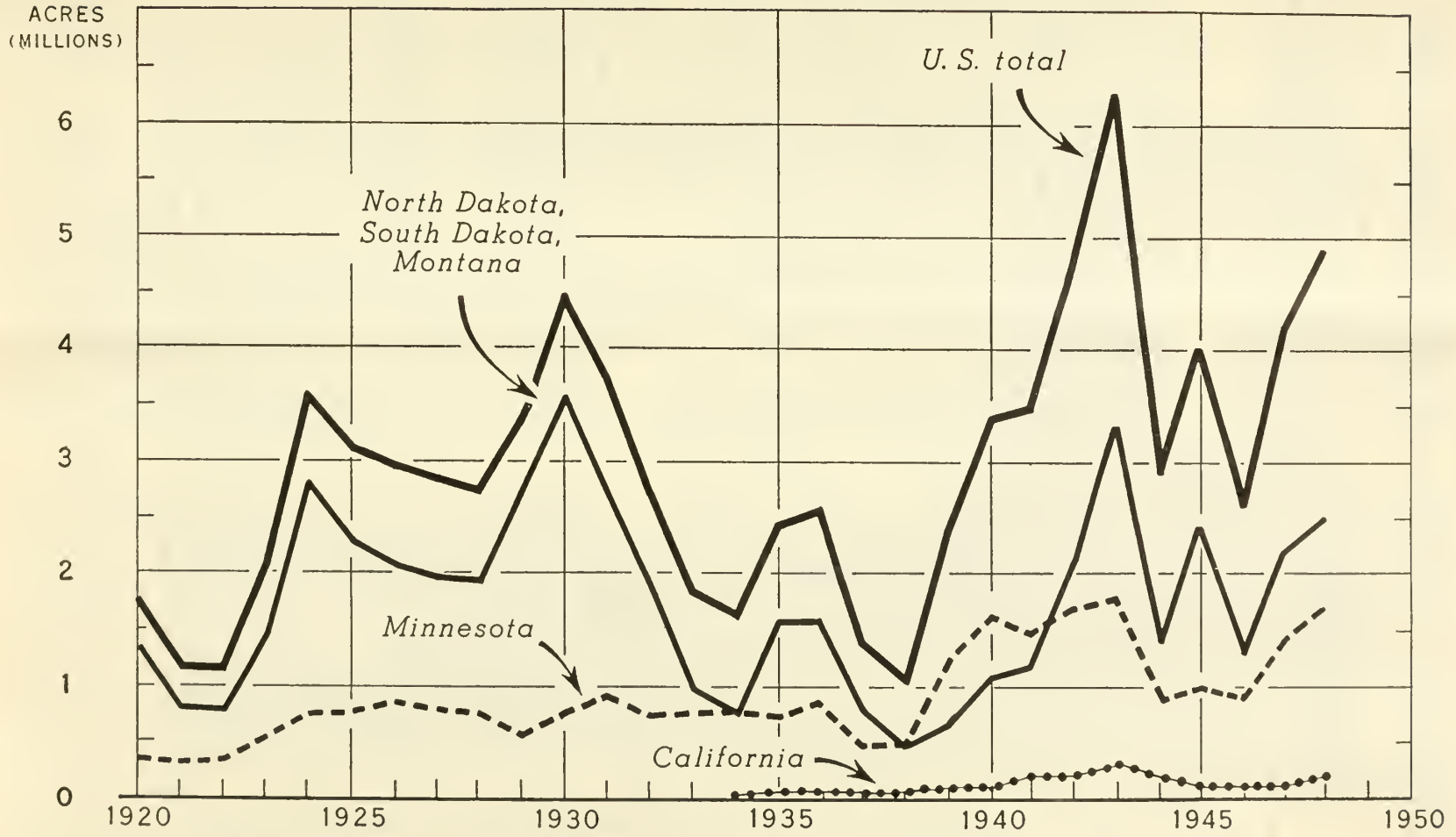

FIGURE 17.—ACREAGE OF FLAXSEED PLANTED IN MAJOR PRODUCING AREAS AND IN THE UNITED STATES, 1920–48.

The acreage of flaxseed is subject to extreme fluctuations. The 1943 acreage was more than three times the average of 1935–39; the acreage fell off sharply in 1944, but it has remained well above the prewar level.

cial price or production incentives. On the other hand, it seems likely to stabilize at levels above the 1935–39 acreage, which was extremely low because of the drought. The acreage planted to flax in the Dakota-Montana area will depend mainly on the comparative returns from wheat and flax.

MORE BEANS AND PEAS

Dry edible beans and dry peas are sources of vegetable proteins that can be substituted, to some extent, for the animal proteins. As they can be readily stored and transported, these direct food crops are well suited to war and relief needs.

The dry-bean acreage increased from the 1.9 million acres planted in 1935–39 to 2.6 million in 1943, which was the peak year. In 1944, the planted acreage dropped to 2.2 million acres, and in 1947 it was below the prewar average of 1.9 million acres. Yields were disappointing in many of the new producing areas, and the competition of other cash crops was too keen to allow the acreage to remain at the high level reached in 1943.

In contrast to beans most of the dry peas are grown as a supplement to other crops rather than in competition with them. Where the annual precipitation is 18 inches or more peas can replace summer fallow on the wheat lands of the Pacific Northwest. The yields of wheat are somewhat lower in a wheat-pea than in a wheat-fallow sequence, but the returns are usually much higher from wheat and peas than from wheat and fallow. This was especially true during the war, when prices were supported at $5.65 per hundredweight for No. 1 peas at country shipping points.

Peas are a highly mechanized crop, and they use about the same machines as wheat. They therefore supplement wheat production with respect to both land and machinery. And, as labor requirements per unit of product are low, the output per unit of additional land, equipment, and labor resources, is high. This is true only in certain areas, however, and there only to the extent that peas can be grown as part of the wheat-pea sequence. Expansion beyond that point means that peas have to be substituted for wheat and grown in succession, or that they replace other crops in other producing areas.

At the beginning of World War II considerable acreage was available for expansion of peas on the basis of supplementary use of resources. Figure 18, page 33, shows how rapidly the acreage of peas expanded during the war. The peak was reached in 1943 with 825,000 acres. This was a much larger acreage than could be grown as a supplementary crop, so some land grew peas in successive years, not only at the expense of wheat but also at a sacrifice of soil maintenance. The crop was grown in some areas that were not well suited to it. The 752,000 acres planted in 1944 represented a closer adjustment of pea acreage to desirable wartime use of resources. In 1948 the planted area was 309,000 acres.

There is no foreseeable domestic food demand for the quantity of peas that have been grown in recent years. They could be grown for a high-protein livestock feed, but the price for them would be much below wartime levels if they were to compete with other protein feeds.

HIGHER YIELDING HAYS

A crop change that developed gradually over the interwar and war years was the shift in the acreage of hay from grasses to the higher yielding legume hays which have a higher protein content and therefore help to balance the livestock ration. Figure 19, page 34, shows the digestible protein available in hay per roughage-consuming unit, by 5-year periods from 1920 to 1944, and for the 4-year period 1945–48. This chart summarizes the changes that have taken place. It indicates that except for the drought years (included in the period 1930–34) the increase has been gradual throughout. The shift toward higher quality and higher yielding legume hays is likely to be accelerated in the postwar years as farmers begin to include more hay and pasture in their crop rotations. The higher protein content of the hay crop will help to balance the ration, and the increased yield of hay will offset at least part of the reduction in volume that otherwise would accompany a smaller acreage of intertilled crops.

ADOPTION OF HYBRID SEED CORN

Development of hybrid seed corn is easily the most important of the interwar and wartime crop improvements. Because corn normally occupies from 25 to 30 percent of the harvested cropland any improvement that greatly increases the yields will naturally have a substantial influence on total production.

Commercial hybrid seed corn was first produced in Connecticut about 1922. Hybrids adapted to the Corn Belt became available in 1929. In 1933 a total of about 143,000 acres was planted with hybrid seed, and in 1948 about 65,097,000 acres. Figure 20, page 35, shows the percentage of the corn acreage planted to hybrids, by years since 1933, in the North Central States and in the United States. Adoption of hybrid seed progressed more rapidly in the North Central States where adapted hybrids were available to farmers earlier, and where corn is the leading farm crop. Adoption is now accelerating in other corn-growing States, especially in the South.

Experience with hybrid seed indicates that acre yields are increased about 20 percent over the yields of open-pollinated varieties. The percent-

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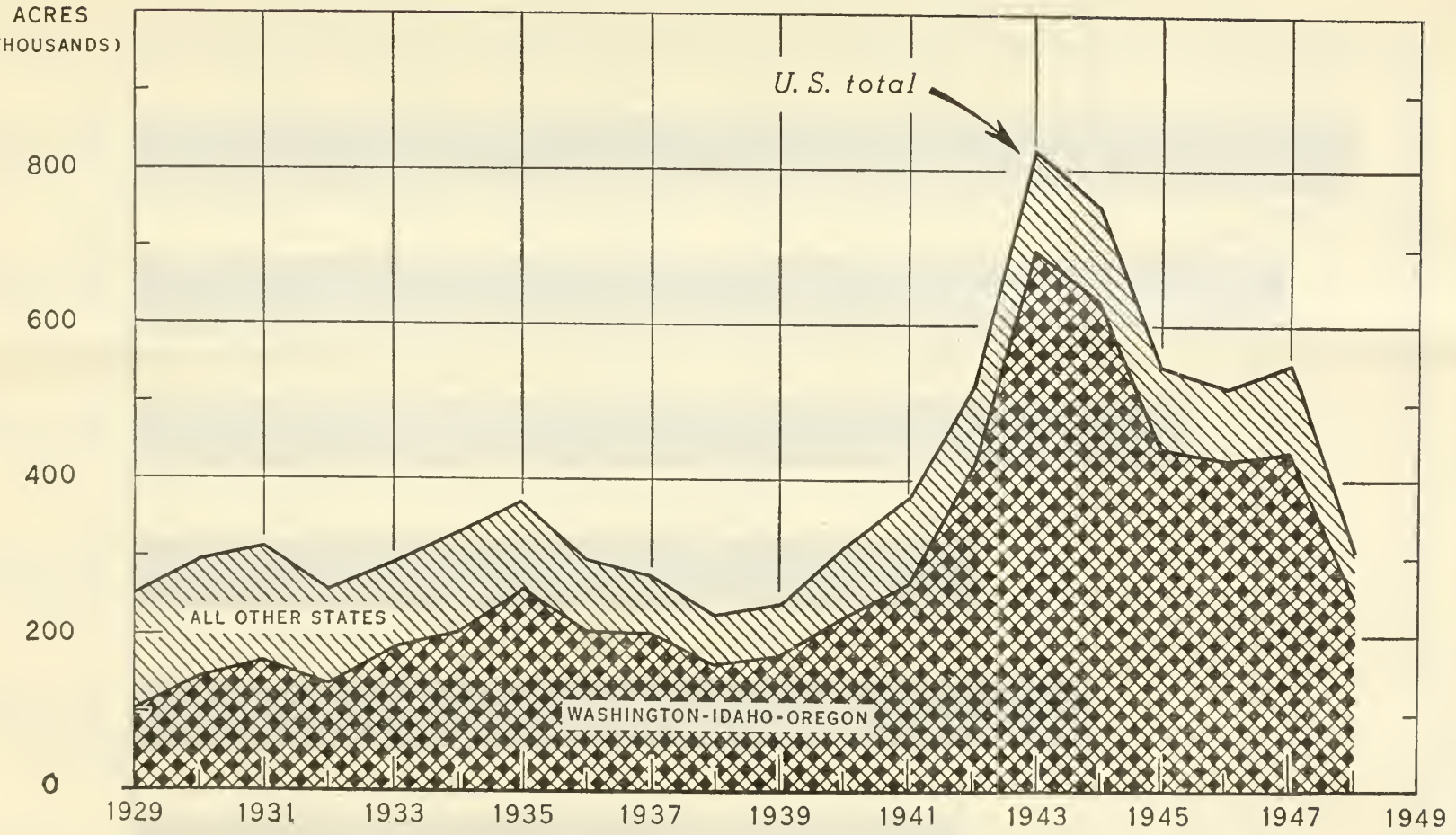


FIGURE 18.—ACREAGE OF DRY FIELD PEAS PLANTED IN WASHINGTON-IDAHO-OREGON AREA AND UNITED STATES, 1929–48.

The acreage of dry field peas rose sharply in the early years of World War II and reached a peak in 1943. The Pacific Northwest States produce the bulk of the output of the United States.

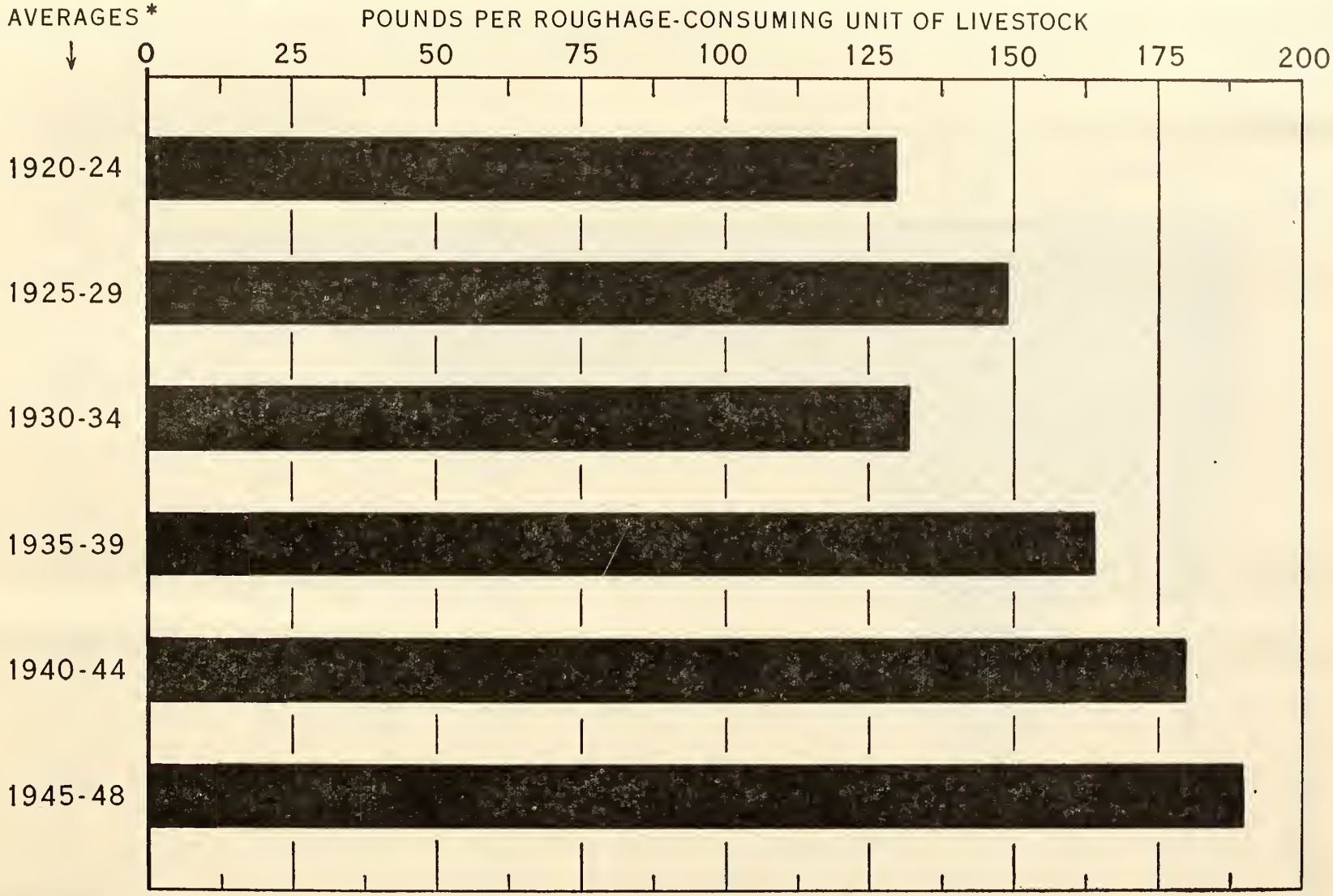


FIGURE 19.—DIGESTIBLE PROTEIN IN ALL HAY FED ON FARMS, UNITED STATES, 1920–48.

Significant changes have taken place in both quantity and quality of the country's hay supply. An average of about 46 percent more digestible protein was available per roughage-consuming unit of livestock in the years 1945–48 than in the years 1920–24. The pronounced shift from grass to legume hays has been the largest contributing factor.

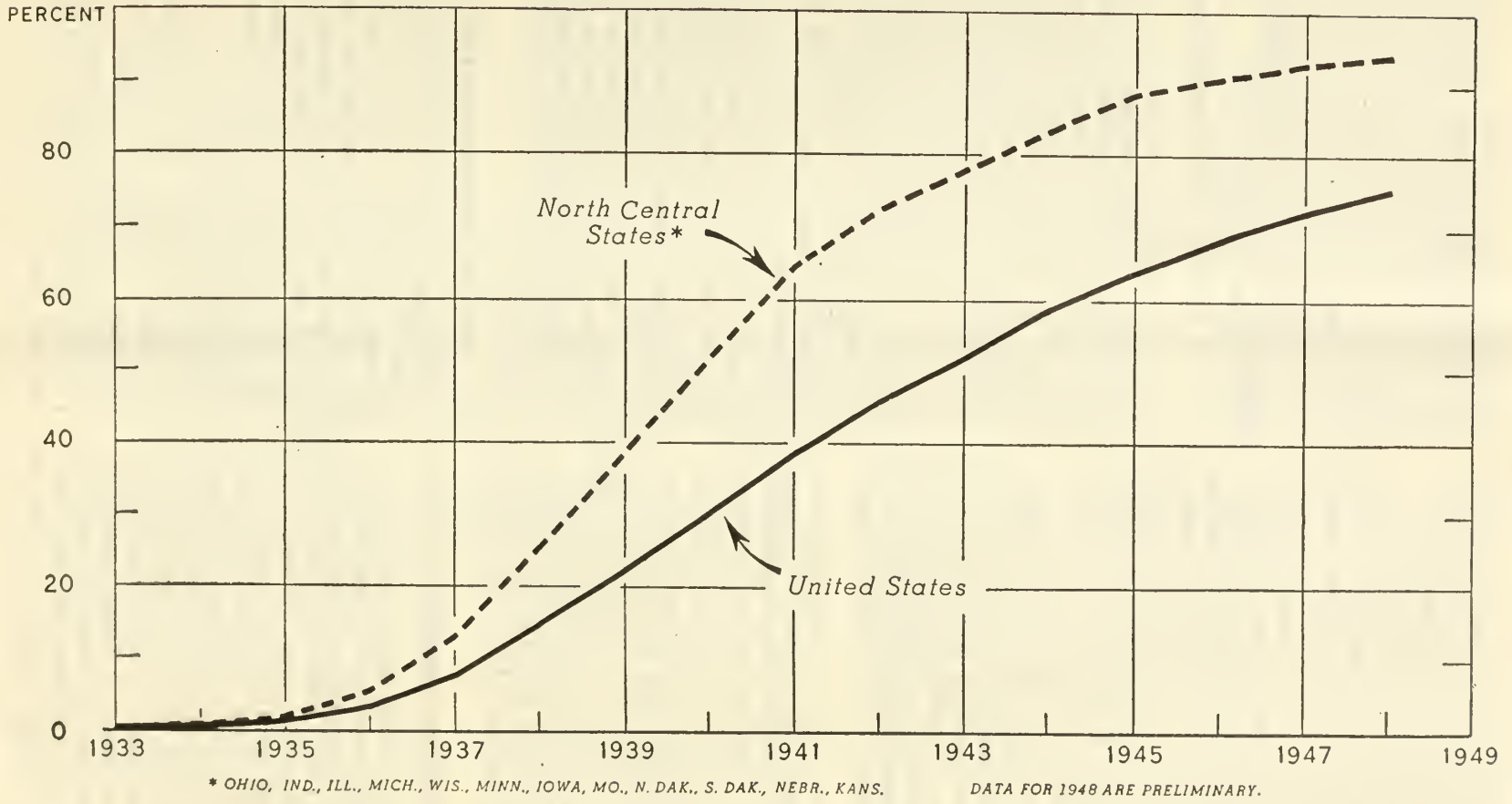


FIGURE 20.—PERCENTAGE OF CORN ACREAGE PLANTED WITH HYBRID SEED, NORTH CENTRAL STATES AND UNITED STATES, 1933–48.

From the merest beginnings in 1933, hybrid seed had replaced open-pollinated varieties on more than three-fourths of the total acreage planted in 1948. The increase has been most rapid in the North Central States, where it was used for planting 94 percent of the acreage in 1948.

age increase is usually about the same on good as on poor land, which tends to give additional advantage to higher yielding areas because expenses do not rise in proportion to the higher yields.

Corn production in 1944 was about a third above the average in 1935–39. The acreage harvested was 1 percent greater, and yields per acre were 31 percent higher (fig. 21). A part of this increase in yields can be attributed to better growing weather than in 1935–39, and a smaller part of it to use of more fertilizer and improvement in cultural practices. But the most effective influence was the greater use of hybrid seed. Assuming an average increase in yields of 20 percent over open-pollinated corn, hybrid seed added 400,000,000 bushels to the 1944 crop. Nearly 16,000,000 more acres would have been required to grow that much corn if open-pollinated seed had been used.

Although the corn crop of 1948 was an all-time record of 3.6 billion bushels, the 1947 crop of 2.4 billion bushels was the smallest since 1936. Power machinery and hybrid seed did wonders in overcoming the handicaps of an unfavorable planting season in 1947, but the dry hot weather which continued through August in the Mississippi Valley was largely responsible for the greatly reduced yields of corn.

The experience with the 1947 corn crop emphasizes that although hybrid seed and power machinery can help to alleviate the conditions of unfavorable weather, they are far from adequate protection against weather hazards. In years of average weather, however, it appears that 3-billion-bushel corn crops will become the rule rather than the exception—even with some contraction of acreage to make room for more hay and pasture. A farmer must bear in mind, of course, that higher yields of corn remove more fertility from the soil, and that if yields are to be maintained he must use more commercial fertilizer, better crop rotations, and more livestock, and make better use of farm manures.

HIGHER YIELDS OF GRAIN SORGHUM AND OATS

Annual production of sorghums for grain in the years 1942–44 was 242 percent of the prewar years 1935–39. The grain sorghums are grown principally in the Great Plains where the yields vary over a wide range, depending upon weather. Figure 22, page 38, indicates that both acreage and production have increased within recent years. Relatively favorable weather, development of new high-yielding varieties that can be harvested with a combine, and the high wartime prices for feed grains, have all contributed to the increased production of grain sorghums. A larger acreage of winter wheat together with low abandonment held down the acreage of grain sorghums in 1945. Less favorable growing weather reduced the yield to 15.1 bushels compared with an average of 17.3 bushels in the years 1940–44. In 1948 production was 131.6 million bushels from 7.3 million acres.

New varieties of oats have resulted in increases somewhat comparable to those of hybrid corn in yields per acre. Better winter varieties adapted for the South have helped to expand acreage and to obtain higher yields in that region. New varieties—as Tama, Boone, Vicland, Marion, and more recently Clinton—adapted to the Northern States, have been grown on a wider scale.

RECORD WHEAT PRODUCTION

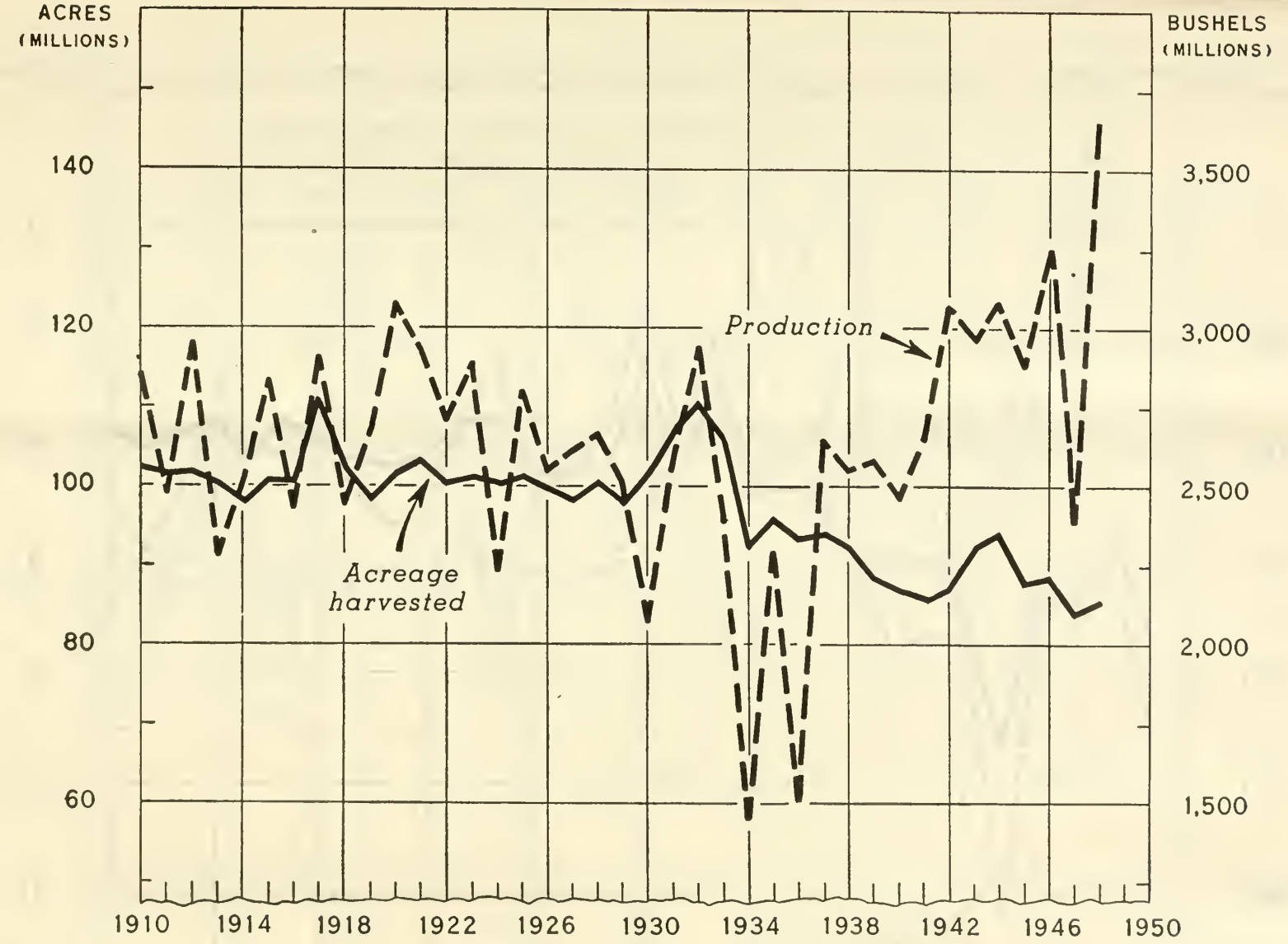
Wheat production averaged more than one-fourth higher in 1942–44 than in 1935–39, with a planted acreage only four-fifths as large (fig. 23, p. 39). More favorable growing weather than in those earlier years is of course the outstanding reason. Figure 24, page 40, indicates that a considerable part of the increase in yields during the war represented recovery from the drought yield levels of the 1930's. This is especially evident in the hard-winter and spring-wheat States, which had more than 70 percent of the planted acreage in 1940–44. The successive record wheat crops of 1946 and 1947, and a near record in 1948, are largely attributable to favorable growing conditions which brought high yields on the extensive seeded acreages.

But in addition to this favorable weather there appears to have been an upward trend in yields in the last decade or so that was badly obscured by the drought cycle. It seems reasonable to expect yields higher, by about 2 bushels per planted acre, in the next few years, than the long-time prewar average. Back of this increase are improved varieties, with particular emphasis on disease resistance, also soil- and moisture-conserving practices, and mechanization, which increases the timeliness of operations.

UPWARD TREND IN COTTON YIELDS

Both the acreage and the total production of cotton were lower in the war and the first two postwar years than in 1935–39, but the yield per acre continued the increase that seems to have begun in 1931. The yield receded somewhat in the drought years, but it reached a new peak in 1937, and an all-time record in 1948. Figure 25, page 41, shows the contrasting trends of cotton acreage and yield per acre.

The upward trend in yields of cotton can be attributed mainly to (1) use of more fertilizer, (2) a shift to higher yielding areas with reduction in acreage, (3) careful selection of land within each area and on individual farms, (4) use of improved varieties, and (5) increased use of legumes. As these factors have not operated with equal



DATA FOR 1948 ARE PRELIMINARY

FIGURE 21.—ACREAGE AND PRODUCTION OF CORN IN THE UNITED STATES, 1910–48.

The acreage of corn harvested in the United States remained approximately stable from 1910 to 1930—at about 100,000,000 acres—except in 1917, when a record acreage of corn was harvested under combined circumstances of World War I and an extraordinary winter-killing of wheat. During the depression—1931, 1932, and 1933—farmers in many areas increased their acreage in an effort to offset low prices. Drought and acreage allotments reduced the acreage before World War II, but the downward trend was reversed in the war years.

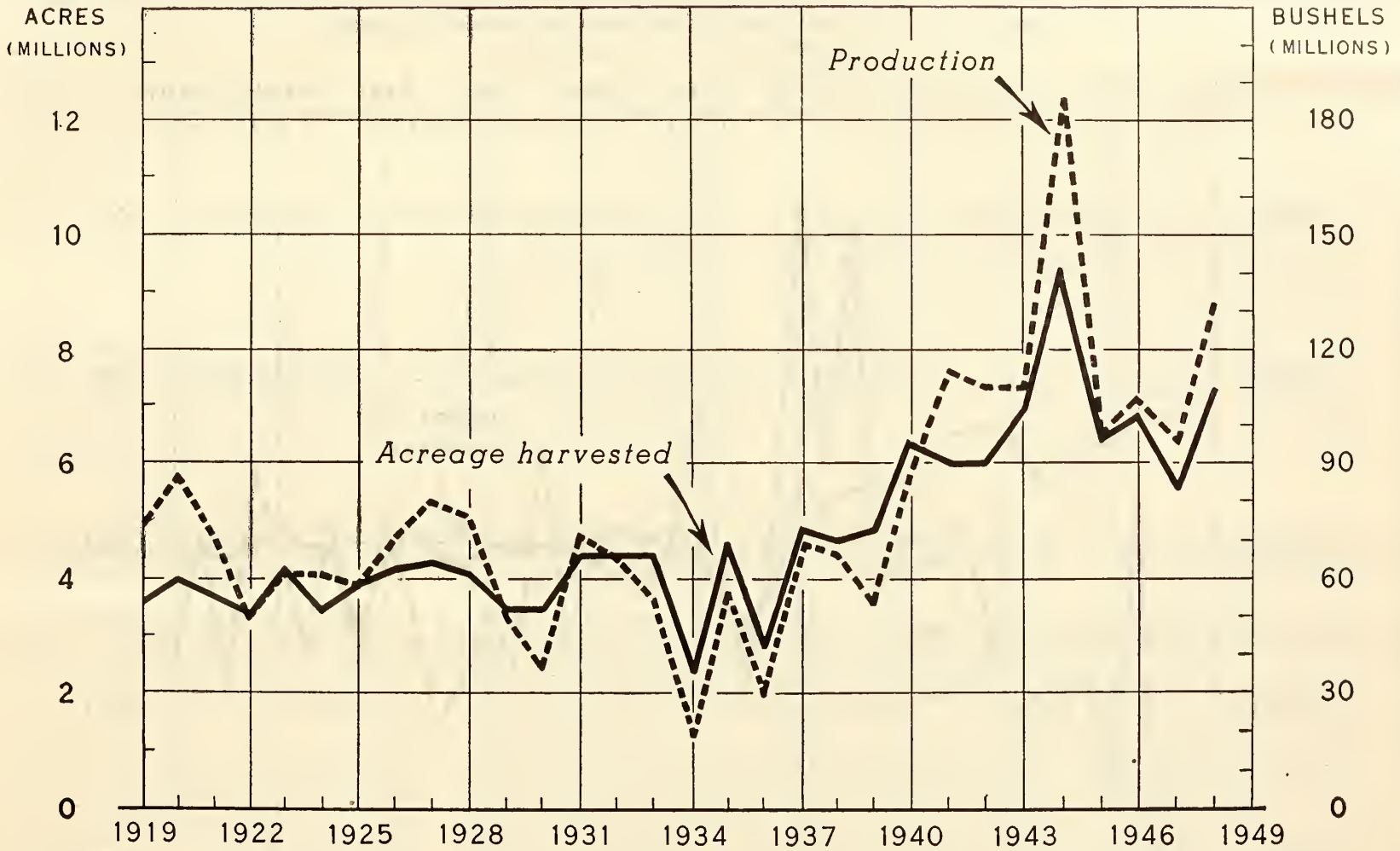
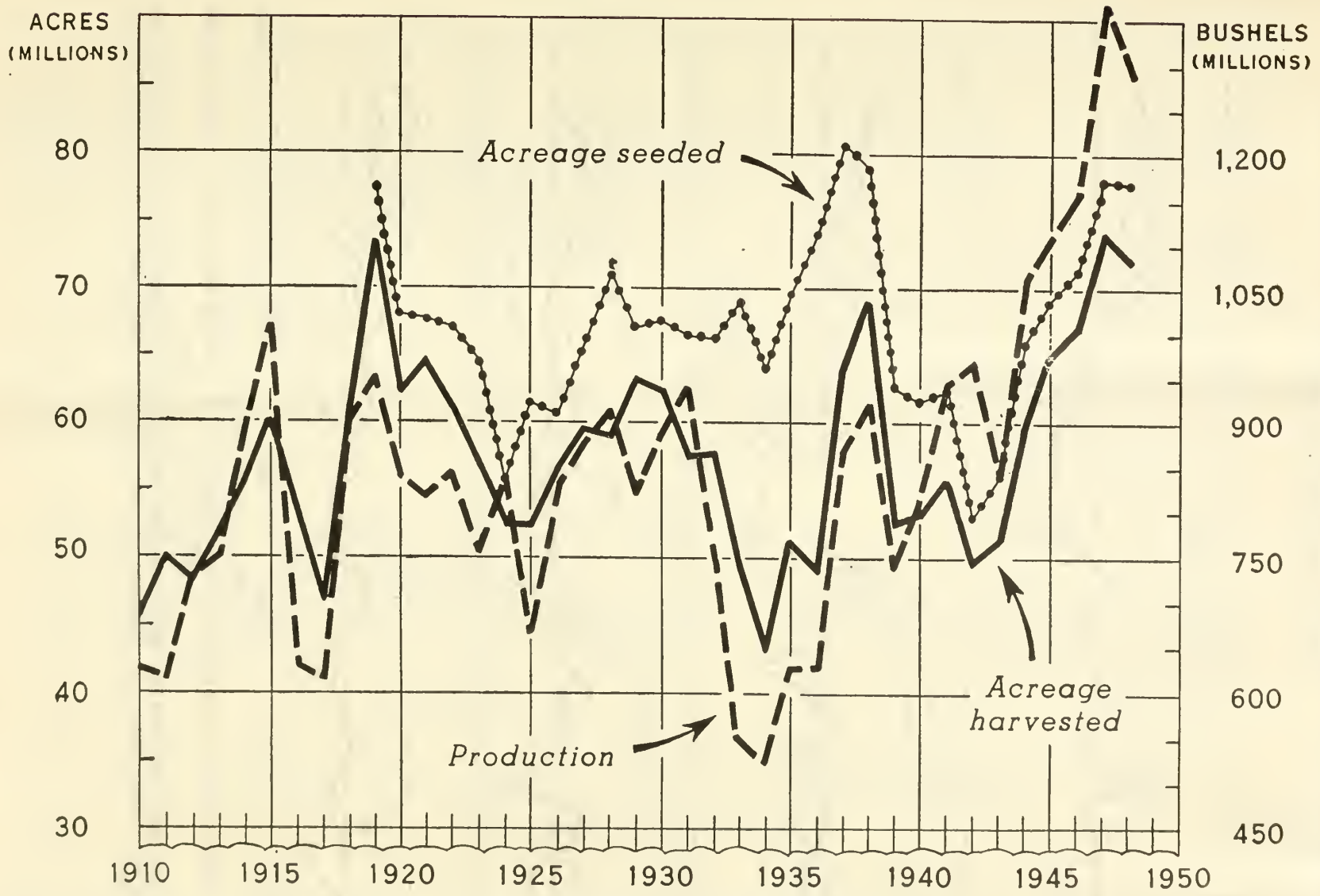


FIGURE 22.—ACREAGE AND PRODUCTION OF SORGHUMS FOR GRAIN, UNITED STATES, 1919–48.

Between 1919 and 1939 the acreage of sorghums harvested for grain averaged about 4,000,000 acres. Production fluctuated greatly during this period because the crop is grown under very hazardous weather conditions. Both acreage and production since 1939 have been far above the prewar level.



DATA FOR 1948 ARE PRELIMINARY

FIGURE 23.—ALL WHEAT: ACREAGE AND PRODUCTION, UNITED STATES, 1910–48.

Most of the wheat is grown in areas of relatively low rainfall. Therefore both the acreage harvested and production are greatly affected by weather conditions. Acreage and production remained at low levels during the war years, but new records in wheat production were established in the postwar years 1947 and 1948.

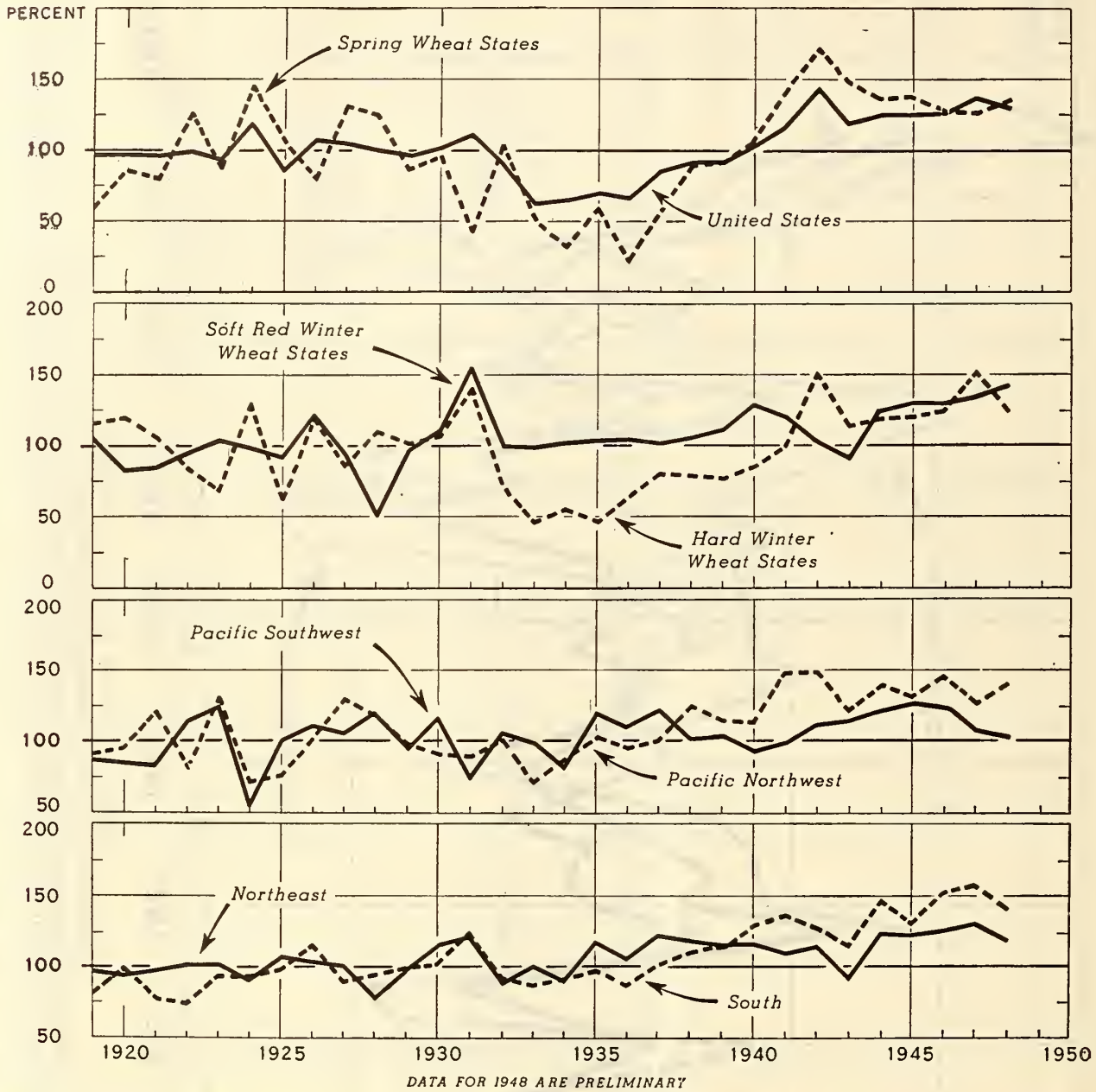


FIGURE 24.—YIELDS OF WHEAT PER ACRE PLANTED, UNITED STATES AND BY GROUPS OF STATES, 1919–48. (INDEX NUMBERS 1923–32=100.)

Yields of wheat have been above the 1923–32 average in most years since 1940, in all regions. Yields in the Pacific Northwest and the Southern States since 1938 have been materially higher than during the 10-year 1923–32 period before the droughts.

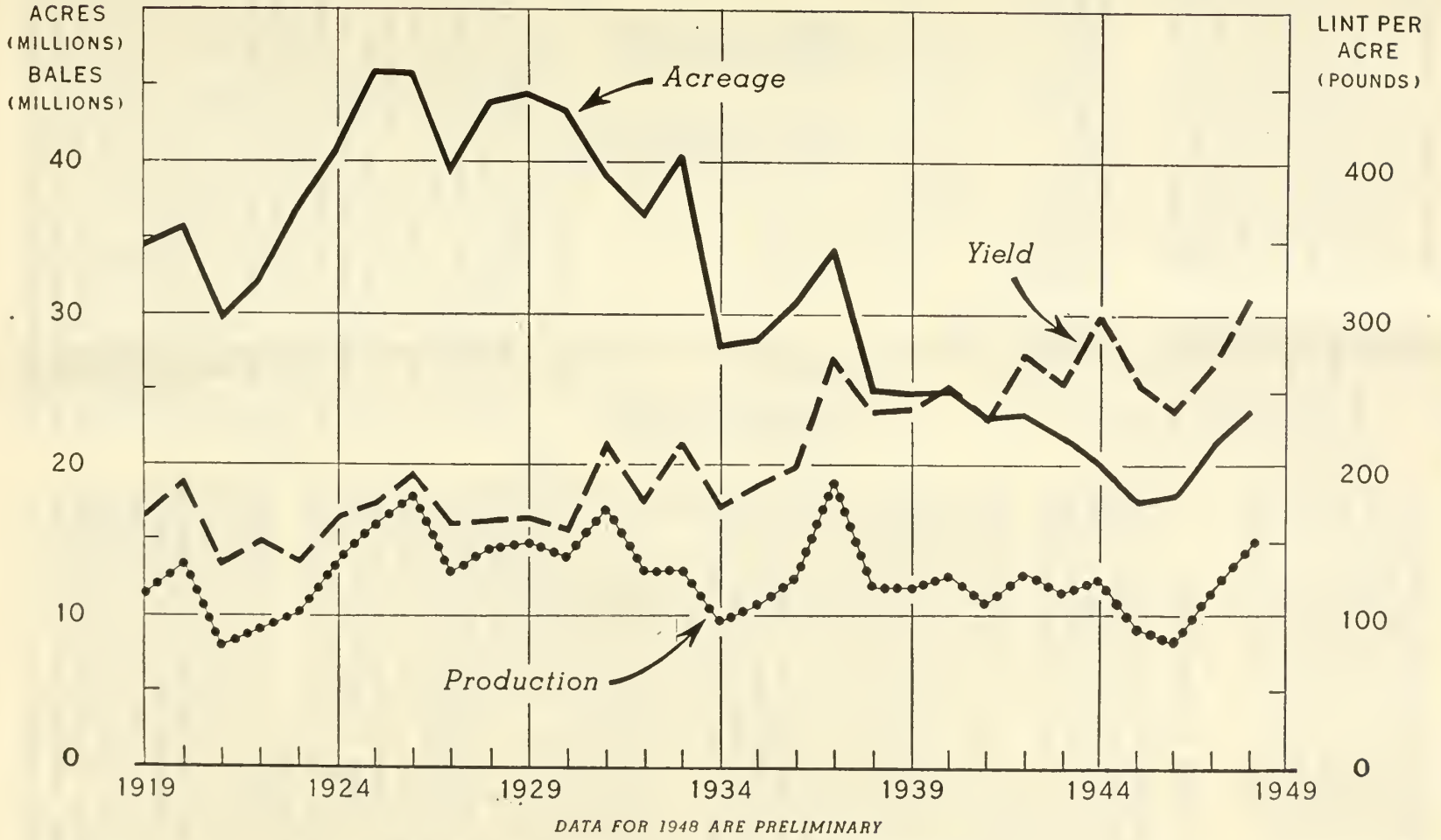


FIGURE 25.—ACREAGE OF COTTON IN CULTIVATION JULY 1, YIELD AND PRODUCTION, UNITED STATES, 1919–48.

Cotton acreage was increasing from 1921 to 1926, when nearly 46,000,000 acres were in cultivation. Since 1926 the general trend has been downward. Production shows a smaller downward tendency than acreage because the trend of yields has been upward.

effectiveness in all cotton-producing areas, there has been a considerable shift in production, as between areas. This is brought out in figure 26, page 43, which indicates that the Irrigated, the Delta, and the High Plains areas have increased their production of cotton above their 1928–32 levels. In some other areas, as in the Texas Blacklands, production is now much lower than the 1928–32 level.

POTATO YIELDS AT NEW LEVELS

Other crop changes that have influenced the level of production materially are the higher yields per acre of white potatoes, the increase in both acreage and yields of fresh and processing vegetables, and the larger acreage and greater bearing surface of fruit trees.

Changes in yield per acre of white potatoes harvested in selected States and for the United States, from 1919 to 1947, are shown in figure 27, page 44. The upward trend in yields is pronounced in nearly all the chief commercial States. The United States average shows a gradual upward climb; it was interrupted for several years in the early 1930's but reached new highs in the early 1940's. The yield in 1948 of 212 bushels per acre harvested was the highest on record.

There are two principal reasons for the higher yields of potatoes. Adoption of a whole group of improved practices is one—raising higher yielding varieties, use of more fertilizer, and more effective control of insects and diseases. The second reason is that these improvements, combined with mechanization, have pushed more of the production into the hands of specialized commercial growers who use the new methods on large acreages, in areas that are especially adapted to potatoes. This has brought a considerable change in the location of the production both within several of the chief producing States and among the different States. The harvested acreage of potatoes has gone generally upward since 1919, in California, Idaho, and Maine. On the other hand, the acreage in the Lake States (Minnesota, Wisconsin, and Michigan) has had a downward trend. The most rapid increase in recent years has been in Kern County, Calif., where very high yields are obtained under irrigation.

Gradual concentration of potato production, principally in the hands of specialized producers who are located in the most favorable areas, is still under way. This trend has been accelerated by the price-support programs and may be influenced by changes in support prices. But it seems probable that if weather conditions are favorable, new records of yield may be established as the large-scale, specialized producers make further improvements in their methods.

EXPANSION OF VEGETABLE PRODUCTION

Acreages devoted to commercial truck crops increased sharply between the two wars (table 5). Improvement in techniques of production, better knowledge of disease and insect control, and better methods of marketing and distribution, gave producers added incentives on the production side. Greater appreciation by consumers of the nutritional value of vegetables in the diet contributed to an expanding consumer demand and provided a market for a corresponding higher level of production.

TABLE 5.—*Harvested acreage of commercial truck crops for fresh market and for processing, United States, 5-year averages, 1920–44, and annual 1940–45*

Year	For fresh market	For processing	Total
	Thousand acres	*Thousand acres*	*Thousand acres*
1920–24	739	741	1,480
1925–29	1,160	1,025	2,185
1930–34	1,600	1,064	2,664
1935–39	1,744	1,386	3,130
1940–44	1,699	1,799	3,498
1940	1,711	1,394	3,105
1941	1,682	1,664	3,346
1942	1,649	1,997	3,646
1943	1,573	1,958	3,531
1944	1,879	1,984	3,863
1945	1,893	1,943	3,836
1946	2,047	2,062	4,109
1947	1,843	1,879	3,722
1948 [1]	1,802	1,710	3,512

[1] Preliminary estimate.

Acreages of fresh-market vegetables expanded more rapidly than the acreages of vegetables for processing between the wars. Production of processed vegetables increased rapidly after 1933, however, partly because of improvements in the freezing of foods and the resulting rapid expansion in demand for frozen vegetables.

Consumption of fresh vegetables, per capita, increased in average figures from 205 pounds in the period 1920–24 to 235 pounds in the 5-year period 1935–39, to 237 pounds in 1943, and to 256 pounds in 1948. Consumption of canned vegetables was 19.6 pounds net canned weight per capita, in 1920–24, 29.9 pounds in 1935–39, 34.5 pounds in 1943, and 38.3 pounds in 1948.

The upward trend in acreage of fresh-market vegetables in the interwar period was reversed from 1940 to 1943. This was influenced in part by growers' difficulties in obtaining farm labor and production supplies, by more emphasis on other needed commodities, by a shift on the part of many

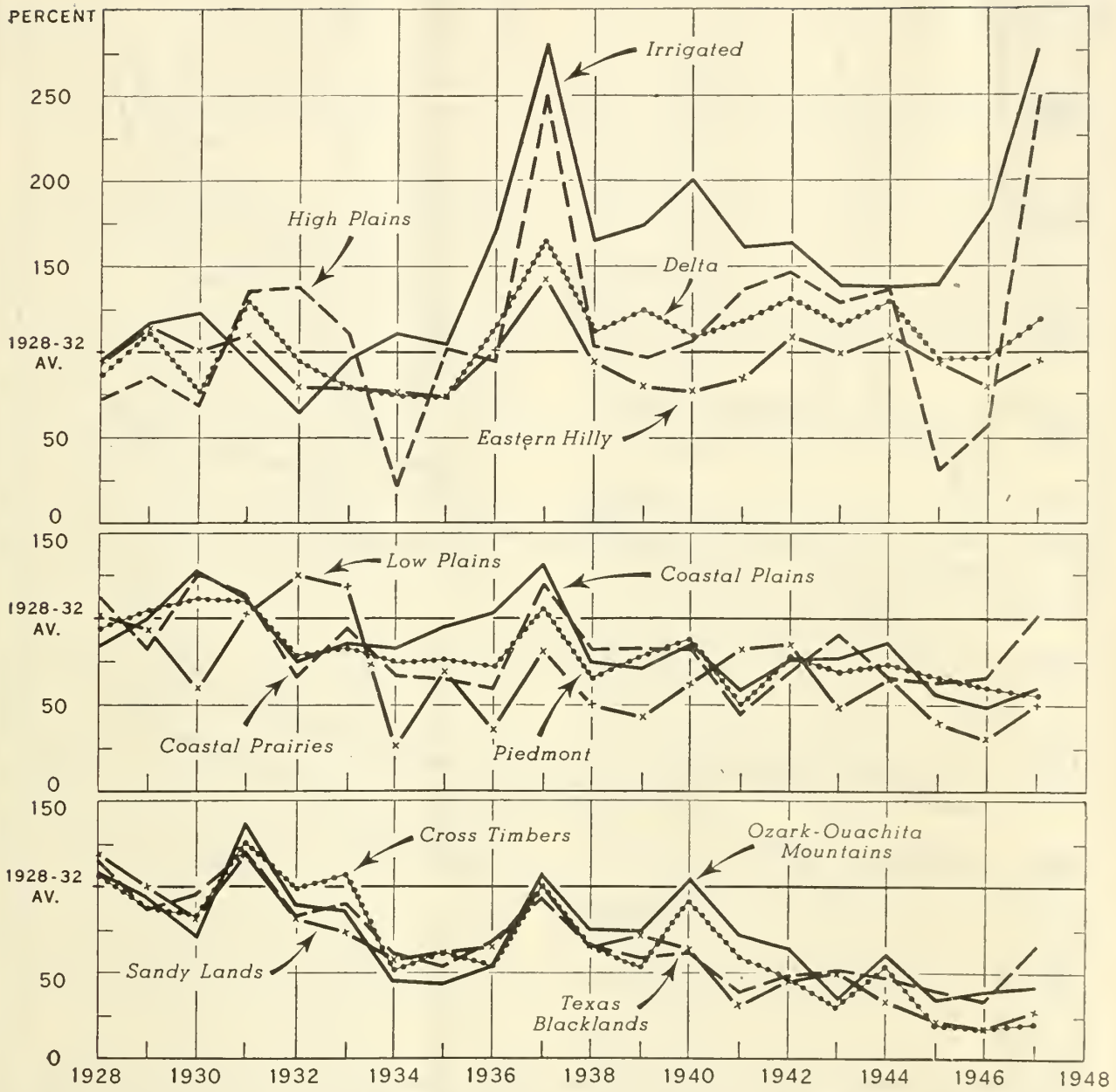


FIGURE 26.—COTTON PRODUCTION AS PERCENTAGE OF 1928–32 AVERAGE, BY PRODUCTION AREAS, 1928–47.

The wartime cotton acreage was below the prewar level in all except the irrigated areas. This resulted in decreased production except in the areas where higher yields have more than offset the smaller acreage.

growers from fresh vegetables to vegetables for processing, and by the victory gardens that displaced some of the commercial market. But a record acreage was planted in 1944, which was exceeded in 1945 and again in 1946. Somewhat smaller acreages were harvested in 1947 and 1948.

In contrast to the downward trend of fresh-market vegetables during the first three war years, the acreage of vegetables for processing increased sharply in 1941 and again in 1942. It was maintained at or about the 1942 level from 1943 to 1946, and was down a little in 1947 and 1948. This means an average about 40 percent above the 1935–39 average. Heavy wartime demands for processed foods for military and lend-lease use provided the basis for this expansion. The major

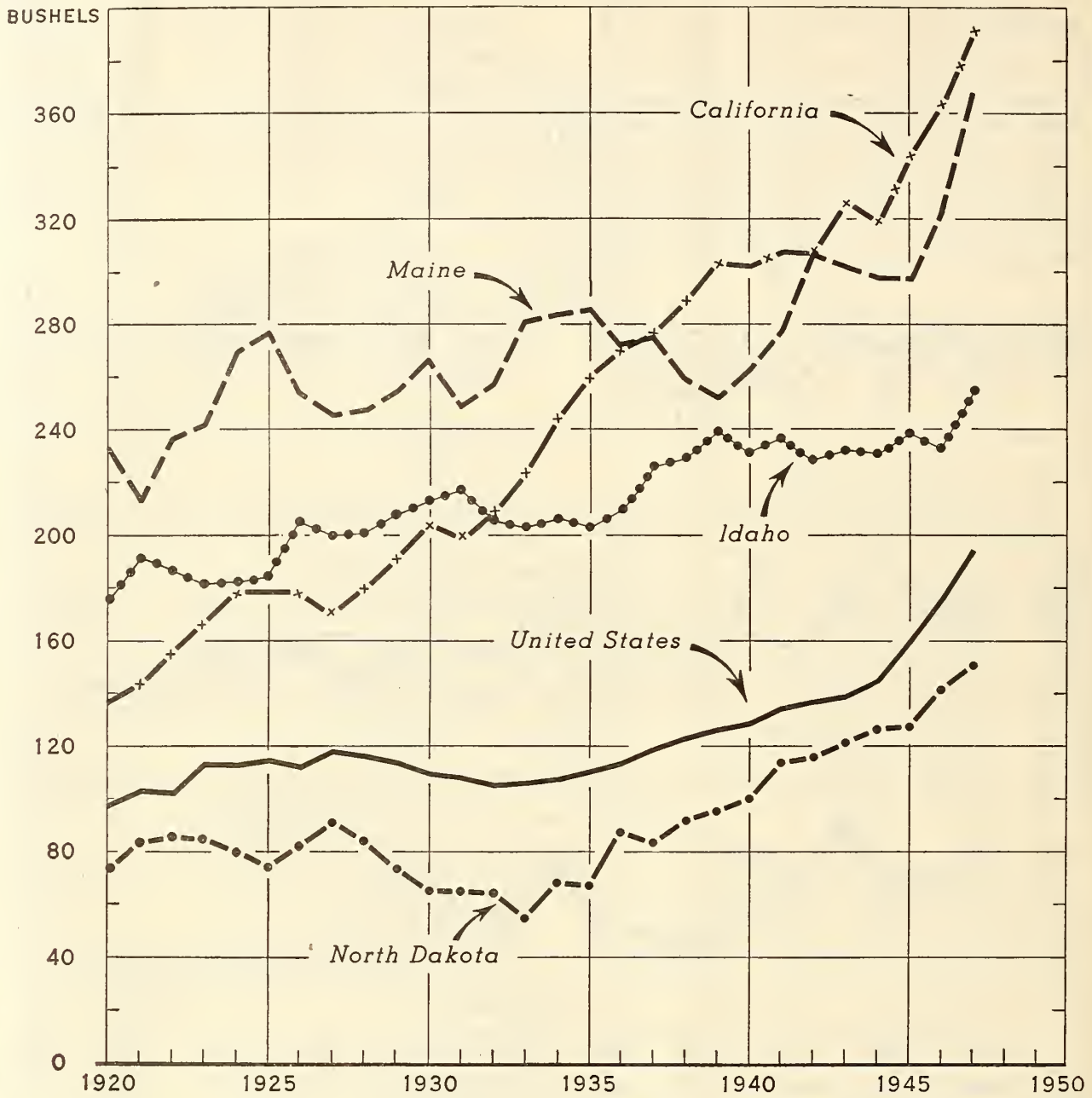


FIGURE 27.—YIELD OF POTATOES PER HARVESTED ACRE, FOUR SELECTED STATES AND UNITED STATES, 1919–48. (3-YEAR MOVING AVERAGE).

Maine, Idaho, and California produce about one-third of the potatoes grown in the United States. They are the only States that consistently show yields above 200 bushels per acre. Production there is concentrated on land best suited to potatoes and in relatively large-scale enterprises. Production in North Dakota has shown a marked shift from farm production for home supply to commercial production in the Red River Valley. The decided upward trend in United States average yields reflects the extension of acreage by commercial growers who apply effective production practices.

processing vegetables were supported at prices favorable to the growers and this encouraged grower interest in meeting the requests for greater production.

The demand for canned vegetables may now slacken considerably, but there is every reason to anticipate an expanding outlet for frozen vegetables which may more than compensate for any

decline in the quantity of processing vegetables that goes into cans. The peacetime outlook for all vegetables will be closely related to the level of consumer purchasing power, but a further rise in per capita consumption can be expected.

GROWING IMPORTANCE OF CITRUS FRUITS

Bearing acreage of tree fruits is not susceptible to much change within a few years, so higher demand is reflected mainly in higher prices rather than in increased output. Most commercial acreage must be well cared for at all times, and orchards that are allowed to deteriorate through lack of care usually cannot be restored. More fertilizer and better cultural practices result in higher yields in many orchards, but the scarcity of labor and supplies during the war frequently prevented using these means to increase the output. Changes that occurred during the war, therefore, were usually continuations of trends that were in evidence during interwar years. Strawberries and cranberries are the only important fruit crops in which acreage and production were materially affected by the war. Acreage of these two crops combined declined from 205,000 in 1941 to 107,000 in 1945. Decline in production was even more marked.

Acreage of deciduous fruit trees of bearing age reached its highest peak in the late 1920's and early 1930's. During the last decade the acreages of most of the deciduous fruit trees have declined gradually, but citrus trees have increased. Total production of combined fruits has increased; this is attributed almost entirely to the rapidly expanding production of citrus fruits. Fruits other than citrus have remained at a relatively constant production level during the last 15 years (fig. 28, p. 46).

The striking point in the fruit picture is therefore the change that occurred in citrus production. From a relatively small part of the output, citrus fruits have increased until they constitute almost one-half of total fruit production, on a tonnage basis. Citrus production rose from about 2,000,000 tons in 1929 to 7,100,000 tons in 1943—a threefold increase in 15 years. The trend is still sharply upward. As most of the orange and grapefruit trees have not yet reached full production, with present numbers of trees and with normal care of orchards, the production and yields can be expected to keep on rising through several decades, for the trees are relatively young and they naturally have a long productive life.

Yields of all fruits on a bearing-acreage basis have increased. The higher average age of the trees probably has been the most influential single cause. This holds true even for apples, although little further increase in yields can be expected because of older trees.

A shift to fruit production usually means that a product of higher value per acre is obtained as soon as the orchard is of bearing age, and the output increases as the orchard grows toward maturity. These facts partly account for the large increases in farm production over a period of years in Florida and in the Pacific States.

Because many fruits are still considered to be virtually a luxury food by many consumers, the level of national income will be of even greater concern to growers of fruits than to producers of other agricultural commodities. If costs of both production and marketing can be reduced, and if such improvements are reflected in prices that induce larger consumption, the markets for fruit can be gradually expanded.

CHANGES IN LIVESTOCK PRODUCTION

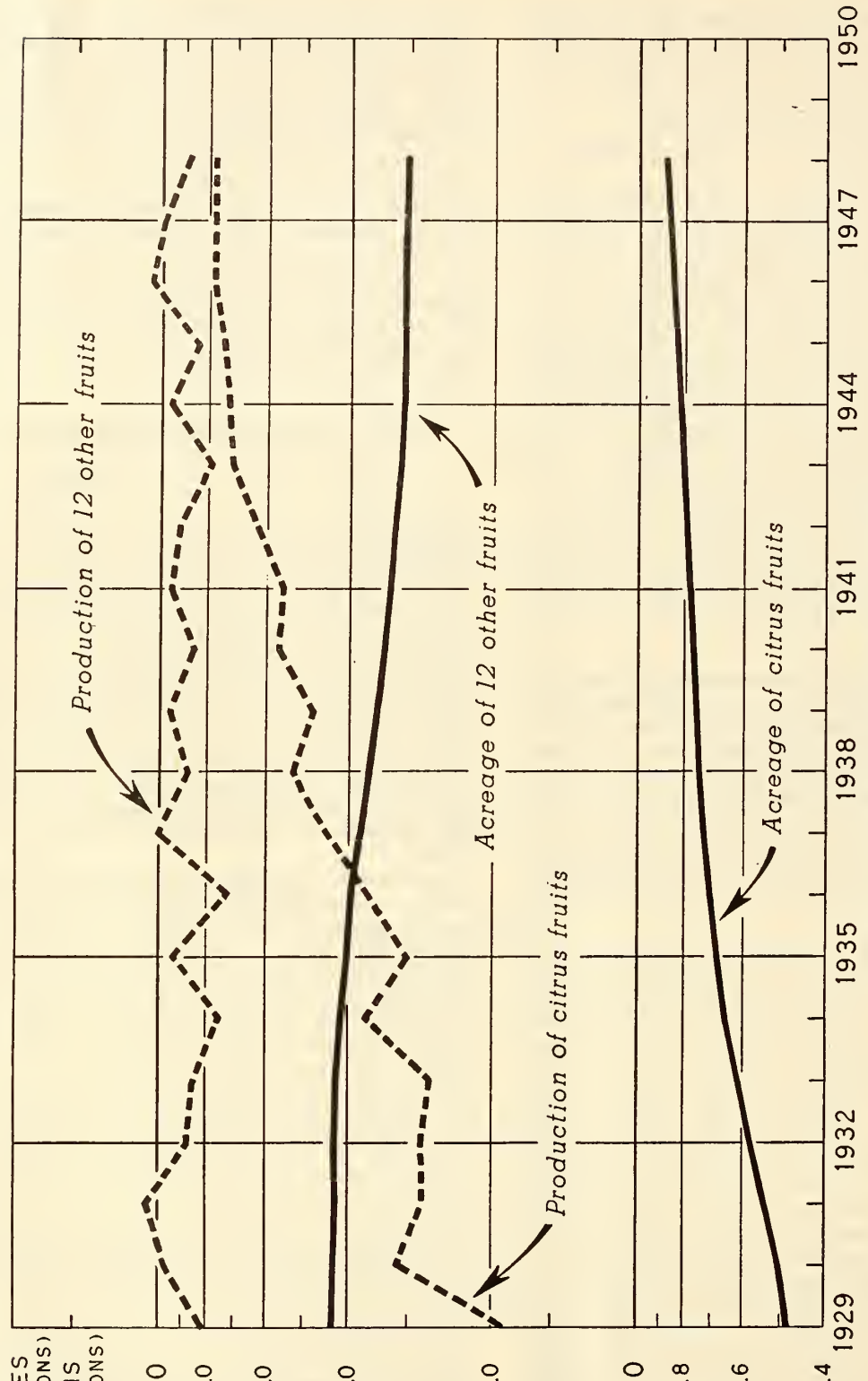
FACTORS INFLUENCING CHANGES

Three major forces are back of the recent changes in livestock production. They are (1) the shift from animal to mechanical power, (2) the variations in the total feed supply, and (3) the higher production per animal. These forces in turn have been influenced by prices of livestock products and other economic changes.

The decrease in horses and mules of 15,000,000 animal units from 1920 to 1946 released land that could grow feed for an equivalent number of productive livestock (animals and their products that are produced for human use). The saving in grain alone amounted to about 16,000,000 tons in 1946—enough to feed 32,000,000 hogs to market weight.

Year-to-year changes in the total feed supply have been about as influential as the shift to mechanical power in their effects on livestock production for human use. The severe drought years, 1934 and 1936, reduced total feed consumption (feed grains, hay, and pasture) about one-fifth below the 1928–32 average. On the other hand, total feed consumption in the war years 1942–44 averaged about 28 percent above the 1928–32 levels, and 34 percent higher than those for 1935–39. Feed production in 1942–44 increased more than in proportion to the increase in numbers of livestock, which meant that there was more feed available per animal. Total numbers of livestock fed increased 20 percent above 1935–39 but the increase in livestock production was greater than this. Excluding horses and mules the increase in production was about one-third.

Livestock production was reduced in 1946 and again in 1947. The short corn crop of 1947 placed definite limits on expansion in the early part of 1948, but the favorable livestock-feed price ratios resulting from the large feed-grain crop of 1948



DATA FOR 1947 AND 1948 ARE PRELIMINARY.

FIGURE 28.—ACREAGE AND PRODUCTION OF CITRUS FRUITS AND OF 12 OTHER MAJOR FRUITS, UNITED STATES, 1929–48.

Acreage of citrus fruit has steadily increased since 1930, whereas the acreage of deciduous fruits has declined. The increase in production of all fruits is due almost entirely to the rapid increase in production of citrus fruits; these fruits account for almost one-half of total production on a tonnage basis. This is a ratio chart showing equal percentage changes.

stimulated heavy feeding as well as the breeding of more animals for 1949 production.

In addition to the changes in the supply of feed there have been notable changes in quality, resulting in the feeding of rations that are more balanced with respect to protein and other nutritive elements. The gradual increase in the protein content of the hay supply has been mentioned (fig. 19, p. 34). The greater supply per animal unit of oilseed meals and other high-protein feeds during the war also helped to balance the feeding rations and to push livestock production upward.

PRODUCTION PER UNIT OF BREEDING STOCK

Changes that have taken place since 1919 in production per unit of breeding livestock are shown for all cattle and for hogs in figure 29, page 48. Figure 5 showed changes in the total production of livestock for human use per animal unit of breeding livestock. This series of records of production per animal unit of breeding livestock are similar to the series that show changes in yields per acre of different crops and production per acre of all crops. They measure the combined effects of all the forces that are back of the changes in livestock production *per unit of breeding stock.* Similarly, the index of production of all crops per acre, measures the combined effects of all the forces that operate to change the total crop production *per acre.*

Changes in livestock production per animal unit of breeding livestock are influenced by weather, chiefly because feed supplies are affected by favorable or unfavorable growing conditions. The bad drought years of the 1930's are reflected in reduced production per unit of breeding animals. But the downward trends shown for those years in figure 29 probably also reflect less attention to livestock in other ways because of the depression and the low prices. On the other hand, the years that combine large feed supplies and favorable prices for livestock soon show the increased production that results both from more liberal feeding and from better care in other ways. For example, in cattle production a larger calf crop, a reduction in death loss, and prevention of disease, all combine with better feeding and other care to produce more meat and milk per cow in the breeding herd.

Increase in output per unit of feed is one measure of increased efficiency in livestock production. There is evidence that significant gains have been made in this direction in all classes of livestock, but the data available on a national basis are not sufficiently refined to allow these changes to be traced. Information obtained in the Corn Belt over a period of years on feed consumed by hogs indicates a reduction of 10 to 15 percent in the quantity of feed used per 100 pounds of pork from the decade of the 1920's to the decade of the 1930's.[5] The number of pigs saved, the prevention of disease, the improvement of breeds, and the feeding of balanced rations all make for higher efficiency in the use of feed.

If similar data were available for tracing changes in feed consumed per 100 eggs produced it seems probable that even greater reductions in feed per unit of product would be shown. Even the over-all national estimates indicate a reduction of about 12 percent in concentrates consumed per 100 eggs produced from the period 1920–24 to 1937–41.[6]

Figure 30, page 49, shows the trend of egg production per layer for the average number of layers on farms. This series shows a sharp upward climb, especially within recent years. The trends in egg production reflect the noteworthy improvements that have been made in the poultry enterprise. In many parts of the country, and especially in the Midwest, it has been transformed from a sideline to an important phase of the farm business.

Figure 31, page 50, shows the changes in milk production per cow over nearly four decades. There was a sharp increase in the 1920's, and then a drop from 1929 to 1934, reflecting the drought and depression then prevailing. More cows were milked during the depression than in the 1920's, so a larger proportion of the cows milked were of beef or mixed breeding, and the feed supply was reduced drastically by drought. Milk production per cow did not return to 1929 levels until 1938. It was maintained at high levels during the war and has reached successive record peaks since that time. Preliminary figures indicate an all-time record of 5,036 pounds per cow in 1948.

Production per cow seems high in relation to previous years but there is still room for considerable improvement. The average milk production per cow, for cows on which full-year records were kept by dairy herd improvement associations in 1945, was 8,592 pounds compared with a national average of 4,797 pounds in that year. In other words, the cows in dairy herd improvement associations produced about 80 percent more milk per cow than the national average. These two estimates of production per cow are not strictly comparable, but the wide difference between the two figures indicates the potentialities of greater production per animal.

More feed per cow, and better balanced rations, would be the two most influential factors in achieving a higher national average production per cow.

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[5] Atkinson, L. Jay, and Klein, John W. Feed consumption and marketing weight of hogs. U. S. Dept. Agr. Tech. Bul. 894, 28 pp., illus. 1945. See pp. 19–21.

[6] Jennings, R. D. Feed consumption by livestock, 1910–41—relations between feed, livestock, and food at the national level. U. S. Dept. Agr. Cir. 670, 57 pp. 1943. See p. 28.

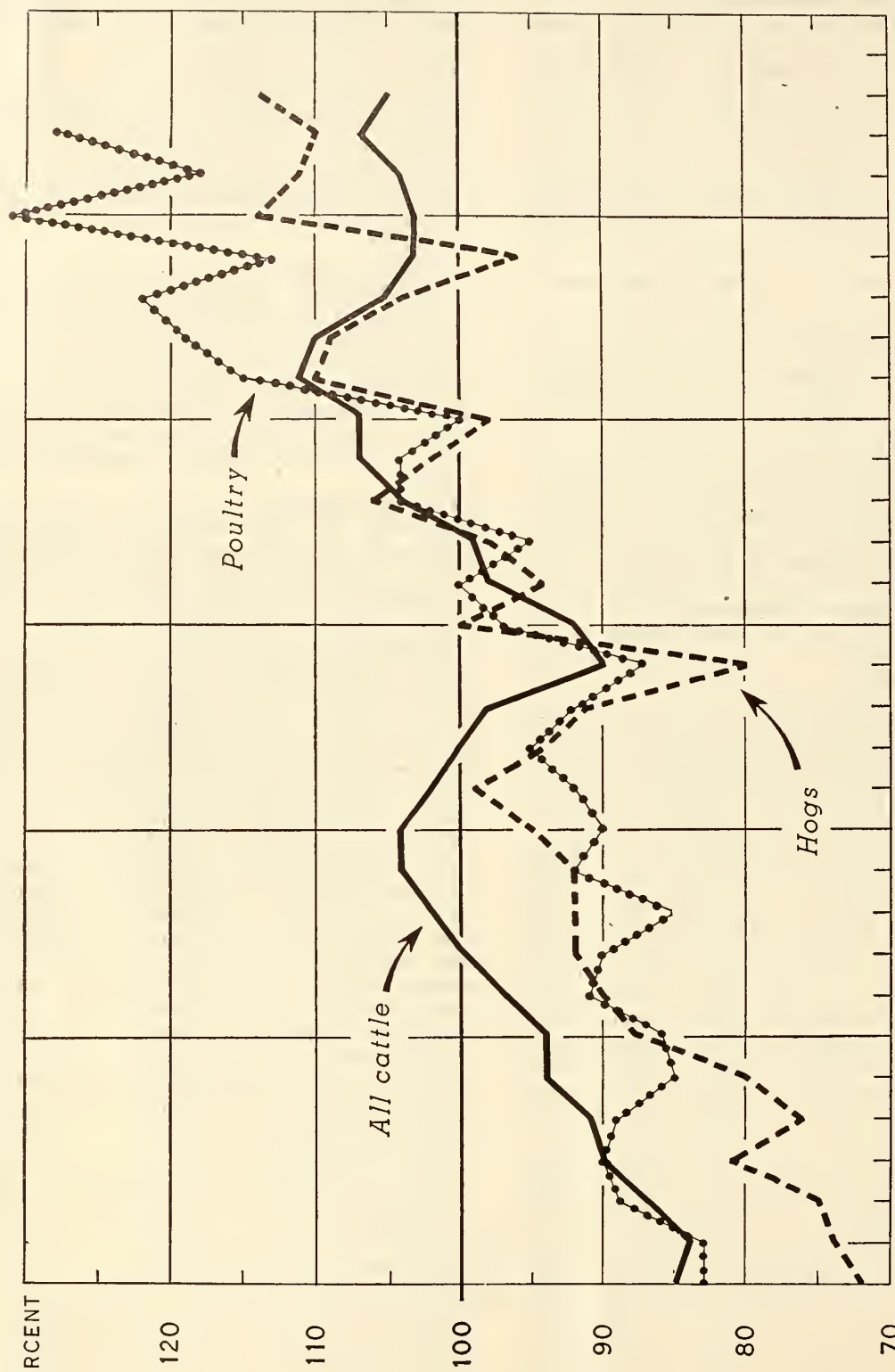


FIGURE 29.—PRODUCTION PER UNIT OF BREEDING LIVESTOCK: ALL CATTLE, HOGS, AND POULTRY, 1919–48. (INDEX NUMBERS 1935–39=100.)

Hog production per unit of breeding stock has moved sharply upward since 1919. There has also been an upward trend in cattle production per unit.

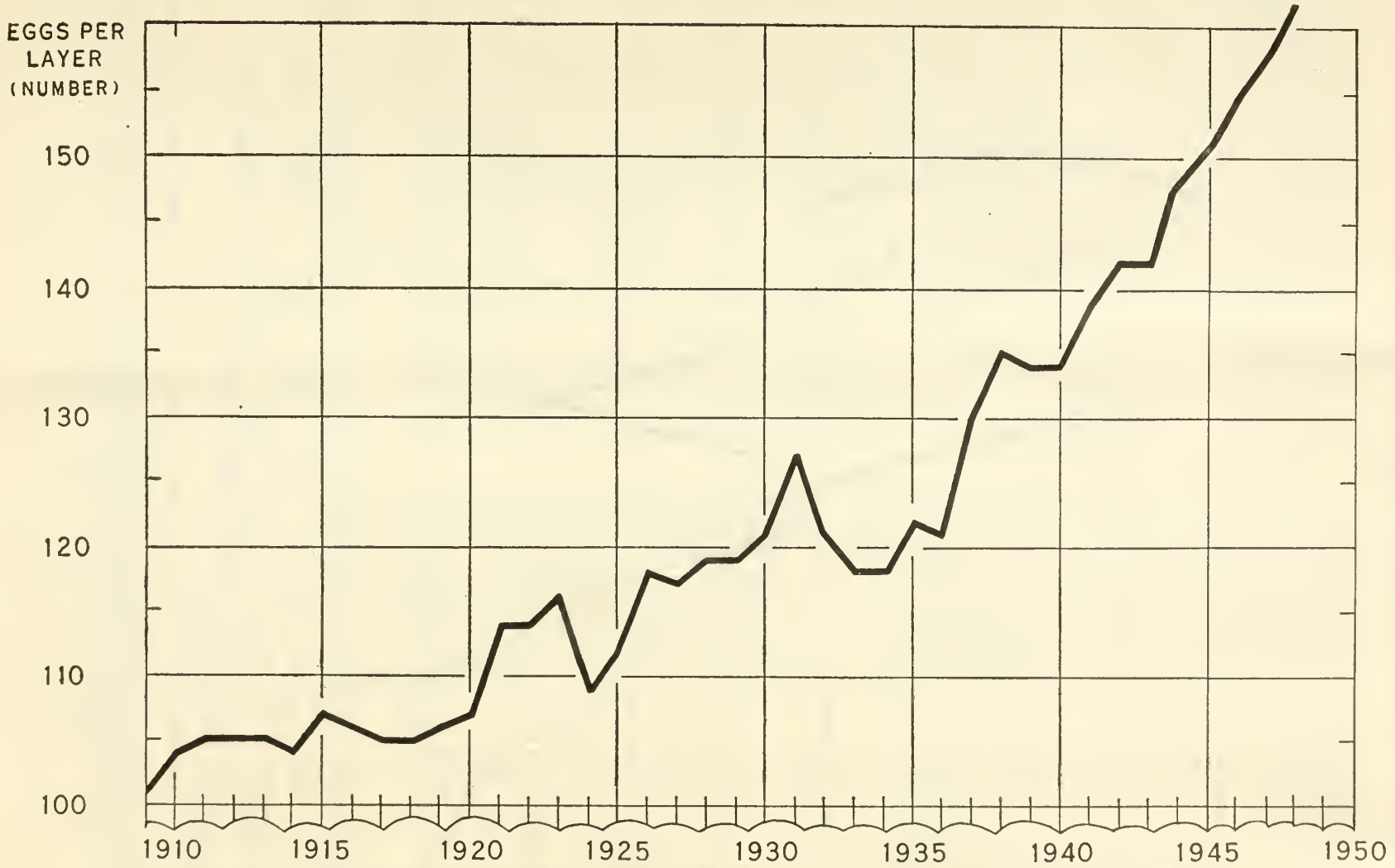


FIGURE 30.—EGG PRODUCTION PER LAYER FOR AVERAGE NUMBER OF LAYERS ON FARMS, UNITED STATES, 1909–48.

Egg production per layer made an upward climb of 50 percent from 1909 to 1945. In the spring of 1949 there was still no indication of leveling off.

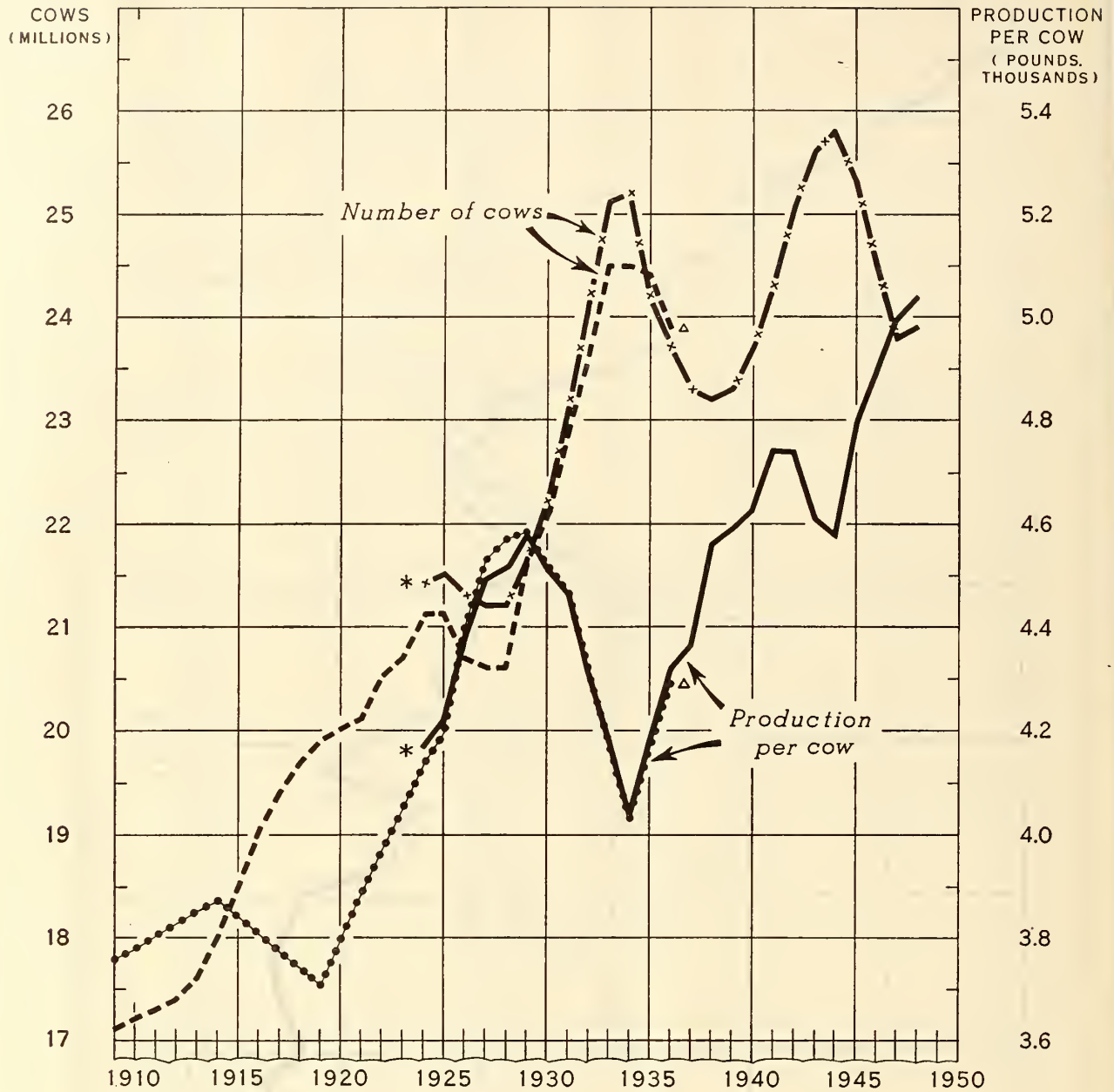


FIGURE 31.—MILK: NUMBER OF COWS MILKED AND PRODUCTION PER COW MILKED ON FARMS, UNITED STATES, 1909–48.

A definite upward trend in milk production per cow for the period since 1909 was interrupted briefly during World War I, and then for a longer time in the drought and depression years of the 1930's (when many cows usually kept for beef were milked). An all-time peak in production per cow was reached in 1948.

Because such a large proportion of the feed used by a dairy cow is required for maintenance, underfeeding means that most of the feed is used for body maintenance, and a relatively small part of it for milk production. In the newer dairy areas, and where dairy production is only a sideline, underfeeding is rather common.

It is recognized, of course, that there are economic limits to heavier feeding, and that these are reached before the physical limits are approached. The economic limits will vary with the price of the product in relation to the cost of feed, and in relation to other expenses. This is true in all classes of livestock, but many farmers feed their cows at levels far below the economic limits, even when milk is high in price in relation to feed. To increase the feed supply per animal, for dairy cows as well as for other classes of livestock, would increase both output per head and net income on the majority of farms.

Other factors also will tend to increase production per animal in future years. New developments in cross-breeding show considerable promise. In dairy cattle, artificial insemination makes it possible to develop the higher milk-producing strains more rapidly than previously. On many farms the herd bull will disappear, and the feed will be fed to milk cows. Improvements in hog breeding, already under way, will increase efficiency in use of feed and produce a carcass of higher quality. More progress will be made in control of disease for all classes of livestock.

PROSPECTIVE DEVELOPMENTS

More progress is called for in improving shelter and equipment, in order to reduce labor and capital requirements in caring for livestock. Further improvements are badly needed in the quantity and quality of the feed supply and in reducing the cost of making the feed available to livestock. As farmers shift toward more soil-conserving systems of farming, more hay and pasture will be available, and that means more roughage-consuming livestock. But improved techniques are needed to produce the roughage in ways that will result in more livestock and livestock products at lower cost per unit of product.

As the introduction of mechanical power gradually makes further progress in the South, the numbers of productive livestock are likely to increase, because of the feed that will be released and because systems of farming are likely to be developed that include more hay, grain, and pasture—crops that can be handled by mechanical equipment. Cattle numbers have increased relatively more in the humid areas of the country than on the ranges, of late, because of the shift to tractor power. This proportionately greater increase will probably continue. On the ranges, expansion of livestock production is dependent upon improvements that will increase carrying capacity, and upon developments that will make it possible to produce more winter feed.

CHANGES IN FARM SIZES AND OWNERSHIP

Factors responsible for a large part of the increases in production also have had considerable influence on changes in the number and sizes of farms (table 6 and fig. 32, p. 52). A part of the change in sizes since 1920 results from factors related to development of new arable land in the West and abandonment of land in the East; and to the very considerable growth in part-time farming, and establishment of rural homes by those engaged in nonfarm work.

The total number of farms counted in the census of agriculture decreased 9 percent from 1920 to 1945. On the other hand, the "land in farms" increased 19 percent. The latter change occurred mostly in the 17 Western States. In fact, the land in farms decreased in most of the Eastern States during this period.

TABLE 6.—*Number of farms by size groups in the United States, census years 1920, 1930, 1940, and 1945*

Census year	Acreage size group							
	Total	Under 10	10–19	20–99	100–259	260–499	500–999	1,000 and over
	Thousands	*Thousands*	*Thousands*	*Thousands*	*Thousands*	*Thousands*	*Thousands*	*Thousands*
1920	6,448	289	508	2,978	1,980	476	150	67
1930	6,289	359	560	2,815	1,863	451	160	81
1940	6,097	506	559	2,512	1,796	459	164	101
1945	5,859	594	526	2,286	1,693	473	174	113

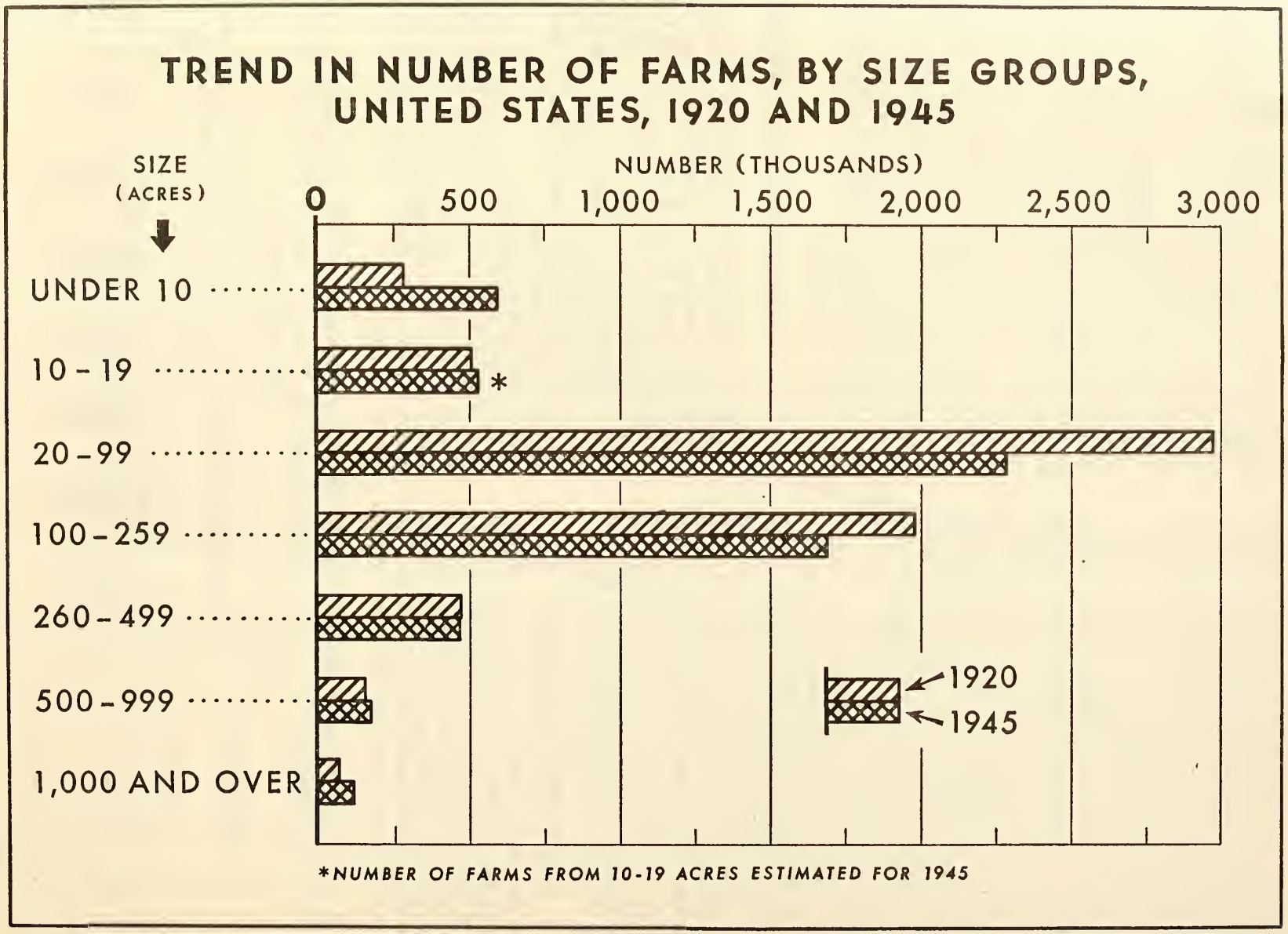


FIGURE 32.—IN THE QUARTER-CENTURY FROM 1920 TO 1945 THE NUMBER OF FARMS UNDER 10 ACRES ENUMERATED BY THE CENSUS MORE THAN DOUBLED. THE NUMBER OF FARMS IN THE SIZE GROUPS FROM 20 TO 259 ACRES DECREASED SUBSTANTIALLY; AND THERE WAS A LARGE PERCENTAGE INCREASE IN THE FARMS OF MORE THAN 1,000 ACRES, WHICH WAS LARGELY ACCOUNTED FOR BY WHEAT FARMS AND LIVESTOCK RANCHES IN THE WESTERN STATES.

MORE PART-TIME FARMS AND RURAL HOMES

In the quarter-century from 1920 to 1945 there was a 106-percent increase in the number of extremely small units that are counted as farms by the census—those under 10 acres (table 6 and fig. 32). Farms of that size are mostly part-time farms, rural homes, and retirement units. Very few are considered as actual farms in the localities where they are found. But they are counted by the census as farms because they have 3 acres or more, or have value of products of $250 or more. The number of farms from 10 to 19 acres increased slightly from 1920 to 1945; these also are frequently part-time farms.

Table 7 contains estimates by the Bureau of Agricultural Economics of the number of part-time and residential units that were counted as farms in the censuses of 1930, 1940, and 1945. This table also shows the number of farms, for those years that may be regarded as "farming units"—farms that are operated primarily as a source of income or to provide a living for the farm family rather than being primarily a place to live. There were 442,000 more part-time and residential farms in 1945 than in 1930, and 871,000 fewer farming units. In 1945 only about 4,300,000 farms could be classed as farms that were primarily a source of income or living for the farm family, rather than being primarily a place to live.

TABLE 7.—*Changes in number of census farms, farming units, and part-time and nominal units, 1930, 1940, and 1945* [1]

Kind of unit	1930	1940	1945
	Thousands	*Thousands*	*Thousands*
All census farms	6,289	6,097	5,859
Farming units	5,141	4,752	4,270
Part-time and nominal units	1,148	1,345	1,589

[1] Number of "farming units" and "part-time and nominal units" for 1930 and 1940 estimated from census data; 1945 numbers derived from "Special Report 1945 Sample Census of Agriculture," table 29.

FEWER SMALL FARMING UNITS

In contrast to the large increase in numbers of the extremely small part-time and residential farms, from 1920 to 1945, there was a 23-percent decrease in what might actually be called "small farms," those with 20 to 99 acres. There were 692,000 fewer farms in this group in 1945 than in 1920. There were 14 percent fewer farms in the size group 100 to 259 acres; this group includes the traditional 160-acre homestead size. But the group from 260 to 499 acres nearly held its own; it showed only a 1-percent decrease in number of farms from 1920 to 1945.

TREND TOWARD LARGER FARMS

At the upper end of the size-of-farm scale there was an increase in the number of farms during this period. The group from 500 to 999 acres showed an increase of 16 percent, and those of 1,000 acres and over increased 69 percent. Although the group of farms of 1,000 acres and over was two-thirds larger than it was in 1920, that group still contained less than 2 percent of the total number of farms, in 1945. But operators of farms of that size controlled about 40 percent of the total land in farms. This seems like a rapid trend toward concentration of land holdings until the data are analyzed more closely. About 87 percent of the number of farms of 1,000 acres or over were found in the 17 Western States. This means that the increase took place mostly in the ranching and dry-land wheat area where 1,000 acres is not a large-scale farm. But census data and other available information indicate that there has actually been some increase in the number of farms that might be termed large-scale farms outside of the grain and ranching areas of the Western States.

More noteworthy than the growth in large-scale farming, was the shift to larger family farms within all the size groups of 100 acres and over. It was made possible and has been accelerated by technological changes, especially by adoption of mechanical power and complementary equipment.

CLASSIFICATION OF FARMS IN 1945

Tables 8 and 9 and figure 33, page 55, provide a summary picture of the distribution of farms by economic classes in 1945. The classification of the farming units is chiefly on the basis of value of products as a measure of size. No comparable figures are available for previous census periods, which means that it is not possible to trace changes in these classes over a period of years. But the 1945 data indicate that farming in this country is still preponderantly a family enterprise. Although the large-scale farm group included 26 percent of the farm acreage and 22 percent of the value of production, the three family farm groups had more than 60 percent of the acreage and produced more than 70 percent of the value of farm products.

TABLE 8.—*Percentage of farms, population, acreage, and value of farm products by economic class, United States, 1945*

Economic class [1]	Number of farms	Farm population	Farm acreage	Gross value of farm production
	Percent	*Percent*	*Percent*	*Percent*
Farming units:				
Large-scale farms	1. 7	3. 7	25. 8	21. 9
Commercial-family farms:				
Large	7. 0	8. 5	18. 3	23. 5
Medium	20. 0	21. 3	24. 1	30. 0
Small	28. 4	28. 5	18. 1	17. 1
Small-scale farms	15. 8	14. 0	5. 8	4. 2
Other units:				
Part-time units	10. 3	10. 9	2. 3	1. 9
Nominal units	16. 8	13. 1	5. 6	1. 4
All farms	100. 0	100. 0	100. 0	100. 0

[1] Special Report 1945 Sample Census of Agriculture, table 29. Economic class is defined in terms of the *total value of products* sold and used by the farm household modified by specified secondary criteria: Large-scale farms, $20,000 and over; large family farms, $8,000 to $19,999; medium family farms, $3,000 to $7,999; small family farms, $1,200 to $2,999; small-scale farms, $500 to $1,200; part-time units, $250 to $1,200 with operator working off farm 100 days or more; nominal units, less than $500 with some adjustments for work off farm and abnormal relative values of farm products and land and buildings.

Perhaps the most difficult farm problems are found on the nearly 1,000,000 small-scale farms that had less than 6 percent of the total acreage and produced only 4 percent of the farm products. The annual value of products on these farms is from $500 to $1,200. Although the farms on which the operator worked off the farm 100 days or more are not included in this group, we do not know how many of these farm families had other sources of income. It is safe to assume, however, that a large group of them had extremely low incomes available for living even in the relatively prosperous year of 1944. These small-scale farms tend to be concentrated in such areas as the Southern Appalachians and the cut-over parts of the Lake States.

Looking forward, some of the same forces are likely to continue to influence changes in the number and sizes of farms as have operated over the last quarter-century. We might expect a further large increase in the number of part-time farms and rural homes. If nonfarm employment is available there might be a gradual decrease in the number of small-scale farms. The full-time family-operated farms are likely to be fewer and larger. And there might be some further increase in the number of large-scale farms, but they will still constitute a relatively small percentage of the total number of farms.

TABLE 9.—*Number and important characteristics of farms by economic class, United States, 1945*

Economic class [1]	Number of farms	Average per farm				
		Gross value of product	All land	Harvested crop land	Value, land and buildings	Value, implements and machinery
Farming units:	*(1,000)*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*
Large-scale farms	102. 1	39, 203	2, 905	384	78, 422	6, 452
Commercial-family farms:						
Large	408. 9	10, 484	514	193	26, 067	3, 021
Medium	1, 173. 0	4, 658	236	104	11, 135	1, 616
Small	1, 661. 9	1, 874	125	46	5, 117	595
Small-scale farms	923. 5	825	72	22	2, 305	204
Other units:						
Part-time units	602. 2	574	43	10	2, 585	209
Nominal units	987. 3	264	65	11	3, 583	176

[1] Special Report 1945 Sample Census of Agriculture, table 29. Economic class is defined in terms of the *total value of products* sold and used by the farm household modified by specified secondary criteria: Large-scale farms, $20,000 and over; large family farms, $8,000 to $19,999; medium family farms, $3,000 to $7,999; small family farms, $1,200 to $2,999; small-scale farms, $500 to $1,200; part-time units, $250 to $1,200 with operator working off farm 100 days or more; nominal units, less than $500 with some adjustments for work off farm and abnormal relative values of farm products and land and buildings.

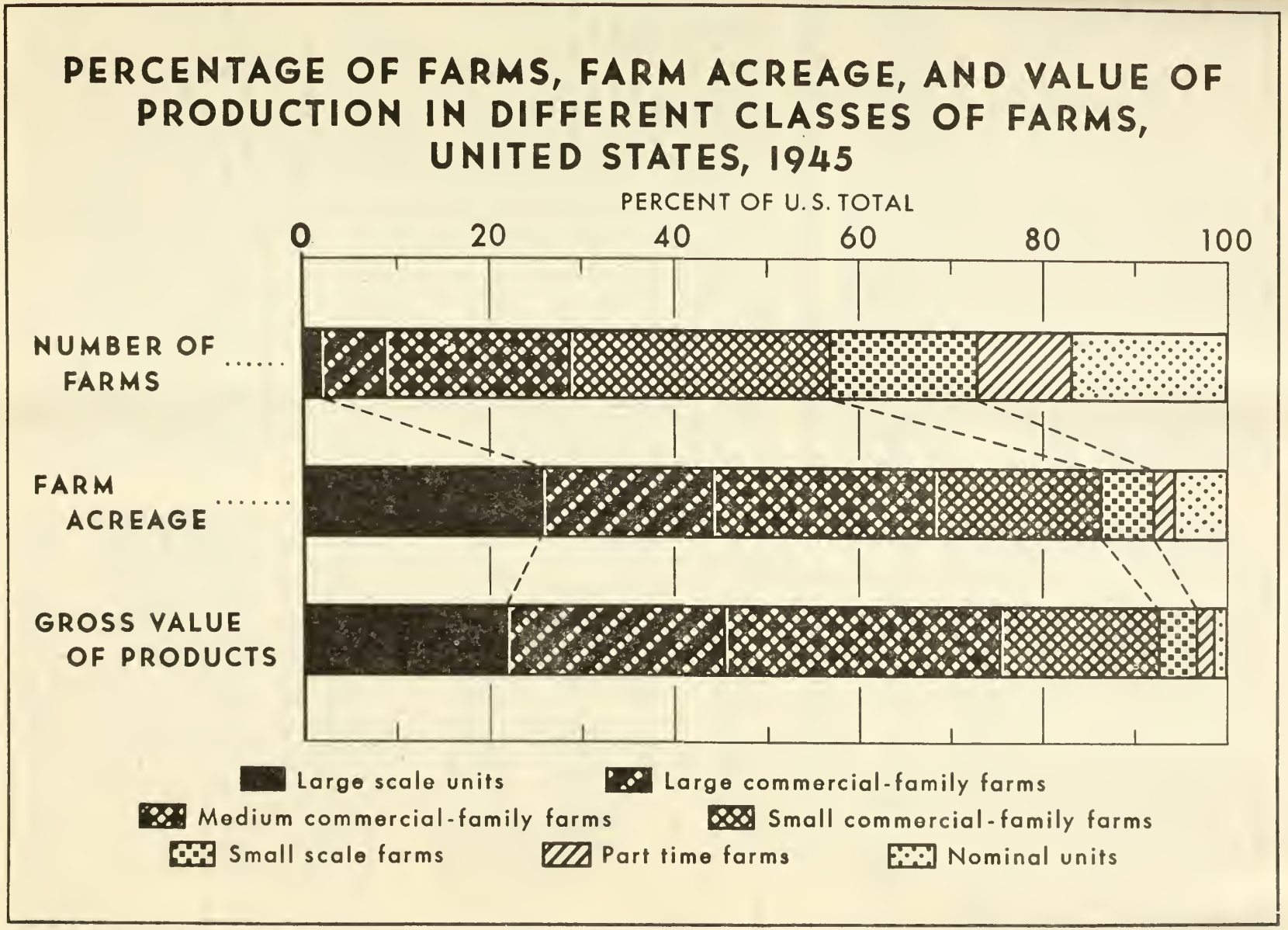


FIGURE 33.—IN 1945 MORE THAN ONE-FOURTH OF THE FARMS COUNTED BY THE CENSUS WERE CLASSIFIED AS PART-TIME AND NOMINAL UNITS, BUT THEY HAD ONLY 8 PERCENT OF THE FARM ACREAGE AND PRODUCED ONLY 3 PERCENT OF THE GROSS VALUE OF PRODUCTS. ON THE OTHER HAND, LESS THAN 2 PERCENT OF THE FARMS WERE CLASSIFIED AS LARGE-SCALE, BUT THEY HAD MORE THAN ONE-FOURTH OF THE FARM ACREAGE AND PRODUCED MORE THAN ONE-FIFTH OF THE FARM PRODUCTS.

RECENT TRENDS IN FARM OWNERSHIP

There have been noteworthy changes in farm tenure during the last quarter-century. Census returns for 1945 indicate that about 32 percent of all the farms counted by the census were operated by tenants, as contrasted with 38 percent in 1920. Tenancy increased in the decade following 1920, and 42 percent of the farms were operated by tenants in 1930. But by 1940, the percentage of tenancy was about back to 1920 levels. A considerable decrease between 1940 and 1945 resulted in the lowest level of tenancy since before 1900. Information from a later survey by the Bureau of Agricultural Economics indicates that only 27 percent of the farms were operated by tenants in 1948.

TABLE 10.—*Number of farms by tenure of operator in the United States, census years 1920, 1930, 1940, and 1945*

Census year	All operators	Tenure of operator [1]			
		Full owners	Part owners	Share croppers [2]	Tenants other than croppers
	Thousands	*Thousands*	*Thousands*	*Thousands*	*Thousands*
1920	6, 448	3, 366	559	561	1, 894
1930	6, 289	2, 912	657	776	1, 888
1940	6, 097	3, 084	615	541	1, 820
1945	5, 859	3, 301	661	447	1, 412

[1] Excludes managers.

[2] Sharecroppers are concentrated in the cotton and tobacco areas of the Southern States. The landlord usually furnishes all the power and equipment, and the cropper provides the labor. Cropper operations are usually closely supervised.

The number of full owners actually increased 7 percent from 1940 to 1945, at a time when the total number of farm operators decreased 4 percent. A large part of the increase in farm ownership is accounted for by the greater number of farms under 10 acres, about 75 percent of which are owner-operated.

The number of part-owner farms increased about 18 percent from 1920 to 1945, and the acres of land they operated by 112 percent. The greater number of part-owner farms helps to explain how so many farms have increased in acreage. Farmers who owned some land have rented adjoining farms or separate tracts that could be combined with their own land for operation as a more efficient unit.

Owner-operatorship of family farms is one of the goals of agricultural policy. The tenure figures for 1945 and 1948 indicate considerable recent progress toward that goal. Data on mortgage debt also indicate that farmers have greatly increased their equity in the land they own. Only 29 percent of the farms in this country had mortgages in 1945, compared with 39 percent in 1940. The total farm-mortgage debt shrank from 6.6 billion dollars in 1940 to a low of 4.7 billion dollars in 1946. But the downward trend was reversed from 1946 to 1947. Mortgage debt has continued to increase since that time, and on January 1, 1949, it was 9 percent above the 1946 low point. There have been large increases in several States of the East, South, and West, that were partly offset by continued reductions in the Midwest.

The blind spot in the mortgage situation is the distribution of mortgage debt among individual farmers. If a large part of it is on farms where young men have made commitments at high prices financial trouble spots are likely to develop with any downturn in farm incomes.

INCENTIVES FOR INCREASED PRODUCTION

That farm production in the 1930's was held in check by drought and depression, despite the technical progress in mechanization and in other lines, has been emphasized. War needs and the incentive of higher incomes broke this dam and released a flood of increased production. But this was not accomplished by one blast at the beginning of the war. It was a fairly gradual process. Both farmers and agricultural workers were too conditioned by the experience with surpluses to believe that the market really would absorb all that the agricultural plant might produce under stimulation. This skepticism was supported by the sag in prices of some products during the year that followed the outbreak of the war in Europe.

But gradually the war demands emerged, and with the passage of the Lend-Lease Act on March 11, 1941, they gathered a momentum that remained unslackened for the duration of the war. Demand was further accelerated in the first two postwar years.

INITIATION OF WARTIME PRICE SUPPORTS

The first public pronouncement of the need for increasing the production of food was made by the Secretary of Agriculture on December 26, 1940, when he urged the desirability of breeding more sows for spring farrow in 1941. On April 3, 1941, price supports were announced for dairy products, hogs, chickens, and eggs, that would be effective until June 30, 1943. This announcement assured farmers of a market for expanded production of these products. But production controls were maintained on wheat, cotton, tobacco, and corn, for the years 1941 and 1942. They were removed

from corn in January 1943, from wheat in February 1943, and from cotton in July 1943.

Part of the reason for maintaining production controls in the early war years was to obtain a shift in the direction of meat, eggs, milk, and oil crops—the products most urgently needed in the first part of the war. But a more effective means was needed for achieving the most desirable combination of farm products. The program of formulating and announcing production goals, combined with support prices and with production payments that were geared to the relative urgency of need for different products, was developed to serve this need.

DEVELOPMENT OF PRODUCTION GOALS

The first production-goals program was worked out in the summer and fall of 1941. It outlined the food needs for 1942 and stated the production objective for each product. These goals were revised in January 1942, following the attack on Pearl Harbor. Goals were successively developed for each of the succeeding years.

Production goals were one step in the process of arriving at a balanced production program. Before goals were determined for any product the prospective needs were analyzed in relation to the resources and the facilities available for its production. Then each product was considered in relation to all the other farm products that were needed in a balanced production program. Studies of production capacity for individual products, and for all products combined into a production program geared to prospective needs, were made in each State to provide a production guide for the goals program. The program as finally developed pointed the direction and indicated the distance that should be traveled to achieve a balanced production.

PROGRAMS FOR ACHIEVEMENT OF GOALS

Support prices and production payments, when balanced in relation to the desired production of each product, furnished most of the driving force that was needed to achieve the objectives outlined in the goals program. But education and information concerning war needs also played an active part, and patriotism helped as the war progressed. Many farmers grew soybeans, peanuts, flax, dry beans, and other strategic war crops because they knew the need was urgent, even though they might have obtained somewhat larger returns by growing other products.

So far as possible, however, support prices and production payments were intended to make the most urgently needed products the most profitable to the producers. Efforts in this direction were somewhat limited by minimum loan provisions for some crops not so urgently needed, and by price ceilings on others; but in general a pattern of support prices and payments was eventually achieved that was reasonably well balanced in relation to the war needs for each product.

With production goals to point the direction and to indicate the distance to be traveled; with support prices, production payments, and educational persuasion; with patriotism and family participation in the war as the fighting continued, as further incentives to attainment, a level and pattern of production was finally achieved that was fairly well proportioned to war needs. Some of the demands for food were not satisfied. They could have been met only by devoting more equipment, and materials to agriculture at the expense of other sectors of the war program. But the most urgent needs were satisfied, and the pattern of production was shifted in the direction of products with the highest war priorities. It seems doubtful that the large changes in production shown in figure 2 could have been accomplished without a program that emphasized the need for those changes, and that supplied incentives for obtaining them. Greater shifts from livestock products to direct food crops could have been made if the food requirements that were developed had called for more sacrifice in quality in order to provide food for more people. And if the need had been so urgent as to have forced a larger allocation of resources to agriculture it would have been possible to obtain much greater increases in production.

So far as materials were concerned, farmers felt the greatest pinch in new farm machinery, especially for the production year 1943, when only 23 percent of the 1940 volume of steel used for farm machines was originally allocated for that purpose. This allocation was increased later, but new machinery was unobtainable for most farmers in 1943. More farm machinery could have been substituted for labor, and the process of mechanization would have advanced further by the end of the war. This in turn would have facilitated agriculture's adjustment to peacetime conditions.

Shortages of some other materials developed early in the war. Fencing, building materials, containers, and other items were scarce; but the minimum needs were met by careful distribution of available supplies. Fortunately, the supply of insecticides and of commercial fertilizer was fairly ample, although more would have been used if it had been available.

Scarcity of labor constituted the worst obstacle to production in some of the seasonal cash-crop areas. The Office of Labor and the State Extension Services assisted in bringing in outside labor, and in recruiting and training local labor from previously untapped sources. Farm families often worked long days to get the essential jobs done.

POSTWAR DEVELOPMENTS

The end of the war relieved some of the scarcities of labor and materials. Farm employment averaged 92 percent of 1935–39 in 1946, 93 percent in 1947, and 92 percent in 1948, compared with 90 percent in 1945. New machinery was not available in sufficient volume to supply all farmers with all the machines they would like to buy until the spring of 1949, when most scarcities disappeared.

Production goals and support-price programs were in effect for the years 1946–48, but the price-ceiling structure lapsed temporarily in July 1946 and, after a short period of reinstatement, was removed from nearly all products in the fall of 1946. Most farm products sold at prices above support levels until the summer of 1948, although potatoes, eggs, and some other commodities required Government support at different times.

Prices received by farmers were 204 percent of their 1935–39 average in June 1946. In October 1946, after most of the price ceilings were removed, they were 255 percent of prewar. In January 1948 they had risen to 287 percent. In January 1949 they were 250 percent of 1935–39, and in April 1949 they were 243 percent.

It is evident that price incentives were even better in the first two postwar years than during the war. On the expense side, however, farm costs have also risen, but not so rapidly as prices received. Prices paid for goods and services used in farm production (not including farm wages) were 150 percent of 1935–39 in June 1946. They had risen to 163 percent in December 1946, and to 199 percent in December 1947. For the entire year of 1948 they averaged 201 percent of prewar, and in April 1949 they were 192 percent. Farm wage rates in the prewar years, 1935–39, were only about two-thirds of the level prevailing in the 1920's. But they rose very rapidly during the war, and in June 1946 they were 321 percent of 1935–39. They averaged 346 percent of prewar in 1947, and 367 percent in 1948.

With cost rates lagging behind the rise in farm prices, and with a much larger volume of output of marketable products, net farm incomes have increased a great deal. Figure 34, page 59, summarizes the gross and net farm-income results to the farmers of the country of their production job during the war and early postwar years. The realized net income of farm operators for the war years 1942–44 averaged 240 percent of the 1935–39 level. In 1946 it was 324 percent of the average for those years; and in 1947 it was 386 percent—nearly four times the net income of prewar years. The rise in net incomes from 1946 to 1947 is almost entirely attributable to changes in prices because the volume of production was slightly lower in 1947 than in 1946. In 1948 the net income was somewhat lower because of the decline in prices for farm products and rising rates of costs, but it still averaged 364 percent of 1935–39.

The operator's net farm income on family-operated farms for different types and locations is shown in figure 35, page 60. This chart traces the extremely low net incomes that prevailed during the early 1930's, the slow recovery during the latter part of that decade, and the rapid rise in the war and early postwar years. The greatly increased production per farm in recent years has meant relatively lower expenses per unit of product; and with more products to sell the net incomes rose faster than did the prices received for those products. If farmers should encounter several consecutive years of lower prices with cost rates remaining at or near present levels, their margin between expenses and gross income would narrow; and net incomes would be reduced faster than the drop in farm prices unless efficiency could be increased to reduce costs per unit of product and thus to offset the lag in cost rates.

IMPLICATIONS OF RECENT AND PROSPECTIVE CHANGES

The forces that shaped the course of agricultural production in the interwar, the war, and the early postwar years, have been analyzed briefly in these pages. Their effects on production are evident in the record-breaking volume of recent years. Most of these forces still have unexpended power. They will continue to influence production in the years beyond the transition from war to peace. New forces, expected and unexpected, will be set in motion. Always farmers will need to adapt their operations to the rapidly changing conditions.

PROSPECTIVE CHANGES

Assuming that a stable peace can be established, and then looking forward beyond the transition years to the time when farming will be adjusted to peacetime conditions, some changes seem fairly certain. They will result from the operation of the forces now under way, and of those that are on the horizon. The changes that seem most likely to occur are summarized as follows:

1. A continuation of the shift to mechanical power until it has largely supplanted animal power is to be expected. The smaller tractors that are more suitable for small farms and rolling land will accelerate this shift in the South, and in other areas that have small farms.

2. Further adaptation of machines for use with mechanical power is certain. Each phase of agricultural production will become more mechanized,

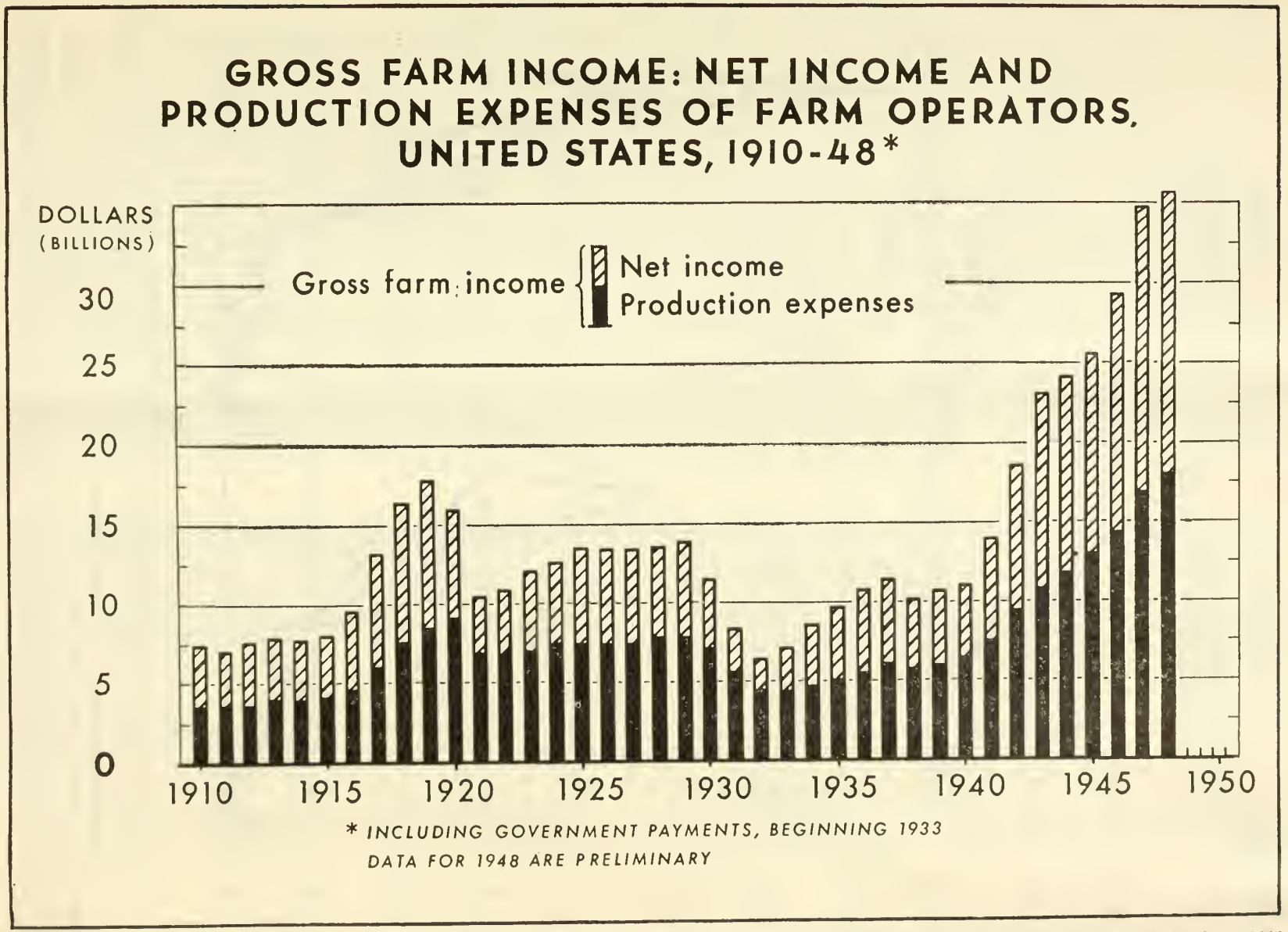


FIGURE 34.—PRODUCTION EXPENSES OF FARM OPERATORS HAVE INCREASED SINCE 1940 BUT GROSS FARM INCOME ROSE MORE RAPIDLY THAN EXPENSES UNTIL 1948.

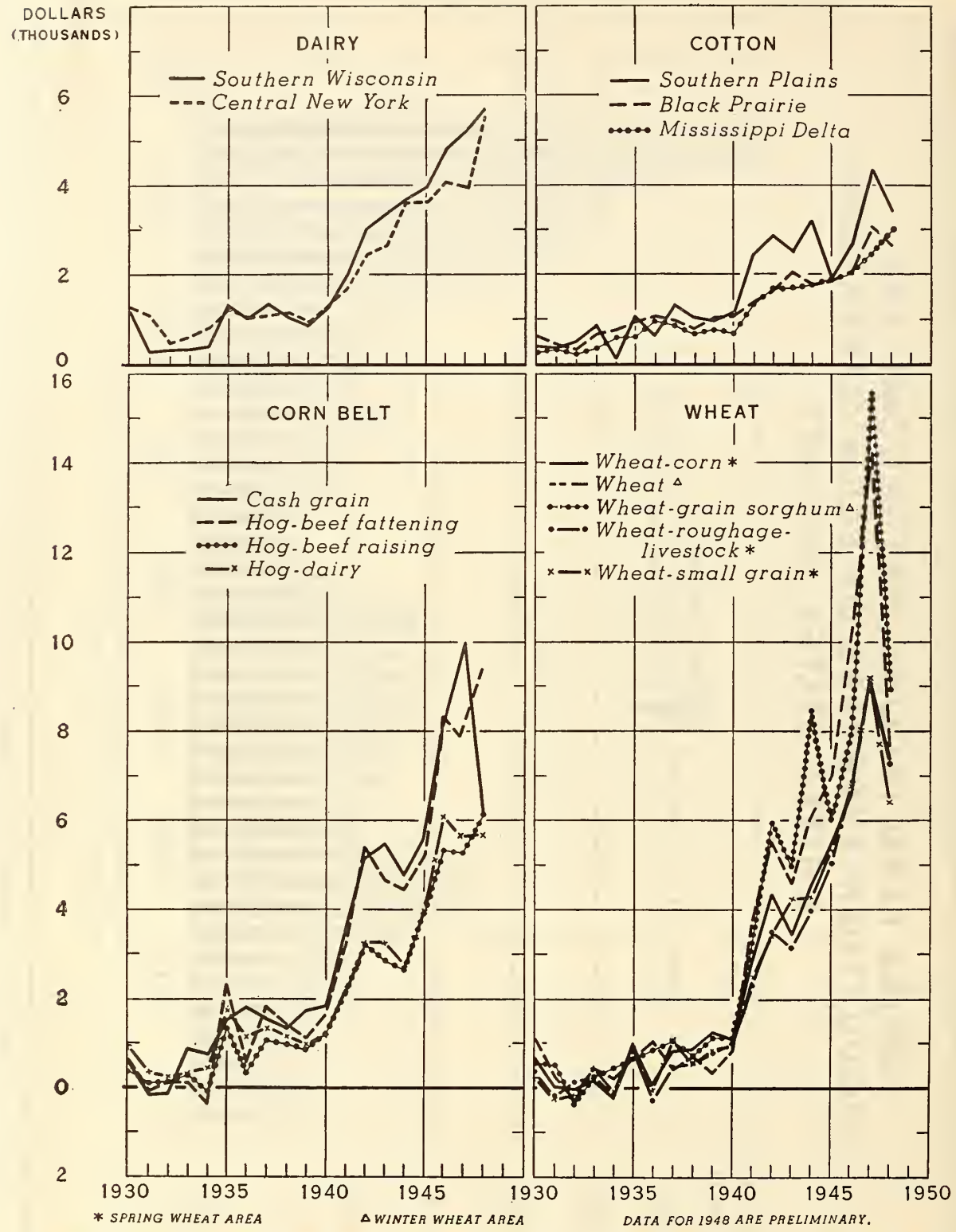


FIGURE 35.—FARM EARNINGS: OPERATOR'S NET FARM INCOME, FAMILY-OPERATED FARMS, BY TYPE, 1930–48.

Annual earnings of farm families operating all types of farms seem to follow the same general pattern. The extremely low net incomes of the drought and depression years 1931–36 were followed by some recovery in the late 1930's. The sharp rise in the war and early postwar years resulted from higher prices combined with increased production per farm.

and more fully adapted to mechanical-power techniques. Eventually the same type of stability may be achieved with mechanical power as was attained with machinery adapted for animal power, previous to World War I. But this process will require some time for full development.

Haying equipment will be adapted to the special conditions of each producing area. Mechanical cotton pickers and strippers will be adopted, gradually at first, and then more rapidly as changes are made in them for more effective use in areas of rolling land and small farms. Some progress may be expected in mechanizing the production of such traditionally hand-labor crops as sweetpotatoes and even tobacco.

3. Use of lime and commercial fertilizer will rise above the high 1947 levels. How rapidly this increase will come depends partly on the kind of educational and conservation programs that are developed, and partly on the level of farm incomes. But many farmers have now learned the value of lime and fertilizer, and they are not likely to reduce their purchases except under conditions of severe depression.

4. Along with the use of more lime and fertilizers will come more rapid adoption of other conservation practices, such as using winter cover crops, grass and legume crops in the rotations, and following contour farming, strip cropping, and other practices designed to control erosion.

5. Further progress will be made in varietal improvements. For example, Lincoln soybeans and Clinton oats are now being adopted. Suitable corn hybrids are being developed and will be adopted in the Southern States. The effects of improved varieties of grain sorghums will become more pronounced.

6. Progress will be made by farmers in combining the use of improved varieties, lime and fertilizer, and conservation and other practices, in effective crop rotations and systems of farming that will result in much higher production because the combined effects of these improvements will be greater than if they are adopted as single practices. In North Carolina, for example, a number of corn experiments combining high nitrogen fertilization, hybrid seed, and other improved practices, resulted in yields of more than 80 bushels per acre compared with usual yields of 15 to 20 bushels.

7. More efficient methods to control pests and diseases of both plants and animals will be available. The effectiveness of the new materials and improved techniques for applications will become more evident within the next few years.

8. Results from animal-breeding experiments will gradually increase the efficiency of livestock production. Work now under way is likely to produce hogs that are more efficient converters of feed into pork of the more desirable cuts. Dairy-herd improvement will be accelerated by more widespread use of artificial insemination.

9. Further improvements will be made in feeding methods. More adequate and better balanced rations will contribute to increased output per animal.

10. Some new land will be brought under cultivation by irrigation, drainage, and clearing, but the total new farm acreage is not likely to be large. If public development work now under way is continued and if all authorized work is carried out, about 4,500,000 acres will be brought under irrigation in the next 10 years. Around 8,000,000 acres might be improved by drainage or clearing during the same period. About half of these developments would take place on existing farms and the rest would involve bringing new areas into production.

11. Supplementary irrigation in humid areas has developed rapidly during the last few years. It is likely to be extended further, especially if the market demand for the products that are irrigated is sustained at fairly high levels.

12. If opportunities for employment are freely open in the cities, many small and unproductive farms will shift from full-time to part-time operation, or even become rural homes where little or no farming is done. If depression conditions should prevail for any length of time this movement might be reversed, as many unemployed people are likely to try to make at least a part of their living from the land.

13. As good roads, electricity, and other conveniences, become more readily available in rural areas more and more people engaged in nonfarm work will seek to establish rural homes. Thus the number of part-time farms and rural homes will be augmented from two sources: (1) Farm people shifting from full-time to part-time farming and (2) urban people seeking homes on the land.

14. Fewer workers will be needed in full-time farming as mechanization gains momentum in cotton production, and in other enterprises that now require much hand labor.

15. Family farms are likely to become larger and somewhat fewer as the productive capacity of farm workers is increased by the newer techniques. Some increase in the number of large-scale farms should be expected. They are not likely to constitute more than a small percentage of the total number of farms but they may produce a rather large percentage of total output.

16. Commercial farming will become a more complex business as technological advances continue. As family farms grow larger more capital will be needed for equipment and livestock. This means that adequate training and managerial ability of a high order will be needed for successful operation of commercial farms.

Changes will occur that are now unforeseen. For example, we have no way of foretelling the impact on agriculture of developments in regard to atomic energy. Over the next quarter-century innovations may be even more significant than those that are now on the horizon. But they are likely to be less important in the next few years because a period of testing of new developments is usually required, and later adoption by farmers is a gradual process.

EFFECT OF PROSPECTIVE CHANGES ON FARM OUTPUT

FARM OUTPUT LIKELY TO CONTINUE AT HIGH LEVELS

Prospective changes that have been outlined are preponderantly those that will tend to push the output of farm products higher and higher, instead of allowing them to recede toward the prewar levels. In their study of peacetime production adjustments, State committees estimated that under favorable economic conditions after the war it would pay farmers to produce at a level about 43 percent above the prewar average.[7] These estimates were based on average weather conditions. They gave consideration to maintenance of soil resources, and included the effects of the adoption of known improvements that would be profitable under conditions of prosperity. Farm output in 1948 was 40 percent above 1935–39, but growing conditions were unusually favorable in that year.

If economic adversity should prevail, the rate of increase in output would be slowed down, but even under unfavorable price conditions, it does not seem likely that the total output would be reduced substantially, unless weather were less favorable than the average. Any reduction that would come from the use of less fertilizer, or from attempts to reduce other variable costs, would probably be partly offset by the effects of the landward pressure of unemployed people.

Severe drought, or other unfavorable growing conditions, could reduce the level of output considerably. In a drought year, like 1934 or 1936, the output might drop about 20 percent. But it would increase again when growing conditions improved. Some of the improved practices—such as using hybrid seed corn and drought-resistant varieties of wheat and grain sorghum, summer fallowing, and contour farming—provide considerable protection against unfavorable weather. But on the other hand, the yield-increasing effects of fertilizer and some other practices would not be realized in case of severe drought. Crop loss from unfavorable weather is one of the major hazards in present-day commercial farming.

[7] See Footnote 3, p. 25.

Aside from this hazard, most of the changes that have already taken place, as well as those in prospect, seem to point irreversibly in the direction of increased production. When the transition to peacetime market outlets has been completed, food production at high levels may have to face market difficulties, unless high employment and purchasing power are maintained, and the channels of international trade are kept open. Financial and trade barriers may limit exports that would supply unmet food needs in other countries.

But regardless of the market outlook, there is no road back from the agricultural revolution that we have experienced. Attention therefore necessarily centers on mobilization for efficient and profitable peacetime agriculture instead of reconversion to a prewar situation that will never return.

If the belief still lingers that production will recede to prewar levels, under average weather, the steps that would be retraced should be considered. Farmers generally cannot go back to animal power because there are too few horses and mules now on farms. The annual colt crops do not begin to maintain the numbers. The mechanical-power phase of mechanization is here to stay, and it is the cornerstone of high-volume output for the market. Going back to open-pollinated corn, or to low-yielding strains of other crops would be decidedly unprofitable even in a depression. And more effective control of insect pests and diseases is likely to be continued, somewhat regardless of price conditions.

It is possible that less fertilizer and lime would be used in a depression, of course, although it would be poor economy in the long run to reduce yields in this way. It would be contrary to the national interest to fail to apply the fertilizer that is necessary for maintaining stable, soil-saving crop rotations. Similarly, temporary reductions in expenses could be made by not carrying out certain conservation practices, but these savings would be made at the expense of future productivity.

POTENTIAL CHECKS ON FARM OUTPUT

The only effective steps that can be taken to reduce the *total volume of output* are those that shift either capital, or land, or labor resources out of agriculture, or perhaps shift all three. But the preceding discussion indicates that if farming is to be carried on at all, an adequate supply of capital is needed for equipment and for current operations in order to achieve the most effective combination with the land and labor resources that are used in farming at any given time. In fact, many individual farmers have a tendency to invest too little capital with their land and labor resources; and changes in types of farming require new capi-

tal investment. This means that the primary steps in reducing the total volume of farm output would have to be taken by shifting either land or labor to other uses.

It is possible of course to use the agricultural land and the labor resources less intensively and to reduce output in that way. Land can be shifted from intertilled crops to sod crops of lower output per acre. And some lands now in crops can be returned to grazing. But farmers are likely to resist these changes for the reasons noted later.

Farm work days could be shortened. This would mean that less work would be done per worker. Farmers already have slackened the pace they maintained in wartime and it is highly desirable that many farmers reduce it even further. But more workers are now available on farms, and besides, with further mechanization, the farming can be done without working so hard. Consequently the effect on production of a shift to shorter working hours may be more than offset by more workers and more mechanization. In fact, the substitution of mechanical power for animal power increases the labor effectiveness of the farm family so much that usually there is soon the question of renting or buying additional land. If more land cannot be obtained an attempt is often made to farm the land more intensively. For example, soybeans are substituted for oats, dairy cattle for beef cattle, and the side-line poultry flock is expanded to an important enterprise in the farm business.

This tendency toward greater production *per farm* as a result of mechanization usually operates in the direction of more intensive rather than less intensive use of land resources. Therefore, if land is to be shifted from intertilled crops to sod crops, or from cropland to grazing, farmers must be convinced of the profitableness to them of this shift over a period of years. Otherwise public compensation is necessary to bring about such adjustments. Public programs could be developed that would shift some land to less intensive uses, but the effect on total output probably would be at least partly offset by more intensive use of other lands.

Some of the unproductive lands could be shifted out of arable farming by Government purchase or lease. They could be devoted to grazing or to forestry and recreational uses. Programs of this kind are needed in "fringe areas" of land that are poorly suited for agricultural production. But the total volume of output would be affected only slightly by carrying out such a program in poorland areas. And public opinion probably would not support a program that would hold productive cropland out of arable farming for any considerable time.

It appears that about the only effective means by which total farm output could be reduced is by a shift of workers from farming to other occupations. That would occur only if employment off the farms were available for those who could not find attractive opportunities in agriculture. This question is discussed later, but it should be noted here that the shift would have to be large enough to result in a net decrease in the number of workers engaged in agriculture.

If a large number of workers shifted out of agriculture, however, the *per capita output* would rise for those who remained in farming. This in turn would mean higher *per capita incomes* with the same total output, and the economic reason for reducing output would disappear. But migration of this magnitude would be unlikely under conditions that result in low prices and pressure to reduce the total output of farm products.

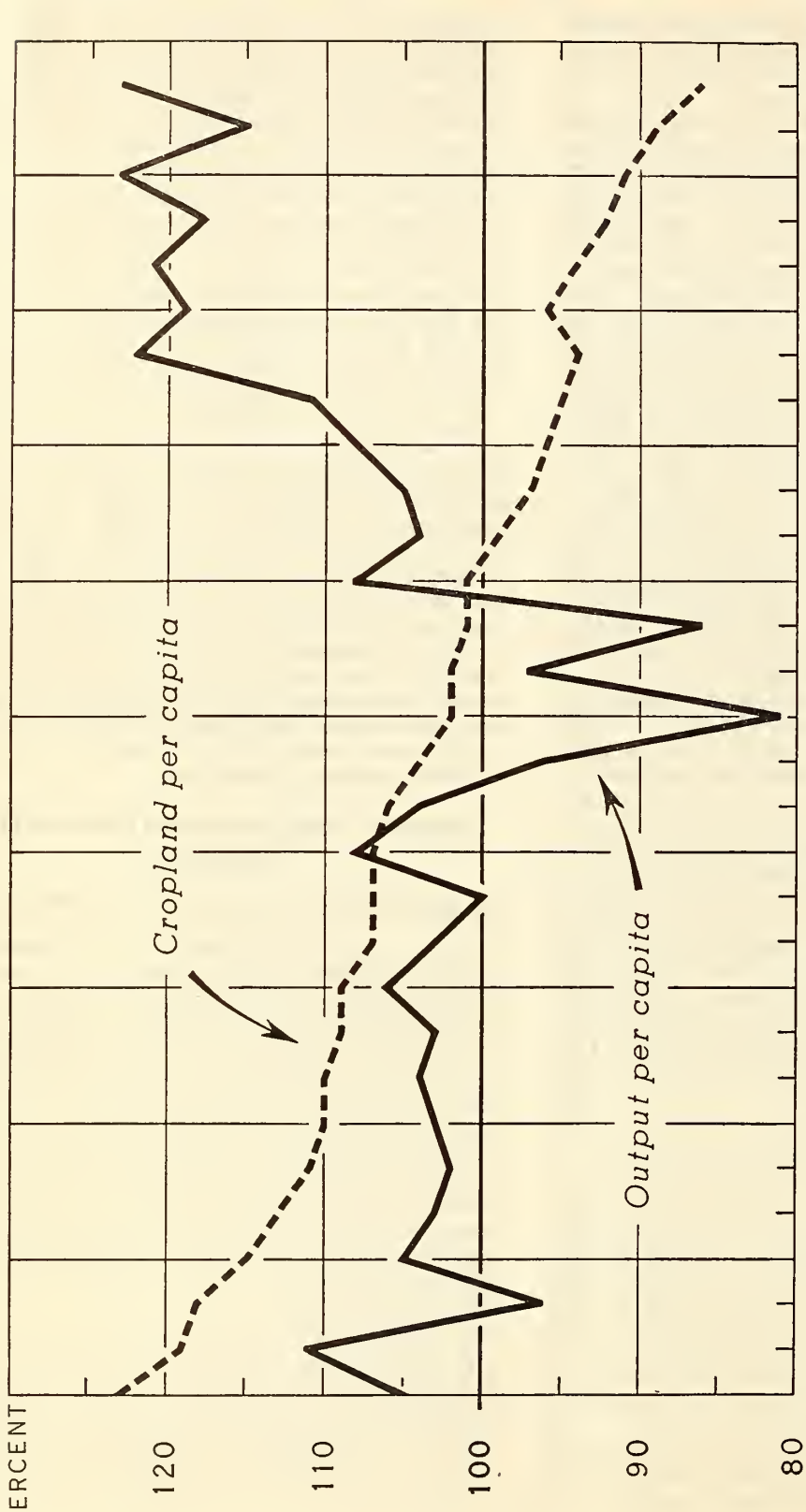
The conclusion seems inescapable that no forces are now operating, or are likely to appear, that are sufficiently strong to offset much of the effect of the forces that will push agriculture in the direction of high-level production. Individual crop or livestock enterprises could be reduced in volume, either by voluntary shifting to other products or by production-control programs; but other products would be substituted and so total output would not necessarily be affected. To make substantial reductions in the total volume of farm output without shifting land and labor resources to nonfarm uses would require rigid controls. It would mean onerous restrictions on the use of land and labor in farm production.

OUTPUT IN RELATION TO POTENTIAL MARKETS

PRODUCTION MAY INCREASE AT SLOWER RATE

If the output of farm products for human use is likely to remain high, it becomes necessary to examine the prospective volume in relation to potential markets. As a basis for striking a balance between potential output and potential markets it seems desirable to summarize the main forces back of increased production into two groups. One is the shift from animal to mechanical power. The other is higher production per acre and per animal. New land development would be a third group, but this is likely to be a minor rather than a major factor in increased production. Irrigation of land now in arable farming would come under the heading of increased production per acre.

It appears that the shift to mechanical power will proceed at a rapid pace for several years. But its effect on total output will diminish progressively as numbers of horses and mules decline toward minimum levels. This means that increased output will then come mainly from higher production per acre and per animal. The rate of



OUTPUT PER CAPITA OF TOTAL POPULATION. TOTAL CROPLAND IS THE SUM OF THE ACREAGE OF LAND FROM WHICH ONE OR MORE CROPS WERE HARVESTED PLUS FALLOW AND CROP FAILURE ACREAGE.

FIGURE 36.—FARM OUTPUT PER CAPITA, AND TOTAL CROPLAND PER CAPITA, UNITED STATES, 1919–48. (INDEX NUMBERS 1935–39=100.)

Cropland acreage per capita has decreased almost steadily for more than a quarter century, while the per capita output of farm products was maintained in most of the interwar years and increased sharply during the war. Release of cropland from production of horse and mule feed largely made possible the maintenance of output per capita in the interwar years. Increased crop production per acre was mostly responsible for the wartime expansion in output per capita.

such expansion depends upon new advances in technology, and their adoption by farmers.

It seems probable therefore that the rate of increase in production might slow down after the substitution of mechanical power has spent its force, unless new accelerating forces are introduced. The rate of increase for the next few years is not likely to be at the wartime pace, because part of that expansion represented release of production capacity that had been dammed up by drought and depression. But previous discussion indicates that an upward trend should be expected.

FORCES TENDING TOWARD LARGER MARKETS

On the market side the largest item is the level of domestic consumption of farm products. This depends primarily on the size of the population, and on the purchasing power that is available for consumers to buy farm products. The population of Continental United States is still increasing and with an upward surge in recent years. One is likely to forget that there were 27,000,000 more people in this country on January 1, 1949, than there were 20 years ago. By 1955, the population seems likely to be about 8,000,000 to 10,000,000 larger than in 1949.

When prospective levels of production are compared with some prewar period it is necessary therefore to remember that there will be many more consumers of meat, milk, and other farm products. A per capita comparison is much more appropriate. Figure 36, page 64, shows farm output per capita and cropland per capita by years from 1919 to 1948. Although the cropland per capita declined about one-fourth in that period the level of farm output per capita increased by 10–15 percent. Assuming average weather, the level of output per capita probably would now average about 10 percent higher than in the years 1925–29.

If exports and imports were maintained at the same levels as in the late 1920's, and if output increased only at the same rate as the population increased, the per capita domestic consumption of farm products would need to be only about 10 percent above the level of 1925–29 to absorb the total farm output. Average food consumption in the 4 years 1945–48 has been nearly 15 percent above that of 1925–29. Consequently it seems possible to achieve a level of domestic food consumption that would provide a market for a balanced output of farm products if high employment and purchasing power can be maintained, and if prices of the foods of higher value are in balance with consumer purchasing power. It should also be feasible to maintain the use of nonfarm food products at higher levels. In the 1920's a large segment of the population did not have the money to buy food enough for minimum adequacy. Consumption of nonfood farm products also was restricted by the low incomes of some groups. Moreover, the export market, although greater than in the 1930's, was not so large an outlet for farm products as it would be possible to develop in an expanding peacetime world economy.

This potential balancing of production and market outlets over a period of years is dependent upon three factors: (1) Increase of farm output no greater than the increase in population, (2) maintenance of employment and purchasing power that will support a per capita level of consumption of food and other farm products at least 10 percent above that of 1925–29, and (3) maintenance of at least as high a volume of exports as in the late 1920's. Any one of these three forces could upset the balance. If a spurt in technological advances should result in a much greater increase in output than in population farm products would press more heavily on market outlets. And if such a spurt should coincide with a period of unemployment the lowering effects on farm prices would be accentuated. On the other hand, maintenance of a high level of employment probably would result in a level of per capita consumption more than 10 percent above the 1920's. Some adjustment is to be expected with the subsidence of the world food emergency, but if other sectors of the economy are prosperous the markets are likely to absorb a large volume of farm products.

NEED FOR BALANCED PRODUCTION OF SPECIFIC PRODUCTS

Although under conditions of prosperity this large volume might be marketed without heavy downward pressure on farm prices, production of the different commodities would need to be balanced in relation to their respective market outlets. But that is where we are likely to have difficulties. Cotton, wheat, potatoes, and eggs, are already experiencing them. Oil crops are a potential trouble spot. On the other hand, more milk, meat, poultry products, fruits and vegetables, would be needed for high level nutrition in our country. And a shift from intertilled crops toward more hay and pasture, which in turn means more livestock, would help to maintain and improve soil resources.

If such shifts could be accomplished we would tend to utilize more effectively the Nation's resources in both land and labor. Beef production is a land-consuming enterprise, and milk, fruits, and vegetables are labor-consuming enterprises. But changes in these directions depend upon a farm price-and-income structure that would make them profitable to farmers. Under conditions of prosperity these adjustments could be made profitable because consumers would have the purchasing

power to buy high-priced foods. But if depression conditions should prevail it would be more difficult to shift production in this way.

ADJUSTING MARKET OUTLETS TO BALANCED FARM OUTPUT

This rough balancing of potential production with potential market outlets indicates that the markets could absorb the potential production if conditions were favorable for high-level consumption. But work in market development would have to be undertaken at home. Export channels would need to be kept open. Shifts in production would be needed—in the direction of foods that would be emphasized in a prosperity diet, and toward farm products that would find larger industrial uses, or that could be exported in greater volume.

As markets for farm products can be expanded, and as the total volume of farm output cannot be reduced without severe restrictions on the use of land and labor, it appears that the slogan "Adjust production to market demands" of the interwar years might well be reversed. It was applicable to shifts from commodities that were pressing heavily on market outlets and into the production of others that had a brighter market outlook. But when reduced purchasing power limited the outlets for *all farm commodities* the remedy was not to be found in reduced production. If farm workers could have found other employment the balance might have been restored by reducing the *total output* of farm products, but the contracted purchasing power coincided with unemployment in the cities. And this caused a landward rather than a cityward movement of workers.

The experience of the 1930's suggests that neither the supply of, nor the demand for, individual farm products is as fixed and immutable as the laws of nature. Each can be modified by human effort, and by man-made institutions. But that experience also suggests that it is less difficult in times of depression to increase the market outlet than it is to reduce the total volume of farm output. From the standpoint of national welfare, food is needed just as much during depression as during prosperity. In fact, measures are needed to increase food consumption among certain groups of the population, even in prosperous times.

Human distress would be accentuated if farmers were to attempt to reduce the total volume of food output in depression years. But farmers do need some form of income insurance, or of income floor, that will protect them against disastrously low prices. Such protection is the farmers' counterpart of minimum wages and unemployment insurance.

Procedures can be developed that will promote a high demand for farm products—for domestic food consumption, for industrial uses, and for export. A national goal of adequate food for health available to all citizens, regardless of the state of economic activity, would go far in the direction of providing stable outlets for farm products. But this requires that public measures be devised to provide adequate food for those who cannot afford it, and that such programs be expanded as needed, if depression should come. Education in the elements of good nutrition could be greatly strengthened for all age groups and all income classes, and this also would help in achieving the goal of adequate food for all.

New uses may greatly enlarge the markets for some farm products in the course of several years. Research in this field holds considerable promise. But it must be clearly recognized that it is not enough merely to discover the physical suitability of a product for the new uses. It must be possible to produce this commodity at a cost that enables it to be sold in competition with alternative products. Price policies for specific farm products can either promote or retard the development of new market outlets.

International arrangements that permit a large volume of both exports and imports can supply a part of the outlet for farm products. Export markets for cotton, tobacco, wheat, and fruits, are extremely significant to all farmers, because competition in other products will be intensified if these outlets are not available. Perhaps even more significant, however, is the indirect effect of international trade in nonfarm products. Exports of automobiles and farm machinery, for example, create domestic employment and therefore increase the purchasing power for food and fiber.

A large volume of exports requires the acceptance of goods and services in exchange. Programs that would protect specific farm products at the sacrifice of greatly expanded world trade would create added competition in the domestic market on the part of farmers whose export markets had been destroyed by the trade restrictions.

Emphasis can be shifted in the direction of reducing costs or of developing more profitable alternatives for the products that might be injured by freer trade. If by mechanization and higher yields the cost of producing oil crops can be reduced materially, for example, they can be grown profitably and in large volume in competition with imported oils. If cost-reducing measures are not sufficient to achieve this possibility, more profitable alternative enterprises should be developed to replace the higher-cost part of the production of domestic oil. Farmers can then shift to those alternatives. Such measures would enable farm-

ers to produce on an efficient low-cost basis in competition with other areas.

PROFITABLE AND ABUNDANT FARM PRODUCTION

Farmers want to produce both abundantly and profitably. They want to make full economic use of their resources. The nature of farm costs makes abundant production the most profitable use of their resources by individual farmers. But the resulting large output under certain circumstances might lower the prices of some products so much that production would become unprofitable for the entire group of producers.

COSTS IN RELATION TO PRODUCTION AND PRICES

Individual wheat producers, for example, cannot reduce output without lowering their individual net incomes, but the price-depressing effect of a large crop may reduce the income of all wheat farmers. The case is usually not so clear-cut as this, but it is natural to reach the conclusion that wheat farmers would increase their incomes if they all reduced production by some pro rata amount. At this point, however, the wheat farmer's cost structure should be examined. If through mechanization he already has labor and equipment on his farm that is partly unutilized, a restriction of output means that his overhead costs will have to be carried by a smaller quantity of wheat. Therefore, his average costs per unit of product will increase if production is reduced. Unless the land taken out of wheat can be shifted to some other productive use the net income available for the farm family might actually be lowered with a reduction in the acreage of wheat.

This illustration from wheat production indicates the need for analyzing costs in relation to production and prices, especially with reference to the effect of the changes in farming that are the primary concern of this report.

Improvements in farm technology frequently are associated with larger output of the products affected by the change. This is not always the case because some improvements save labor or capital investment without increasing the output, but most of them do result in more products. When the demand for farm products is expanding, at least as rapidly as the products going to market are increased by technological advancement, the market will absorb the larger output without reduction in prices. Farmers will benefit from improvements adopted under those conditions. The general economy also benefits because the larger output prevents a rise in prices. This was the case during the war and the early postwar years. But if production increases faster than the demand for the product, prices are likely to go down. When that happens a part or perhaps all of the gain from the improvement may be shifted away from the farmers; and, for the general economy, may be offset by greater unemployment.

Whether an improvement lowers costs without affecting output or results in an increase of farm products, the farmers who first adopt it will retain whatever gain results, *until or unless prices of farm products are affected.* This means, of course, that farmers who adopt an improvement that actually reduces costs always gain in the early period of its adoption. The farmers who do not make the change are not affected by the improvement until or unless prices of farm products are reduced. But if improvement results in the displacement of labor, hired labor may be adversely affected, unless other employment is available that pays as well or better than the work from which they were displaced.

Farmers will tend to hold all of the gains from improvements that do not result in a larger output, because these changes have no adverse effects on prices.[8] The ultimate effects on farmers of improvements that increase production are not so clear.

In view of the emerging market difficulties in some farm products, it may be helpful to trace the economic effects of an improvement that results in a larger output. Hybrid seed corn is again a good illustration. Yields per acre are increased about 20 percent and the extra cost of hybrid seed is small in relation to this increase. For purposes of this illustration, we might take a 50-bushel yield with open-pollinated corn, and say that with the use of hybrid seed the yield was increased to 60 bushels, or 10 bushels per acre. For simplicity, let's assume that the price of corn is $1 a bushel. Then the additional income per acre is $10. Subtracting the higher cost of hybrid seed and of harvesting the larger crop may leave about $7 per acre net gain from the use of hybrid seed. This is an improvement that is easy to adopt and very profitable to farmers who make the change. Experience in the Midwest indicates that adoption is therefore rapid once the possibilities are known and the adapted seed is available.

As a result of widespread adoption of hybrid seed, the quantity of corn going to market might increase 10 percent, and if there is no offsetting increase in the market demand for corn the price of corn might go down 15 percent. The before-and-after situation of an average farmer with 50 acres of corn then might be about as follows:

[8] They do not affect prices unless they result in making farming so attractive that more labor and capital are invested in farm production. This could result in so bidding up the price of land that the gain would become capitalized, and new purchasers would not benefit because they would have a higher cost structure.

Before the change:
50 acres at 50 bushels per acre, or 2,500 bushels corn.
2,500 bushels at $1 per bushel, or $2,500 gross return.
After widespread adoption has resulted in lower prices:
50 acres at 60 bushels per acre, or 3,000 bushels corn.
3,000 bushels at $0.85 per bushel, or $2,550 gross return.

Although the assumed reduction in price shows a slight gain in gross return with the higher yield, the extra cost for seed and for handling a larger crop might actually mean a lower *net return* to the farmer for the larger crop.

If the price goes down so much that the larger output brings no more income to the farmer than he got before the improvement was made, the only way that he could continue to gain from the improvement would be to reduce his *total costs*. If this could be achieved he would be producing the larger output at a lower total cost than was formerly incurred to produce the smaller output.

It may seem difficult to produce more products at a lower total cost than was previously incurred for a smaller output but this has actually occurred rather generally on farms in this country over the last quarter century. For example, changes in farm power and machinery from 1920 to 1940 resulted in an actual decrease in both the investment in power and machinery and the current operating costs when the same prices are used in both periods. But this is not all. We have already seen that such equipment enables a man to do more work than he could with horses or mules and the old type of machinery.

Suppose that adoption of mechanical power on the same Corn Belt farm that adopted hybrid seed corn enabled the farm family to do the work with little or no hired help. They would then save both on the cost of power and on outlay for hired labor. The result would be a larger total output at a lower total cost, which would be accomplished by adopting a combination of improved practices. The combination frequently is extended to include the use of commercial fertilizer and more legumes in the rotation, which in turn means higher yields of corn and other crops. This chain type of reaction also includes improvements in livestock practices on many farms.

Frequently the process is worked out a little differently. Suppose the operator of the Corn Belt farm in our illustration decides to rent an extra quarter-section of land—one that was formerly operated by another family. This enlargement of the farm increases the *output per worker* very considerably. But we should note, of course, that another family is released for other types of employment. Fewer people are now engaged in farming, but the *total cost* of producing farm products is usually reduced by this kind of change. The cost reduction, however, is not in proportion to labor displaced because in part it involves a substitution of capital for labor. But usually the net income is increased for those who remain in farming. Whether the effects on those who leave the farm, and on the general economy, are favorable or unfavorable depends upon whether other employment is available for those who are displaced.

EFFECTS OF TECHNOLOGICAL CHANGES ON COSTS AND RETURNS

These illustrations point to the following effects on costs and returns from farming, and on farm people, of increases and decreases in production on farms, especially those caused by technological changes.

1. Because the demand for many farm products is such that at any one time a smaller output has a higher gross value than a somewhat larger output, an improvement that increases production may result in lower prices for the product. If demand is not increasing prices might be reduced sufficiently to cause farmers to lose all or nearly all of the gain from a cost-reducing improvement that is associated with a larger output.

2. But if, as a result of mechanization and other improvements *that are already adopted*, a farmer has equipment and family labor that is only partly utilized, a reduction in his *total output* will increase his average costs per unit of product. If production is reduced under those conditions it will be made in the part of his output that is produced at the lowest cost per unit. The price of the product, therefore, would have to rise considerably to offset the loss in income from cutting back on the part of the output that had the lower cost. Restriction of a single product such as wheat would have the same effect, unless the farmer could substitute some other product on the land taken out of wheat.

3. Many farmers have been able to adopt improvement combinations that have resulted in lower total costs for a larger output than they formerly had for a smaller output. Such changes enable them to hold much of the gain from improved methods, even if prices go down because of larger marketings.

4. If improvements that reduce costs result in fewer workers on farms the *net returns per worker* engaged in agriculture can rise even though the total gross income to agriculture is reduced. In other words, improvements that result in a larger output per worker also are likely to mean higher net returns per farm worker. This result can be expected if workers who are no longer needed in agriculture can shift out of farm work and into other employment.

5. It makes a big difference whether an improvement that displaces many hired laborers, as for example, the cotton picker, is introduced at a time when other employment is available for the

displaced laborers: or whether it comes in a period of unemployment when the workers who are displaced cannot find other work. If the displaced workers have to be supported by various kinds of unemployment insurance or work programs, the gain from the improvement in the way of reducing costs may be offset temporarily by the cost of work relief. A reduction in total output may have the same labor-displacing effect as a labor-saving improvement.

6. Farmers who are not in a position to carry out cost-reducing improvements will not be injured by other farmers adopting them *until or unless* the effect is felt in the form of lower market prices. But there will be a greater spread in net returns between those who adopt lower cost methods and those who do not adopt them. The effect of this is seen in the relatively low incomes per worker in the farming areas that have been least affected by the recent changes in farming.

DESIRABLE SHIFTS COULD BE PROFITABLE

If at the same time that farmers are reducing their costs the market outlets for farm products are expanded—because of increases in population, by maintenance of a high level of production and purchasing power in the nonfarm sectors of the economy, and by other means—farmers need not fear the tendency of production-increasing improvements to result in lower prices. In fact, they will benefit from both the larger volume of production and the lower cost per unit.

But even under those conditions, production within agriculture would still need to be balanced in relation to the needs for different kinds of farm products. The harmonious relationship between conservation and high-level nutrition has been mentioned. But shifts in the direction of more hay and pasture, that induce the production of more milk and meat, need to become *the most profitable production alternatives* in the areas where such shifts are desirable, if the changes are to be carried out by farmers.

If the market outlook indicates that there should be less emphasis on wheat, cotton, and some other cash crops, and more emphasis on hay and pasture for livestock feed; but if market forces are not sufficiently strong to bring about these shifts they could be accelerated in two ways. One would be to provide high support prices for milk, meat, fruits, and vegetables. This would encourage shifts in production toward such products. But these are commodities that consumers buy in much larger quantities when their prices are relatively low in relation to consumer purchasing power, so higher prices would cut off the part of the market that would be essential in achieving the goal of high-level nutrition. And the potential shift in this direction would then be severely limited by the smaller market outlet.

The other way to aid farmers in achieving both conservation and desirable shifts in production would be to assist in lowering the cost of producing the products that promote conservation and good nutrition. To achieve this, emphasis might be placed on improvements that increase the efficiency of producing these products. Aid might be extended in obtaining lime, fertilizer, and legume and grass seeds, and other materials that are needed in working out long-time farm plans for stable, soil-improving farming systems. Establishment of more stable tenure systems would give farm operators greater financial interest in soil maintenance and improvement. Many farmers would need educational assistance and management guidance also in carrying out such a program. A *combination of these measures*, as needed on individual farms, would go far toward making the desirable shifts in production the most profitable ones for farmers to carry out.

Assistance to farmers in adoption of cost-reducing measures that are specially applicable to hay, pasture, and livestock, should result in an expansion of the total market for farm products. Larger quantities of meat and milk will be bought if these products can be produced profitably by farmers at prices that are relatively low in relation to consumer purchasing power. Market expansion is more difficult in some of the other farm products. As shifts in this direction also will tend to conserve soil resources they are especially desirable at a time when such products as wheat and cotton are likely to have market difficulties.

INCREASING OUTPUT AND INCOME PER WORKER

Because increases in output per worker usually result in higher net returns per worker special measures might be developed in some areas to capitalize on the potentialities of increasing output per man as mechanization and other improved practices are adopted. Table 11 shows the progress in reducing hours of labor on corn, wheat, cotton, and some other crops, from 1910 to 1948. These changes indicate potentialities in reducing costs by lowering the requirements for labor in the major farm crops.

TABLE 11.—*Average hours of labor used per acre and per unit of production, and yield per acre for designated crops, selected periods 1910–48* [1]

Crop and item	1910–14	1925–29	1935–39	1940–44	1945–48
Corn:					
Man-hours per acre	35	30	28	26	24
Yield, bushels	26	26. 4	25	32	35. 2
Man-hours per 100 bushels	135	114	112	82	67
Oats:					
Man-hours per acre	16	12	10	9	8
Yield, bushels	29. 4	29. 5	29. 2	31. 8	35
Man-hours per 100 bushels	53	40	35	29	23
Hay:					
Man-hours per acre	12	12	11	12	12
Yield, tons	1. 15	1. 22	1. 24	1. 35	1. 37
Man-hours per ton	10	10	9	9	9
Wheat:					
Man-hours per acre	15	11	9	7	6
Yield, bushels	14. 4	14. 1	13. 2	17. 1	17. 7
Man-hours per 100 bushels	106	74	67	43	34
Rice:					
Man-hours per acre	55	37	32	29	26
Yield, bushels	35. 8	42. 9	49. 7	45. 5	46. 4
Man-hours per 100 bushels	154	87	64	64	56
Potatoes:					
Man-hours per acre	76	73	70	71	80
Yield, bushels	99. 7	114	117. 2	136. 7	182. 3
Man-hours per 100 bushels	76	64	59	52	44
Sweetpotatoes:					
Man-hours per acre	132	122	116	115	118
Yield, bushels	94. 4	93. 8	84. 9	87. 4	96. 3
Man-hours per 100 bushels	140	130	137	132	123
Dry beans:					
Man-hours per acre	47	30	28	24	21
Yield, pounds	778	655	855	898	988
Man-hours per 100 pounds	6	5	3	3	2
Sugar beets:					
Man-hours per acre	128	109	97	95	90
Yield, tons	10. 6	10. 9	11. 6	12. 7	13. 2
Man-hours per ton	12	10	8	8	7
Cotton:					
Man-hours per acre	116	96	99	103	102
Yield, pounds	200. 6	171. 3	226. 2	259. 9	268. 6
Man-hours per bale	277	268	210	190	182
Tobacco:					
Man-hours per acre	356	370	415	448	495
Yield, pounds	816	772	886	1, 026	1, 164
Man-hours per 100 pounds	44	48	47	44	43
Soybeans:					
Man-hours per acre	----------	16	12	11	10
Yield, bushels	----------	12. 6	18. 5	18. 3	19
Man-hours per 100 bushels	----------	126	64	58	52

[1] Hours of labor are computed for the acreage harvested and include preharvest work on acreage that was later abandoned.

During the war, the labor used per unit of product was reduced along the entire farm front. Gross farm production increased 18 percent from 1939 to 1944, but the total man-hours expended for the 1944 production were only slightly more than those used in 1939. And as there were fewer

workers on farms, the production per worker in 1944 was 26 percent above the 1939 level. Farm production in 1944 used about 3 billion fewer man-hours than would have been needed under 1939 production conditions. That represents a saving of 1.5 million man-years of work at 2,000 hours per worker. The change is accounted for by (1) lower labor requirements per unit of product resulting from increased crop yields per acre, (2) greater mechanization, (3) some shifting out of high-labor crops such as cotton, (4) less labor per unit of livestock because of increased production, and (5) the spreading of overhead and miscellaneous labor over a larger volume of production.

Figure 37, page 72, summarizes the remarkable gains in efficiency that agriculture has made over the last quarter-century. Total physical inputs (farm labor, power, and other resources) per unit of farm products decreased about one-fourth from 1920 to 1945. This means that the cost per unit of producing farm products has decreased about 25 percent in terms of the physical labor, power, fertilizer, and other materials that go into farm production.

These accomplishments represent rapid progress, but much more startling changes lie ahead if full advantage is taken of the opportunities for reducing labor requirements and for increasing the output per man. For example, mechanical pickers and other improvements may soon make it possible to reduce the man-hours used per bale of cotton in many areas to about one-fourth of the hours required by the older methods. If fairly complete mechanization of the cultivation and harvesting of cotton could be attained, the man-hours used per bale might be reduced to 65 hours, as a national average. This would release 1.6 billion hours of labor on an output of 13,000,000 bales. That is equivalent to about 800,000 man-years of labor at 2,000 hours annually per worker. Expenses per bale of cotton would be greatly reduced. Such a drastic change could not come rapidly, but the end result would have a decided impact on the economy of the South, as well as on the entire national economy.

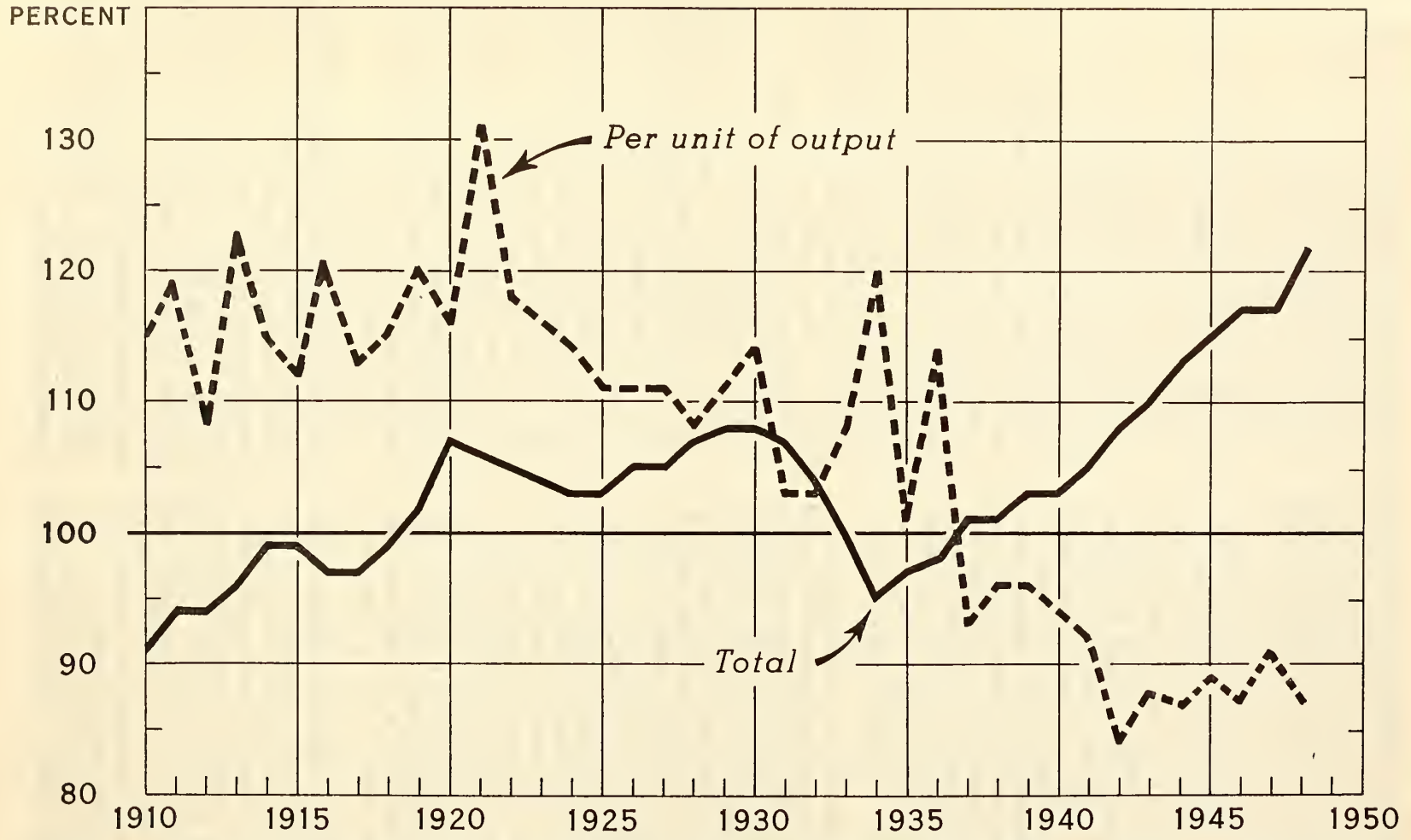
Changes that would enable agriculture to take full advantage of the potentialities of the new technology would be so sweeping that there is little likelihood that they will ever be completely realized. In many respects this may be fortunate, because national welfare cannot be measured solely in terms of efficiency. But it seems apparent that considerable progress in adapting farming to the new technology is desirable and necessary if farmers as a group are to be prosperous.

The distance to be traveled varies greatly by areas and by broad regions. Figure 38, page 73, shows the gross farm production per worker by census geographic divisions from 1919 to 1948, compared with the average production per worker in the United States for the years 1935–39 as a base, or 100 percent. The effect of the drought in the early 1930's and the piling up of workers on farms because of the depression is evident in the curve that shows gross production per worker for the United States. But the influence of drought on production per worker is most evident in the north central and mountain divisions.

Gross production per worker in the three southern divisions has been much lower than the 1935–39 average for the United States throughout the entire period shown in figure 38, page 73. These three southern divisions have had about 50 percent of all the farm workers in the Nation, and have contributed about one-third of the total United States production in most of the years of the interwar and World War II periods. With the exception of the years of drought, gross production per worker in the West North Central States was 50 to 60 percent above the 1935–39 national average in the interwar period, and it was more than twice that prewar national average in the war years, 1942–44. Gross production per worker in the Pacific States has shown a tendency to increase throughout the entire period.

What are some of the causes of such wide geographic variations in gross production per worker? Table 12 gives part of the explanation. The South Atlantic and East South Central States had the lowest gross production per worker in 1944. The acres of cropland, value of land and buildings, and value of livestock per worker, were less than one-half of the national average. The value of equipment per worker was about one-third of the average for the country as a whole. In other words, the average farm worker in these two southern divisions had less than half as much land, buildings, and livestock, and had only about one-third as much machinery to help him in his farm-production job, as did the average farm worker in the United States.

The figures in table 12 indicate that material increases in production and net income for southern farm workers largely depend upon (1) providing more land, livestock, machinery, fertilizer, and other capital items per worker and (2) opportunities for nonfarm work for the young people who grow up on farms but who will not be needed in farm occupations, and for the workers who will be released from agriculture as mechanization and other improvements gain momentum. These changes are inevitable. They are already under way. The only question is how rapidly the transformation will take place.



INPUTS ARE PHYSICAL QUANTITIES OF ALL FARM LABOR, LAND, MACHINERY, POWER, FERTILIZER, AND OTHER MATERIALS AND RESOURCES USED IN FARM PRODUCTION (WEIGHTED BY AVERAGE 1935-39 PRICES)

FIGURE 37.—PRODUCTION INPUTS: TOTAL AND PER UNIT OF FARM OUTPUT, UNITED STATES, 1910–48. (INDEX NUMBERS 1935–39=100.)

Total physical inputs (farm labor, power, and other resources) per unit of farm output decreased about 25 percent over the last quarter century.

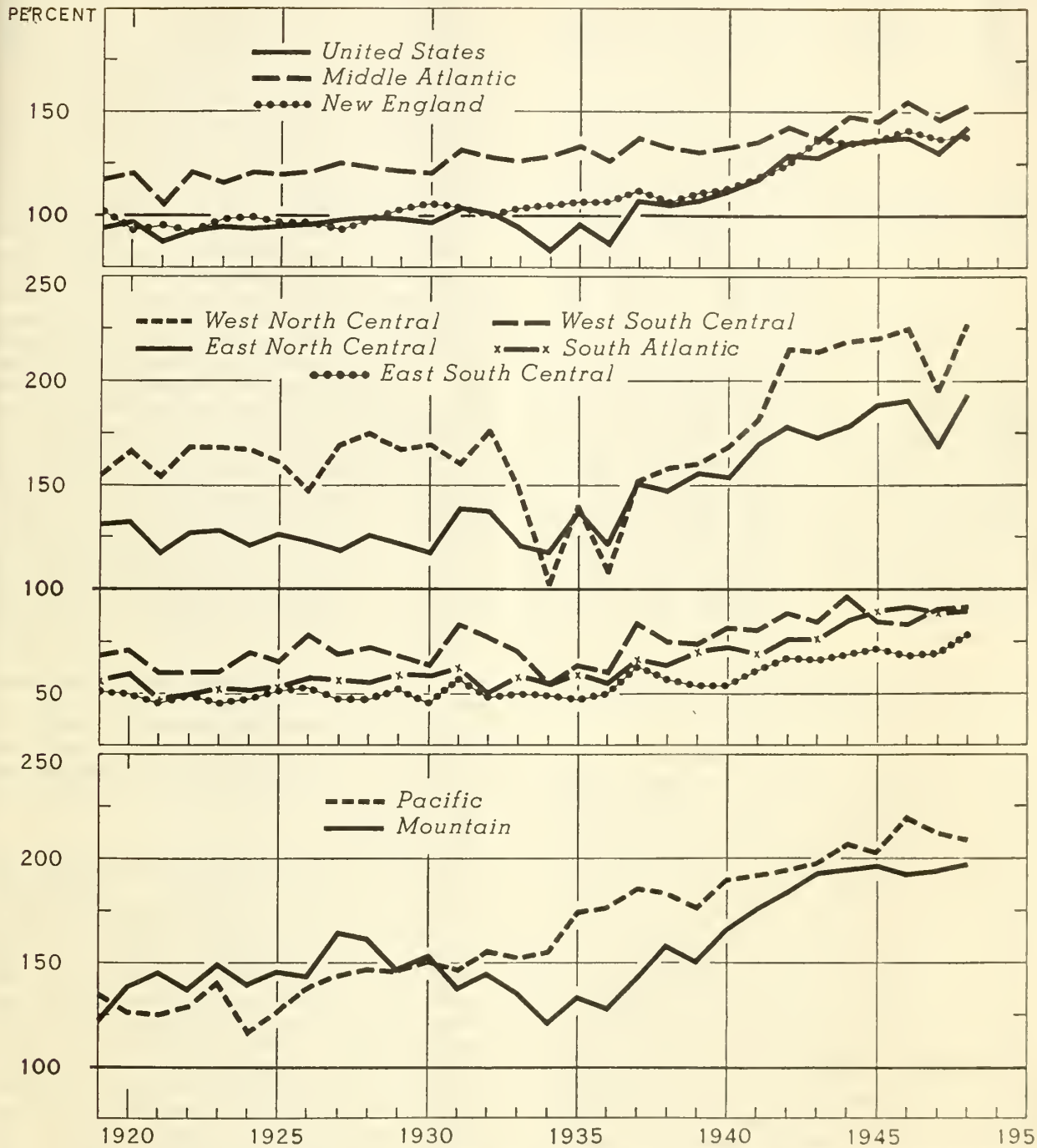


FIGURE 38.— RELATIVE GROSS FARM PRODUCTION PER WORKER, BY GEOGRAPHIC DIVISIONS, 1919–48. (INDEX NUMBERS U. S. 1935–39 AVERAGE=100.)

Farm production per worker has been lowest in the southern divisions during the entire period 1919–48. The most consistent upward trend in production per worker has taken place in the Pacific division, although relatively greater wartime increases occurred in the North Central and Mountain divisions.

TABLE 12.—*Gross production per worker, and value of land and buildings, livestock and equipment per worker, by census geographic division, 1944 and 1945* [1]

Census geographic division	Production per worker, 1944 (U.S. average = 100)	Land and buildings per worker, 1945 [2]	Livestock per worker, 1945 [2]	Equipment per worker, 1945 [2]	Total cropland per worker, 1944
	Percent	*Dollars*	*Dollars*	*Dollars*	*Acres*
Pacific	154	8, 746	826	623	32
Mountain	144	6, 470	1, 820	719	68
Western States	150	7, 784	1, 246	664	48
West North Central	162	7, 668	1, 592	926	91
East North Central	132	7, 175	1, 184	863	45
Middle Atlantic	109	3, 942	1, 018	838	24
New England	100	3, 960	745	529	17
Northern States	139	6, 665	1, 299	864	59
West South Central	71	3, 433	616	320	32
South Atlantic	63	2, 212	343	187	15
East South Central	52	1, 923	351	177	15
Southern States	62	2, 519	434	227	20
United States	100	4, 622	844	513	38

[1] Production per worker in 1944 is used because that is the production year reported in the 1945 census.
[2] From the 1945 Census of Agriculture.

Readjustments of this kind will create opportunities for farm workers in the South to equal the per capita production and income of farm workers in other regions. But on many farms the change involves shifting from a simple cash-crop type of farming, with hand-and-mule operations, to relatively complex soil-conserving types, that involve forage, pasture, winter cover crops, livestock, mechanical power, and larger farms. This kind of farming requires more management and more mechanical skill for successful operation. In most other areas the shift to mechanization and more complex types of farming has been made gradually, and managerial and mechanical skills have developed as needed. The shift from hand-and-mule farming to the mechanical-power phase is a much more drastic change. It may be retarded by lack of requisite managerial and mechanical skills.

Eventually southern farmers will learn the new ways of farming even by trial and error methods; but it would be possible to speed up the learning process. A *management advisory service* could help to overcome the lack of experience with new methods. Such a service could help farmers work out systems of farming that involve the improved methods, and it could also provide some guidance in adopting the new techniques. Encouragement might be given to the organization by farmers of cooperative-management associations for employing professional management assistance. Research agencies could render service on this front by establishing research test farms where new developments could be tested, and where farmers would see them in operation. Frequently there would also be need for credit programs to provide capital for improvements and for enlarging farms.

Although the readjustments in southern farming are likely to be more drastic than changes in other areas the same general process is at work elsewhere. Mechanization and other improvements have not only increased the size of farm that a family can operate but they have also made farming a much more complex business. This means that successful, modern farming requires less brawn and more brains than the farming of a generation ago, and that it takes a large capital investment to become established on the size of farm that a family can easily handle from a labor standpoint. Some farmers will need new sources of credit to obtain farms of adequate size, and to buy the livestock and equipment to operate them. Full-time farms that are too small to utilize mechanical power effectively are likely to be too small to provide a satisfactory living for a farm family.

The farmers who can utilize available assistance in adjusting the type and size of their operations to the new techniques are likely to be rewarded with incomes that compare favorably with earnings in other occupations. Such rewards are necessary if farming is to attract a proportionate share of the capable youth who are choosing their life occupations.

But tables 8 and 9 indicate that there are large groups of farm people who have not benefited from mechanization and associated improvements. Some of these people probably are best fitted for farm work, but they cannot readily adapt themselves to the new techniques. Many are older people who look forward to retirement. But some younger workers will not be able to operate farms of the size and complexity required by the new techniques. Greater effort is needed to assist these small-scale farmers in making the kind of changes that are most likely to improve their situation. Perhaps part of this group can develop relatively simple types of farming which, even though somewhat less profitable, are better suited to their capacities. Research is needed on the economic possibilities in this direction. Some will find their best opportunities as hired farm workers. Better housing and more adequate security are problems of major importance to the hired-labor groups.

The largest group among those who are likely to be disadvantaged by the further shift to the mechanical-power phase and associated improvements are the ones who will have to seek employment elsewhere because their work will no longer be needed in agriculture. If high industrial activity is maintained, other work will be available. But even so, the shift to new work and new environment will be difficult. Employment offices in rural areas will be needed to inform workers of job opportunities. Many of those who are no longer needed on the farms will need preliminary training for other occupations.

As modern transportation makes it possible for more people to combine rural living with nonfarm work, it would be possible to expand the number of part-time farms and rural homes at the same time that many workers shift to nonfarm employment for their major source of income.

A high level of economic activity will need to be maintained if the workers displaced in agriculture are to be absorbed in other occupations. Figure 6, page 9, indicates that progress in technology has increased output per man in other industries in the same way as in agriculture which means that a market must be found for a greatly increased industrial output. To a very large extent, increased employment at high wages can create its own market, if consumers are permitted to share the benefits of improvement in the form of lower prices. But as output from the productive plant of this country is increased it may become highly desirable to shift more effort into the service occupations—into the health and educational professions, into recreation, and into other professions and services that will provide better living for all the people.

A high level of production is not an end in itself. It is only one of the means to achievement of a better way of living. As increased efficiency is developed in both agriculture and industry less work will be required to produce both food and other products. More time will be available for other things including leisure and recreation.

Farmers can retain for themselves some of the real benefits from agricultural improvement if they will take effective steps to utilize the first results. These steps include (1) slackening the pace of farm work and increasing the leisure time available for the entire farm family, (2) investing the higher earnings in education and health, and in home conveniences, and (3) refraining from capitalizing increased earnings into higher land values, which make the business of farming more hazardous and less profitable for themselves and for their children. Better farming should always mean better living.

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NOTE

This report is a revision of the summary of a study that was begun in the fall of 1944 with the purpose of analyzing the changes in farming during the interwar and war years, appraising the forces back of the large increases in production, and evaluating some of their peacetime implications. The original summary report was issued in processed form in June 1946 under the title "Changes in Farming in War and Peace." This is the second revision of that earlier summary but is the first report on the subject that has been printed. It includes our production experience in the United States in the years 1946 to 1948; and other new information, especially with respect to farm classification and trends in sizes and ownership of farms.