Volume Title: Recent Economic Changes in the United States, Volumes 1 and 2

Volume Author/Editor: Committee on Recent Economic Changes of the President's Conference on Unemployment

Volume Publisher: NBER

Volume ISBN: 0-87014-012-4

Volume URL: http://www.nber.org/books/comm29-1

Publication Date: 1929

Chapter Title: Agriculture

Chapter Author: Edwin Nourse

Chapter URL: http://www.nber.org/chapters/c4962

Chapter pages in book: (p. 551 - 606)

CHAPTER VIII

AGRICULTURE

By Edwin G. Nourse

The several chapters of this survey thus far have dealt with consumption, transportation, merchandising, manufacturing industries, labor and management, with only casual bearing on the situation in agriculture. In those chapters, great emphasis has been laid upon the radical adjustments, both in technique and in business organization and practices, which have been outstanding developments of the post-war period. Turning now from discussion of our national industry in general to the particular problem of agriculture, one must be struck with the fact that the adjustments there called for have been no less drastic in character. Circumstances, however, have conspired to accord to the farmer a less satisfactory meeting of his difficulties, and therefore a general situation as to prosperity with which he is by no means satisfied, and which practically all students of the problem agree leaves him on a lower level of prosperity than that being enjoyed by the majority of economic groups.

At intervals during the last few years, Congressional committees, private institutions, Government workers, and interested individuals have attempted to formulate quantitative statements of the farmer's situation, and to measure the extent of his distress or the degree of his economic disadvantage.[1] Comparisons have been made longitudinally

[1] One of the most common short-cut methods of statistical comparison has been to take the index numbers of farm-product prices and divide by the index of prices (wholesale) of nonagricultural commodities to produce a quotient which was often labeled "an index of farmers' purchasing power."

"This method of measuring the value of farm products," says C. M. Purves, of the United States Bureau of Agricultural Economics (*Index Numbers of Prices Farmers Pay for Commodities Purchased*, (mimeograph report)) "has not been entirely satisfactory because farmers do not buy at wholesale nor are index numbers of nonagricultural wholesale prices weighted according to the amount of farmers' purchases. . . . Index numbers of prices paid by farmers for what they buy have been constructed by the Bureau of Agricultural Economics, United States Department of Agriculture. These indexes show changes in prices since 1910 of commodities purchased by farmers for the family living and for operating the farm. They are constructed with the same base period and as nearly as possible in the same manner as the indexes of prices received for farm products. The ratio of the index number of prices received for products sold to the index number of prices paid for commodities farmers purchase will hereafter be used instead of the ratio of farm prices to nonagricultural wholesale prices as a measure of the purchasing power of farm products.

with conditions of agriculture in previous years, and in cross section as comparisons with other economic groups. Such nominally exact calculations have been impaired by innocent errors and partisan distortions to an extent which has caused them to produce more confusion than enlightenment. Professor Black has examined many of these difficulties, and says:[2]

If any conclusion at all can be safely drawn from these data, it is . . . that the real per capita incomes of farm people fell behind badly from 1870 to about 1895, improved

"Users of these index numbers of farm prices and of prices paid by farmers are cautioned against their misinterpretation and misuse. These price index numbers do not measure changes in farm receipts or in farm expenses, and the ratio of prices farmers receive to prices paid for purchases is not a measure of the purchasing power of the farmer. These index numbers do not take into account any variations in the quantities of crops sold or quantities of goods purchased. Furthermore, the prices used in constructing these index numbers do not represent all sources of receipts or all varieties of expenditures. The income from farming is spent not only for commodities purchased for the family living and for operating the farm but also for interest on mortgages and loans, rents, railroad fares, and other items which are not represented by these index numbers. Strictly speaking, the ratio of the index number of prices received for farm products to the index number of prices paid for commodities purchased merely represents the power of a fixed quantity of selected farm products to purchase a fixed quantity of goods in relation to the base period."

These index numbers of farm prices, prices paid by farmers, wages, and taxes (1910–1914 = 100) are presented in the following table:

Date	Prices received for farm products	Prices paid by farmers for commodities bought	Ratio of prices received to prices paid	Farm wages paid to hired labor	Taxes on farm property (1914 = 100)
1910	103	98	106	97	...
1911	95	101	93	97	...
1912	99	100	99	101	...
1913	100	100	99	104	...
1914	102	101	101	101	100
1915	100	106	95	102	102
1916	117	123	95	112	104
1917	176	150	118	140	106
1918	200	178	112	176	118
1919	209	205	102	206	130
1920	205	206	99	239	155
1921	116	156	75	150	217
1922	124	152	81	146	232
1923	135	153	88	166	246
1924	134	154	87	166	249
1925	147	159	92	168	250
1926	136	156	87	171	253
1927	131	154	85	170	258

[2] John D. Black, "Agriculture Now?" *Journal of Farm Economics*, April, 1927, pp. 151–161.

from then until 1919, especially during the last three of these years, and then fell with a crash in 1920 and 1921; and if farm people are badly off now, it is principally because of developments during the war, and the price *débâcle* since, but to some extent because agriculture *had not entirely recovered by* 1916 *from the severe retrogression of the* 1870–1895 *period.*[3] But it is doubtful even if such a conclusion is safe . . . It is still entirely possible, in spite of these figures, that agriculture's share in the general income relative to population was somewhat less in 1915 than in 1870. Agriculture made great progress during this period; but possibly the cities made more progress . . . [Amended data] strongly suggest that in 1918 and 1919 the per capita incomes of farm workers were at least equal in purchasing power to those of the average of all other workers in the same sections of the country, but that from 1909 to 1916 they were far from being so . . .

The Federal Reserve Board's data show that factory wage earners' buying power in 1925–26 was 16 per cent higher than in 1919–20, and that even their money incomes were 3 per cent higher. The difference between 16 per cent more for city labor and 19 per cent less for farmers is truly stupendous. The year 1926 was the best year that the corporations in the United States have ever had. Each year of late has shown a large increase in the number of million dollar incomes. The outward signs of this rapidly increasing well-being of the already well-to-do and of the somewhat improved condition of the city working classes are evident to farm people the moment they enter a city's gates. It is small wonder that they are discontented.

Thus, whatever our devotion to the statistical method, the inadequacy of data forces the careful student back to statements of the problem which are qualitative rather than quantitative in character. Whether a given farmer's reward, when translated from price returns to real wages, interest, and profits, and the latter suitably adjusted in the light of psychic income, is more than that of a city worker of equal ability and expending equal effort, we shall probably never know, nor would the information do us much good if we had it. Any reasonably acute observer who examines any large sample of American farm life is pretty sure to conclude that the price level of agricultural commodities does not pay production costs on the present plane of efficiency and leave to the majority of farmers a surplus large enough to maintain standards of living comparable to those of town and city dwellers, and provide adequate education, recreation, and insurance against sickness and old age. Whether this condition tends to grow better or worse, and what measures, if any, are practically available for its improvement, we shall discuss later in the chapter. First, however, we must get a general view of the forces which have operated to produce the conditions amidst which we now find ourselves.

I. DIFFICULTIES CONFRONTING AGRICULTURE

There is always danger of talking about "the farmer" and "American agriculture" as a unit. In a large and diversified country, differences in type, activity, and situation are numerous and extreme—so much so, in fact, that a properly specialized account of the several branches of our

[3] The italics are the author's.

agricultural industry involves a diversity of details quite unmanageable in a discussion of the present scope. We must content ourselves with the broad outlines of major factors which apply somewhat generally over the country.

Since most of the interest and attention with reference to the situation of agriculture during the last eight years has centered on the comparatively low level of prices for agricultural commodities, we should notice first the forces operating to create and prolong this unsatisfactory price equation.

On the demand side:

1. Since the war, several strong competitors, particularly in the field of cereals and livestock products, have become increasingly strong contenders for what had been our traditional export outlet.

2. The possibility of developing in foreign countries a satisfactory, expanding market for the more intensive types of agriculture, coming with the maturer development of our agricultural industry, has been seriously checked by the slow recovery of the industrial nations of Europe and the fact that internal disorders in Russia, China, Mexico, and elsewhere have retarded the progress of these countries toward the higher type of European commercial and industrial civilization.

3. Dietary habits, fashions in clothes, and other factors in domestic consumption have caused this department of market demand to yield rather disappointing results to the farmer.

4. The rapid and widespread substitution of mechanical power for draft animals has further curtailed the demand for products of the soil.[4]

On the supply side:

1. Additional land has come into use for the first time or land already in use has been advanced to a more intensive stage of utilization, while withdrawals have been too slight to afford an adequate offset.

2. The maturing of methods of disseminating knowledge of efficient farm practices is beginning to show clear results in the increase of farmers' efficiency as producers, while declining fertility, though pulling in the opposite direction, seems a factor of less significance at the moment, and is indeed checked by many of the improved methods just referred to.

[4] The writer has developed these points more fully in *American Agriculture and the European Market*, 1924; *Journal of Farm Economics*, January, 1927, p. 21; *Proceedings of the Academy of Political Science*, January, 1928, p. 116; *Journal of Political Economy*, June, 1928, p. 330.

3. The process of mechanization has "stepped up" the productivity of man labor applied in many parts of our agricultural industry, while the number of workers leaving agriculture has only partially offset this increase.[5]

And, finally, the market mechanism by which supplies and demands are brought together in terms of price has shown:

1. Higher freight rates—only partially offset by the development of water transportation or the use of the motor truck.
2. An increase in many handling and selling charges as a result of higher costs of operation, particularly in the matter of wages paid.
3. Higher costs of containers and of labor and facilities used in packing and repacking, storing, and processing products on their way to the consumer.

Let us now examine these factors in the order in which they have been listed.

II. THE DISAPPOINTING DEMAND

It is a matter of common knowledge that the development of western Canada, Argentina, Australasia, and other countries has contributed to the decline of American exports of cereals and animal products which was clearly under way before the opening of the World War, or has required us to meet a very low price basis in the world markets as the condition of our continuance in the business.

Canadian wheat supplies have risen from 52 million bushels in 1900 to 232 million in 1913, and 550 million (preliminary estimate) in 1928. Similarly, Argentina produced 239 million bushels of wheat in 1927–28 as against 169 million in 1913–14, and 78 million in 1899–1900. The Australasian figures moved up from 49 million to 108 million and 119 million, respectively, during the same years. America's exports of the five principal cereals declined from 530 million bushels in 1897–98 to

[5] In some localities, farmers have been constrained to work longer hours and use more labor of women and children in the hope that a larger output might offset the unsatisfactory unit price of their product. For example, the issue of *Wallaces' Farmer* for October 4, 1926, says editorially: "What part of our bumper crops are the product of the unpaid labor of women and children? An Iowa subscriber writes: 'As our boy of thirteen and I stopped to rest our teams in plowing this summer, I looked around and counted ten of us in sight cultivating. There were three grown men and seven children, one girl and six boys, all plowing corn. The ages ranged from eight to fourteen years.' Farmers like this man are not working their children because they want to. They are doing it because they see no other way of keeping the farm going and turning out the volume that seems to be necessary in order to get by. Child labor on the farms is one of the factors that put real fire into the farm relief movement. Men will fight harder to save their children from hardship than to save themselves."

168 million in 1913–14. From the war-stimulated peak of 533 million bushels in 1921–22, they again dropped to 210 million in 1925–26. From this low point, however, they have risen somewhat during the last two years of heavy production, but on a basis of price unsatisfactory to American producers, and indicating the outward thrust of heavy home production rather than the attractive pull of profitable foreign demand.

Beef exports from the Argentine have risen from 54 million pounds in 1900 to nearly 2 billion pounds as an annual average to-day, while American exports have become negligible.[6] Similarly, exports of pork products have shown a marked decline, although our pre-eminence in corn growing enables us to retain a position in the world market, particularly so far as lard is concerned. The postwar decline in the export of pork products has brought them to less than 40 per cent of the war-time peak, but they are still at a level slightly above the immediate prewar years. This is doubtless owing in part to the redundance of domestic corn supplies in the face of the sharply declining number of horses and mules. Great Britain is still our greatest agricultural export market, but the trend of her interest seems to lie toward fostering imports from within the immediate family circle of her own empire, or from nations whose trade relations fit better than those of the United States into this system of exchange.

Second, as American agriculture has in some sections turned its attention from the old staples toward newer specialties, such as dairy and horticultural products (see Table 1) which are in or near the luxury class, the possibility of developing for these products a profitable export market to take the place of that for cereals or meat has been curtailed by the shock suffered by European industrial life, where in the prewar period consumers for such classes of products were developing at a most satisfactory rate. The repercussions of Europe's difficulties upon other nations in a less advanced stage of economic development has tended to check their economic progress, and thus to prejudice the possibilities of developing such a market rapidly in non-European countries. Add to this the internal disturbances of such countries as China and Mexico, the general tendency for non-European civilization to move at its own pace rather than at the tempo which was being introduced through European influence at the height of the imperialistic period, and we have a situation which seems, in general, to present no very flattering outlook for export surpluses of the American farmer.

Turning now to the domestic situation, we find standards of lighter eating and drinking, the use of less voluminous clothing, and an expanded use of natural and artificial silk and of paper products, where formerly textiles of agricultural origin were employed, which has brought about a

[6] Except in the case of oleo oil, which amounts to about 90 million pounds a year.

by no means insignificant lightening of the public demand for the farmer's wares.[7]

Finally, in the past 13 years there has occurred a decline in the number of horses and mules on farms from 25.7 million to 19.5 million head, as an accompaniment of the increase of tractors and trucks. During the same period there has been an even greater decline in the number of horses and mules in towns and cities. Estimates vary as to the amount of pasture and crop acreage that has been thereby released, but it seems clear that demand for at least 15 to 18 million acres of hay and grain land has dropped away as a result of this transition from horse power to internal combustion motors. Obviously, there is some offset in the growth of the market for farm products among those who produce these machines and the gasoline and oil with which they are fed. Their purchasing power, however, is largely directed into other channels, and the disruption of prices owing to the inability to readjust types of farming has been severe. Throughout much of the corn belt, oats and hay have come over a long period of time to a very important and very firmly entrenched position in standard crop rotations. Farm equipment, the experience of workers, and the whole farming system have grown up around this rotation plan, and as yet no fully satisfactory substitutes have been found to meet the new ratio of demands anywhere nearly as well as did the old corn, oats, and meadow combination.

All in all, then, the farmer has been called upon to make drastic adjustments to altered purchasing power abroad, the competition of newer industrial lands, and several cumulative changes in the volume and character of domestic demand. The one mitigating circumstance has been that our domestic industrial population has, in general, been rather fully employed at comparatively good wages. The national policy, however, has looked toward restriction of immigration, and hence a smaller number of mouths to be fed. High wages go not so much to increase the takings of products raised on the farm as to create a demand for greater fabrication of products and additional forms of trade and professional service. The situation thus presented on the demand side has been one which, in order to keep the various branches of the agricultural industry stabilized and so far as possible prosperous, would have called for a large degree of control over the quantity and direction of producers' efforts. How fully this condition has been met, we must now see.

III. EXUBERANT PRODUCTION

In spite of the fact that the census of 1890 celebrated the passing of the American frontier, the decades since that time have continued to witness the bringing of additional farm land into use, and the process did

[7] Phases of this matter are discussed in considerable detail under the heading "Changes in Consumption" in Chap. I (see pp. 530–558).

not terminate at the outbreak of the World War or with the signing of the Armistice. Land utilization is not determined by broad policies of public welfare nor is it under comprehensive state control. It proceeds largely along lines of individual profit-seeking on the part of private landholders, reinforcing their own zeal for land exploitation by Government reclamation projects wherever possible. As a result of this, additional areas have been or are being drained, irrigated, or cleared of timber, brush, and stone to make farms for settlers. Likewise, the extension of railroads and highways and the coming of the motor truck have increased the utilization of certain areas of land previously inaccessible.

But more significant than so-called "reclamation" is the process by which a considerable amount of land, particularly in the western half of the country, has been raised from range use to that of crop cultivation, or from extensive crop growing to general farming, stock raising, or horticultural uses. Millions of acres of Texas, Oklahoma, and Kansas range land have, since 1920, gone into cotton and wheat, and the vineyards and orchards of California and other states have been recruited from one-time grain and hay fields at a rate which has threatened to swamp certain branches of the horticultural industry. Some of these developments are clearly apparent in Table 1.

TABLE 1.—ACREAGE OF SPECIFIED CROPS IN CALIFORNIA, 1920–1928

(In thousands of acres)

Commodity	1920	1921	1922	1923	1924	1925	1926	1927	1928[a]	Change since 1920
Extensive crops	4,439	4,181	4,259	4,223	3,316	3,729	3,738	3,749	3,840	−599
Wheat	714	557	712	748	377	603	653	812	796	
Barley	1,250	1,188	1,129	1,095	765	1,050	1,080	994	1,083	
Oats	155	140	150	162	86	151	156	147	144	
Hay (tame and wild)	2,320	2,296	2,268	2,218	2,088	1,925	1,849	1,796	1,817	
Intensive crops	1,356	1,295	1,447	1,546	1,714	1,934	2,090	2,155	2,306	+950
Truck	171	145	191	214	221	268	327	356	360	
Fruit (bearing)	1,035	1,095	1,189	1,249	1,364	1,494	1,601	1,671	1,725	
Cotton	150	55	67	83	129	172	162	128	221	

[a] Preliminary.

Obviously, there is another side to the picture, and some land, utilized during the World War or before, has been so unprofitable under postwar schedules of price as to be "abandoned," either literally or in the sense of reverting to less extensive uses. In certain of the northeastern states, some of this land is being reforested by state or private agencies. It would be futile to attempt to make a quantitative determination of the ratio which such subtractions bear to the additions already discussed. The point is that such withdrawals have ordinarily been in sections where the land is of poor quality, undesirable in climate or topography, or at a

disadvantage in terms of transportation or other facilities for production or social life, whereas the accretions have been of land which is superior for some technological or economic reason. Regardless of how the area of "abandoned" land would compare with that of new additions, it is evident that such withdrawals have not been sufficient to bring production into desirable balance with demand, while at the same time additions to land area or increases in intensity of cultivation have complicated the problem and tended to delay ultimate adjustment. In spite of repeated protests from farmers and farm organizations against public reclamation enterprises during this period of adjustment, Government irrigation projects have made some addition to our productive plant, and local interests have pushed private developments wherever their immediate interest seemed to be served thereby.[8]

While this factor in the situation must not be exaggerated, an understanding of the problem requires that it be remembered that the agricultural resources of the country are by no means all in use, and that changes in agricultural technique or in other branches of our economic life frequently result in tapping these latent resources in such a way as seriously to disturb the adjustment of existing agricultural enterprise.

Probably a larger factor, and certainly one more general in its application, is that of the advancing technique of agriculture as a fruition of efforts toward general dissemination of scientific farming methods throughout the agricultural group. From the Civil War to the World War, we had a succession of developments of Federal and state departments of agriculture, agricultural colleges, agricultural experiment stations, extension service, and county demonstration agents or farm advisers. The pressure of war needs and "food-will-win-the-war" campaigns resulted in a rapid development of the extension service and the putting of local educational agents in about 4,000 of the principal agricultural counties, from one end of the country to the other. This has been followed by intensive development of boys' and girls' club work, with exhibitions and prizes provided by banks, chambers of commerce, and other interested bodies, with state and national championships rewarded with ribbons, cups, cash, tours, and even calls upon the President of the United States. Farm bureaus have developed educational activities and systematic programs of work, and the teaching of agriculture has been widely extended in the high schools, a move facilitated

[8] One of the items in the agricultural referendum recently submitted to its members by the Chamber of Commerce of the United States reads as follows: "The Committee recommends that the bringing into cultivation of additional areas for agricultural production at public expense be delayed until such additional production of agricultural commodities as would result therefrom can be demonstrated to be an economic need of the nation." There were, according to the preliminary canvass, 2,537½ votes in support of this proposition and 391½ opposed. This commits the Chamber in favor of the proposition.

by the development of consolidated school districts in many sections. The pressure upon the farmer to make both ends meet, coinciding as it did with this forward thrust of educational effort in agriculture, has resulted in a widespread advance in sound and scientific farm practices, which, as such things go, has been phenomenally rapid. While quantitative measures of its effectiveness are out of the question, its qualitative significance is established in the testimony of agricultural leaders in all parts of the country.

These practices have included wider dissemination of good seed, better methods of tilling, drainage, terracing, and the like, better sanitation for livestock, with better breeding, more intelligent feeding, record keeping, and the culling of unprofitable animals from flocks and herds. Its details are almost endless, but in general it may be characterized as a move to bring the science of agriculture, as developed by two generations of laboratory and test-plot work, into the daily understanding and practice of the rank and file of farmers.

Finally, the most dramatic and probably the most significant single factor which has entered into the productive situation of agriculture within the last few years has come with the increased mechanization of the farm, primarily as a result of the development of the internal combustion engine. This represents the second wave of mechanical advance in American agriculture, the first having been the sweeping adoption of horse-drawn implements in the period between the Civil War and the World War. Some suggestive comparisons may be made between the two movements.

Prior to 1850, American agriculture, in common with that of all other countries, was carried on by hand labor, employing only a few simple tools, and differing but slightly from the methods of the Middle Ages or ancient times. During the latter years of this period, however, "Yankee ingenuity" had been busy on the problem of devising machines which would save labor and improve results in farming, so that from the steel moldboard plow of 1833 to the Marsh harvester of 1858 a fairly extensive line of horse-drawn implements had been made available to the American farmer. Actual adoption of this power equipment was extremely slow until the pressing demands and shrinking labor supply, which developed as the Civil War progressed, forced farmers in large numbers to turn to these labor-saving methods. Immediately after the war came the homestead movement, and an even more pressing demand for horse-drawn implements. These were perfected in great variety as the years went on, but, with few exceptions, were limited in size and character to the sort of machine which could be moved over the ground and derive its operating power from a team of from two to five horses or mules. "Big-team hitches" were developed in some parts of the West, but a one-

horse or a two- or three-horse team was the norm of practically all farm operations up to the time of the World War.

The only notable exception in which the horse gave way to mechanical power in farming during the nineteenth century was the steam thresher, and there was a very slight application of steam engines to plowing. The development of dry-farming methods some twenty years ago accentuated the demand for mechanical power, and internal combustion engines were employed in tractors of a clumsy and none-too-reliable sort in the last few years just prior to the World War.

In all this, we see a situation rather strikingly similar to that of farming during the Civil War period. Technical developments of considerable potential significance had taken place, but pressure had not as yet been sufficient to force the general adoption of the newer methods. High war prices, the patriotic appeal that "food will win the war," the loss of farm labor through the draft, and the pushing of agriculture out into regions where extensive methods were employed, strongly stimulated the adoption of tractors, trucks, and stationary motors on our farms. The machines available were fairly crude, but they demonstrated the effectiveness of such forms of mechanical power on the farm and created a market outlet and a volume of field experience which enabled manufacturers to make rapid strides in the mechanical perfection of such equipment, and in furnishing it at prices and on credit terms which enabled the farmer to make the transition from the horse-power agriculture of his fathers to methods so largely dominated by power equipment that it is hardly an exaggeration to speak of present and prospective American agriculture broadly as "power farming." This phase of the situation now developing in American agricultural production is hardly less than revolutionary.

IV. THE ADVANCE OF POWER FARMING

The transition from horse power to mechanical power in agriculture, although it began about twenty years ago, shows its most striking development during the past ten years. This is revealed in Chart 1, which is based upon the statistics of horses and mules on farms, and of tractors in use during a series of recent years. Table 2 presents data covering the first of these points. It is noticeable that the pressure for large production caused the number of horses and mules to hold their own or even increase up to 1919. Thereafter the tide turned, and the decline in horses on farms has continued down to the present. Far from abating, it seems now to show signs of further acceleration. In the South, where mules are almost exclusively employed, the beginning of the decline was deferred until 1926, but the most recent figures show that the movement has now clearly begun. Other evidence suggests that it may proceed at a rapid pace.

CHART 1.—A COMPARISON OF THE NUMBER OF HORSES AND MULES WITH THAT OF TRACTORS ON FARMS, 1910–1929

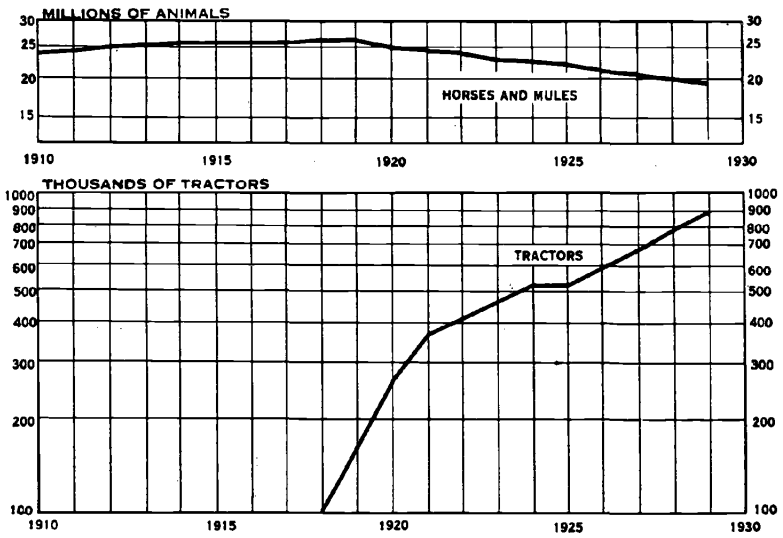

TABLE 2.—NUMBER OF HORSES AND MULES ON FARMS, 1910–1929

(Thousands)

January 1—	Horses	Mules	Total
1910	19,833	4,210	24,043
1911	20,277	4,323	24,600
1912	20,509	4,362	24,871
1913	20,567	4,386	24,953
1914	20,962	4,449	25,411
1915	21,195	4,479	25,674
1916	21,159	4,593	25,752
1917	21,210	4,723	25,933
1918	21,555	4,873	26,428
1919	21,482	4,954	26,436
1920	19,848	5,475	25,323
1921	19,134	5,586	24,720
1922	18,564	5,638	24,202
1923	17,943	5,702	23,645
1924	17,222	5,730	22,952
1925	16,489	5,725	22,214
1926	15,830	5,740	21,570
1927	15,145	5,679	20,824
1928	14,541	5,566	20,107
1929	14,029	5,447	19,476

The other side of the picture shows a sharply rising curve of tractor use. Table 3 presents these data both from the standpoint of current sales and of accumulating tractor equipment on farms, which is more definitely comparable to the horse figures previously presented. This

table indicates a ratio of one tractor to each 7.8 farms of 50 acres or over in 1925, as against one tractor for each 16.9 farms of 50 acres or over in 1920. Such a figure is only roughly suggestive of the rapid advance of the tractor in a period of a very few years, and development has of course been most rapid in the years since the census of 1925 was taken. It is

TABLE 3.—TRACTORS MANUFACTURED, SOLD, AND IN USE ON FARMS, 1910–1929

Year	Manufactured	Sold in the United States	In use on farms, January 1
1910	4,000	.....	.....
1911	7,000	.....	.....
1912	11,000	.....	.....
1913	7,000	.....	.....
1914	10,000	.....	.....
		.....	.....
1915	21,000	.....	.....
1916	29,670	27,819	.....
1917	62,742	49,504	.....
1918	132,697	96,470	80,100
1919	164,590	136,162	147,600
1920	203,207	162,988	[a]246,139
1921	73,198	.....	354,600
1922	99,692	101,192	381,675
1923	134,590	117,701	447,000
1924	119,305	99,011	498,225
1925	167,553	121,998	[a]506,745
1926	181,995	126,725	585,068
1927	200,504	160,637	643,825
1928	171,137[b]	99,491	768,825
1929	.....	.....	852,989

[a] These figures are from the United States Census. The others are estimates of the National Association of Farm Equipment Manufacturers.

[b] Preliminary.

perhaps more significant to note the situation in particular states which bulk large in our agricultural industry, and whose type of farming is well suited to the utilization of the tractor.[9] Such a selected list is shown in Table 4. Obviously this method of presenting data has serious shortcomings, since tractors vary considerably in size and the larger farms ordinarily have more than one tractor each.

The snorting, balking marvels which first introduced the gas engine tractor to the farming community following 1902 were a nine days' wonder, but during the next decade they were rapidly perfected, and

[9] It is to be remembered, however, that the use of the tractor is by no means limited to wheat-farming states, the newer cotton region, and the comparatively large corn and livestock farms of the Middle West. It has been introduced into the potato fields of Aroostook County, Maine, and is to be found in respectable numbers in all the more important farming sections east as well as west of the Mississippi River.

general adoption proceeded swiftly and much as a matter of course. In fact, less thought has been given to the significance of the movement and its implications for the future of our whole agricultural industry than would have been desirable. The point alluded to earlier in this chapter may be here reiterated and developed in more detail, namely, that the introduction of the tractor implies and necessitates a sweeping revision of the whole character of our agricultural industry and of our ideas with reference to farm organization and management, land values, and other phases of rural economy.

TABLE 4.—NUMBER OF TRACTORS ON FARMS IN SELECTED STATES, 1918–1929

State	1918	1920	1922	1924	1926	1928	1929
Iowa	[a]8,940	[a]22,319	[a]26,876	[a]32,623	[a]40.612	[b]49,695	[b]59,609
Nebraska	[c]4,746	[c]8,888	[c]10,886	[c]11,457	[c]19,489	[b]24,486	[b]29,062
North Dakota	[d]	[e]13,006	[d]	[b]16,000	[b]18,177	[b]21,995	[b]24,156
Illinois	[d]	[e]23,102	[d]	[b]43,325	[b]47,893	[f]61,398	[b]69,973
Kansas	[g]5,415	[g]17,177	[g]21,717	[g]25,019	[g]33,853	[b]41,275	[b]49,681
Texas	[d]	[e]9,048	[d]	[h]16,905	[b]19,103	[b]23,114	[b]27,238
Montana	[d]	[e]7,647	[d]	[h]6,602	[b]6,700	[b]8,107	[b]14,000

[a] *Iowa Monthly Crop Report.*

[b] Estimate. The Montana estimate is clearly too low. There were probably 10,000 tractors in the state, Jan. 1, 1928.

[c] *Nebraska Agricultural Statistics.*

[d] Information not available.

[e] *United States Census*, 1920.

[f] *Illinois Farm Equipment Survey*, 1928.

[g] *Reports of Kansas State Board of Agriculture.*

[h] *United States Census*, 1925.

One reason that we have given so little attention to this grows, no doubt, out of the fact that the tractor was first thought of as a mechanical device which would take the place of the horse in existing methods of agriculture. But this iron horse, or "steel mule," as one manufacturer actually christened his tractor, does not merely take the place of horseflesh in the traditional scheme of agricultural production. We are coming slowly to perceive that it sets a new pace and, rather than fitting itself unobtrusively into our agriculture, creates a demand that agriculture be quite drastically readjusted in accordance with its needs and potentialities.

It was but natural that the tractor in its early days should encounter a heavy weight of inertia—old methods and old ideas in what has always been regarded as a highly-traditionalized calling. It was born into a world of horse machinery, farmers trained to the handling of teams, and sizes of farms and methods of organization which had been worked out in response to the needs of horse farming.

As the tractor has established itself, however, farmers have with great rapidity learned to handle the new type of power with skill and

enjoyment. Old implements have been adapted to the larger power made available through the tractor, or new implements devised to exploit its possibilities, and farm sizes and farming methods have begun to adapt themselves to the possibilities of the new source of motive power. Mutual adjustments of the internal combustion engine to farming and of farming to the internal combustion engine are now encountering less resistance, and are gathering such increasing momentum as to cause some agricultural engineers to predict that we stand on the threshold of a new agricultural era, which will be marked by revolutionary changes in the application of mechanical power to farming. Time alone will tell whether this is an exaggerated view, but at all events it appears that the period which we have just passed through is that of the relatively difficult initial introduction of something new and radically different, and that we are only now passing into the period of widespread adoption of improvements thus far developed by the leaders rather than the mass. To see the nature and appraise the significance of what is now under way, we should examine separately several of the major fields of agricultural production in which these changes have been taking place.

V. POWER FARMING AND WHEAT

Wheat growing easily takes its place at the head of the list in any discussion of mechanized farming. It was in this industry that bonanza farming developed in the latter part of the nineteenth century. Here also the steam thresher first blazed the trail of power machinery on the farm. It was the wheat growers of California, followed by those of the Pacific Northwest, who developed the combine harvester, which is one of the most outstanding features of the present development of power farming.

During the World War, when wheat was a commodity of prime importance, every effort was directed toward making the most of our productive possibilities; the now famous Campbell Farming Corporation of Montana had its inception, and showed what a man trained as an engineer could make of mechanical methods on some 100,000 acres of dry-farming land. Since the war, with the vigorous competition of Australia and Argentina returned to the market, our wheat industry has been constrained to follow this same line of attack, through greater mechanization, in the effort to reduce production costs to a point where we can survive in this competition. With rapid improvement in tractor design and the development of smaller sizes of combines, this method of harvesting has become the standard of modern practice over a large part of the western wheat belt, and is rapidly pushing eastward, adding the other small grains to its sphere of operation.

The "combine," or harvester-thresher, is simply a small threshing outfit, or "separator," hooked up with a cutter-bar and elevating apron

such as are used on the standard grain binder. The binding mechanism is omitted from the harvester and the grain passed direct from the cutter-bar to the cylinders of the separator in a loose condition. As first developed, these outfits were hauled by big teams of from 12 to 20 or more horses each. This is still done to some extent, but more and more the tractor has taken the place of the big team. The larger combines ordinarily derive their power from a separate gasoline motor mounted on the front of the separator, but smaller outfits often are operated by a power "take-off" from the tractor which hauls the apparatus.

In some types of this machine, the threshed grain is spouted directly into a wagon or truck which accompanies the combine harvester over the field. In other cases, a grain tank is added to the machine, and in this the grain is collected and dumped, in lots of 50 bushels or in larger or smaller amounts, into wagons or trucks at convenient points. In the matter of disposal of straw, practice differs. Where it is feasible to plow the straw under, a straw spreader attached at the rear of the combine will effectively distribute the straw and chaff over the land. In some cases, however, the growth of straw is so heavy that it is necessary to remove it from the land. In such event, attachments are available which will deposit the straw in a continuous windrow for burning or collection by a hay loader, or gather it into convenient piles or small stacks for burning, baling, or hauling in the loose state.

The method of converting standing grain into threshed wheat at one operation first developed in California, then in the Palouse Valley of Washington and Oregon, and in the Southwest. In all these places grain ripens uniformly, is not often beaten down by storms or subject to frost damage. In Montana, the Dakotas, and farther east, however, all these difficulties present themselves with more or less frequency. If these sections are to secure the benefits of this cost-reducing method, their ingenuity is challenged to adapt the combine harvester in such a manner as to minimize these difficulties and yet secure at least a substantial part of the economies made possible by eliminating the older method of binding and shocking wheat. This has resulted in the use of windrowing attachments, or "swathers." By this method, grain which is not sufficiently dry for immediate threshing can be cut and deposited unbound in a single windrow, where the grain from a swath of 10, 20, or even 25 feet in width may be held until it is in suitable condition and good weather is available for threshing. Then the combine, with a "pick-up" attachment, similar in principle to the standard hay loader, is drawn over the field, completing the operation.

Obviously, this method foregoes the saving obtained by completing the whole process by a single operation. It retains, however, the economy of twine and power required for binding the grain, and eliminates the heavy labor charge of shocking and handling the bundled grain

to the thresher. It likewise leaves the straw distributed in the field when it is desired to plow it under and, if a bunching attachment is used, makes field baling or the hauling of straw for bedding an economical operation.

The extent to which the use of the windrowing method will permit of the economical use of the combine over the more humid sections of the country is still in the process of experimental determination. Such outfits are in use to-day as far east as the Atlantic coast, and seem to be establishing themselves as standard farm practice in all important grain-growing sections.[10] With the present trend of grain prices and the growth of production in areas where "direct combining" is practicable, it would seem a fair inference that sections which are not able to compete, at least to the extent of doing field threshing with the windrow method, are likely to be in large measure forced out of the business of growing grain commercially.

Some idea of the rapidity of the recent spread of the combine over the country may be gained from the figures giving the total number sold in the United States annually during the past six years. These are as follows:[11] 1923, 1,099; 1924, 1,590; 1925, 3,563; 1926, 6,277; 1927 11,221.

Likewise, the figures showing distribution by states are interesting from the point of view both of dispersion and of the apparent direction of growth. These figures are given in Table 5.

Figures which will show accurately the comparative cost of the three methods are difficult to secure, both because of the experimental stage in which the windrowing method still remains and also because of the diversity of conditions under which the various methods are employed. A Texas study,[12] however, computes the cost of harvesting with the combine as ranging from 14.7 cents per bushel with an 11-bushel yield down to 7 cents with a 23-bushel yield, and average costs of harvesting with the binder and stationary thresher at 33 cents per bushel. Nebraska studies[13] show combine costs of 9 to 12 cents per bushel with yields of 11.8 to 13.4 bushels, and estimate the cost of the binder method at about 31 cents per bushel. A report made by the United States Department of Agriculture[14] shows similar savings, and the writer found it to be the judgment of careful observers in Montana that the combine reduced

[10] More and more, as the combine has moved out of the wheat area, efforts have been made by manufacturers to increase its range of uses by developing appliances not merely to meet special conditions, but to facilitate its use on as wide a range of crops as possible, including particularly soy beans, clover, and peas.

[11] United States Bureau of Census figures.

[12] "Harvesting Grain with the Combine Harvester-thresher," Texas Agricultural Experiment Station, *Bulletin*, No. 373.

[13] *Extension Circulars*, Nos. 811 and 814.

[14] *Technical Bulletin*, No. 70.

TABLE 5.—NUMBER OF COMBINES IN VARIOUS STATES[a]

States	1926	1927
California	2,000	2,100
Colorado	.....	800
Idaho	800	1,100
Illinois	64	310
Indiana	.....	72
Iowa	.....	27
Kansas	8,276	12,782
Michigan	.....	10
Minnesota	.....	11
Montana	550	1,100
Nebraska	.....	3,000
North Dakota	26	200
Ohio	.....	20
Oklahoma	3,189	5,746
Oregon	1,500	1,800
Pennsylvania	.....	26
South Dakota	.....	225
Texas	2,684	2,890
Virginia	.....	4
Washington	2,500	3,100
Utah, Nevada, and Arizona	350	500

[a] As calculated by the National Association of Farm Equipment Manufacturers.

production costs by about 15 to 20 cents per bushel. The cost under the windrowing method presumably gets about half the savings secured by direct combining, but has considerable advantage in meeting difficult conditions of harvesting without the wasting and spoiling of grain which is unavoidable where the binder method is used.

In order to secure maximum economies, it is necessary to use the combine outfit to nearly its maximum capacity. For a medium-sized machine, this means something like 1,000 acres during the season, and it is generally calculated that no economies are effected unless at least 300 acres of grain are to be handled each year. In the regions of general farming, this would necessitate custom work or some sort of co-operative arrangement by which the combine would be used on several farms each season. The other way of meeting the situation is through the growth of larger operating units, each capable of utilizing one or more combines and other machine equipment well up to its maximum capacity. In the heart of the wheat belt, operating units are so large that "in recent years many wider machines have been purchased, and 20-, 24-, and even 36- and 48-foot machines are to be found."[15] With even a 16-foot machine, 40 to 50 acres per day may be cut, and the speed with which the work is completed is an important factor in avoiding waste and getting the best quality of grain.

These direct savings of as much as 20 cents a bushel on production costs have brought more farm relief to the wheat grower than has actually

[15] W. E. Grimes, *Journal of Farm Economics*, April, 1928, p. 226.

resulted from tariff protection at a nominal rate of 42 cents per bushel. The development of the combine and other low-cost methods has enabled the Pacific coast states to survive in world-market competition, has made possible the relative stabilization of the wheat-growing industry of Montana[16] and western North Dakota, and has enabled the Gulf Southwest to expand its production.

Evidently these low-cost methods are particularly suited to a rather extensive method of producing rather moderate yields on land which ranges down to comparatively low grades. This introduces a factor of competition to be met, for a time at least, by the grain lands farther east not dissimilar to that which confronted the Northeastern states when the prairies of the Middle West were rushed into production as an accompaniment of the coming of the horse-drawn binder. To what extent and by what measures central and eastern farmers may meet this competition is one of the interesting phases of the present farm problem.

The prominence which has been given to the combine harvester should not cause us to overlook the fact that it is but one, though doubtless the most striking, phase of the mechanization of grain production. Its coming has been largely facilitated by the use of the tractor, and the tractor in turn has made possible many other economies and improvements in grain farming. One of the chief of these is that it largely mitigates the burden of seed-bed preparation, particularly in the winter wheat region. "Fall plowing," socalled, actually is to a large extent performed in the late summer when weather is hot, moisture not infrequently inadequate, and flies and other insects add the last straw to break the horse's back. The tractor manifests sublime indifference to temperature, flies, or the condition of the soil, and permits of timely and thorough preparation of the ground and seeding under the most favorable conditions. Whether for fall or winter seeding, also, the tractor can be pushed long hours, even all night with suitable lighting attachments, and thus overcome almost any crisis, presented by unfavorable weather or flood or frost damage, which necessitates reseeding.

In other types of equipment, also, there has been considerable progress. Ideas of the proper amount and kind of stirring of the soil which

[16] The accelerated speed of power-farming development in Montana is revealed in the following table of sales of tractors and combines in that state during the last four years:

Year	Tractors	Combines
1925	1,160	112
1926	1,749	220
1927	3,607	968
1928 (estimate)	4,925	2,720

should take place in the annual plowing and in summer fallow operations have changed considerably, and the one-way disk, or "wheat-land plow," and the "duck-foot" cultivator have been devised to meet this situation, producing optimum condition with less labor than required by the older methods.[17] With a tractor of suitable power, the ground can be covered very rapidly with these appliances. These implements go far toward solving problems of weed eradication and control of soil-blowing in the land of summer fallow.

Finally, it should be remembered that the achievements of the internal combustion motor include the development of the farm truck, which scuttles about over the fields, taking on grain as it is discharged from the combine harvester and putting it swiftly on its way to market, at costs which would have been unbelievable in the old days of horse teams. Even the so-called "pleasure car" is an important machine, transporting the farmer and his laborers rapidly over the distance between home and fields, or between the farm and the town where repairs must be secured in case of a breakdown. As a matter of fact, the development of the automobile must be regarded as a condition precedent to much that has happened in the recently rapid progress of farm equipment. Air strainers, methods of sealing-in the motor, heat-treating of metal, the development of alloy steels, and methods of precision as developed in the automobile factory have been carried over in the making of farm tractors and trucks to the end that costs have been reduced, performance immeasurably improved, and the working life prolonged to a truly remarkable extent. In a modern tractor factory, methods of testing are as exact and exacting, and the speed, precision, and economy of the process by which an evolving machine advances down the assembly line until it moves off under its own power are as highly perfected as those found in any first-rate automobile factory.

It has already been suggested that the application of machine methods introduces new complexities as to the size and organization of the farm. The acceleration of the harvest period resulting from the use of the combine has likewise created new problems of marketing—of storage, car supply, glut prices, and moisture damage. The last is being attacked vigorously through methods of bin ventilation and weed removal attachments on the combine. The issue as to physical movement and price behavior challenges the farmer to tackle a whole series of problems.

[17] F. A. Wirt, agricultural engineer with the J. I. Case Co., supplies the author with figures of comparative cost (based in large part on cost studies made by the United States Department of Agriculture), which indicate that the cost of growing wheat, using the one-way disk plow and combine, amounts to barely 45 per cent of the total cost by the old method of plow, harrow, binder, and thresher, and that the cost of seed-bed preparation with this "wheat-land plow" is only about 55 per cent of the cost of plowing and harrowing. This implement might itself be called a "combine," since it results in telescoping two tillage operations into one.

How much and what kind of storage must he provide on the farm or (through organization) at the local shipping point or terminal market? Must he, through co-operative organization, secure a more orderly marketing of the crop, or can the machinery of future trading work out a scheme of differentials between the different months, weeks, and days, which is just and reasonable in view of the cost of effecting the necessary time distribution of a highly seasonal crop? Can farms of the present sizes and types of organization secure an effective and economical utilization of the size and number of machine units which will secure minimum production costs? Must problems such as the elimination of moisture damage and avoidance of the cost of windrowing be met by changes in cultural methods, designed to secure more adequate weed control, or by the popularization of varieties which have shorter and stiffer straw, earlier ripening, or less tendency to "shatter" when ripe?

The plant breeder and the agronomist seem disposed to match the brisk pace set by the agricultural engineer and implement manufacturer, and, at perhaps a somewhat more conservative rate, the actual farmer and professional students of farm organization and management are effecting an evolution in the size and set-up of operating units. In both the northwest and southwest wheat belts, farms 5,000, 10,000, and even 50,000 acres in extent are being operated, some of them with striking results in the way of efficiency and low unit costs. The subhumid region was originally granted to settlers in homesteads of 160 acres, and such grants were only slowly increased to the half-section and finally the section. Experience shows that in much of this region such a holding gives a family nothing but a chance at starvation, whereas a block of four sections, with modern equipment, will produce a very satisfactory family income, and can, in the region of summer fallow, be handled by two men suitably equipped with modern machinery, and the possible addition of a little seasonal labor. Farmers who had sufficient resources or skill or courage to "stick it out" in the years following the price decline of 1920 are building up such business units, through the lease or purchase of lands given up by their neighbors. One four-section farm in Montana is made up of eight parcels, seven of which went through foreclosure proceedings. These seven include the farm of the present operator, who is managing the larger enterprise with so much success as to be fairly on the way toward eventually owning the whole tract.

The present trend toward modern agricultural efficiency in the wheat belt gives assurance that America can supply itself with an abundance of grain at costs commensurate with modern industrial standards, and even send a considerable surplus abroad over cheap water routes from the Pacific Northwest and the Gulf Southwest. It is, however, a condition which affords ruinous competition to wheat enterprise in many of the

older sections of the central and eastern states,[18] and rocks the foundations of land values in some of these older sections, much as they in their turn forced a revision in the agricultural utilization and land prices of the New England states.

It must be remembered that the very force which is contributing to the increase of low-cost wheat supplies in the Great Plains of the United States is also strengthening the chief competing regions in other countries. Farm implement manufacturers have been aggressive in developing the foreign market for the new power machinery even as they developed the export market for horse-drawn implements a generation ago. It goes without saying that wheat production in the prairie provinces of Canada is carried on by efficient machinery methods practically identical with those used in our own western wheat belt. It is perhaps not so well known that Argentina, Australia, and other wheat-producing countries are taking our tractors, combines, and tillage implements in considerable numbers, and seem to be entirely capable of duplicating the same sort of power-farming efficiency which we have so strikingly developed. Both these countries, as well as Canada, have considerable areas of level subhumid land, comparable to our own Great Plains region, among their advantages for low-cost grain farming.

Sparseness of population has been something of a brake upon the development of these competing sections, but it is just such a condition which promotes the rapid introduction of power machinery, and gives labor and investment such a high productivity as to attract new operators into the field. Furthermore, Great Britain is definitely attempting to direct some of her redundant population to the most favored agricultural

TABLE 6.—DOMESTIC AND EXPORT SALES OF SPECIFIED FARM MACHINERY, 1922–1927[a]

Year	Two-bottom plows		Disk plows		Combines		Tractors	
	Domestic	For export	Domestic	For export	Domestic	For export	Domestic	For export
1922	54,876	6,435	13,841	1,100	1,608	854	100,092	10,223
1923	67,211	19,060	15,591	2,985	1,099	2,986	115,040	16,608
1924	45,866	16,681	12,043	3,694	1,590	3,671	96,539	25,585
1925	60,937	30,290	16,296	6,712	3,563	1,878	118,739	46,627
1926	75,132	44,617	17,237	6,981	6,277	4,707	122,940	47,605
1927	62,952	25,925	15,174	5,346	11,221	4,701	155,843	43,761

[a] Bureau of the Census, Department of Commerce, *Manufacture and Sale of Farm Equipment.*

[18] For example, the state of Nebraska straddles the 100th meridian, and thus exemplifies both types of farming. The study cited above shows a cost of 38 cents for the production of wheat in Perkins County in the western end of the state, as against an average of 86 cents in four of the eastern countries.

regions of her outlying dominions,[19] and much of the immigration of Europe turns toward undermanned regions, now that the immigration policy of the United States restricts entry here. The preceeding table of exports of certain types of agricultural machinery as compared with sales in the United States shows to some extent the manner in which the strong foreign competitors of the United States are keeping step with the march of our own technological progress.

VI. THE CORN FARMER

Several of the changes already discussed with reference to wheat enter into the present situation of the corn industry. Excellent and moderate-priced tractors, in sizes smaller than those which are ordinarily used for hauling the combine and doing other wheat-farm work, are available to the corn grower in the general farming regions where corn is the backbone of the cropping system. Even with horses, some of the most progressive corn belt farmers developed efficient methods of economizing man labor, such as driving a five-horse team on a two-bottom riding plow and leading a three-horse team, which followed the plow with a disc or harrow. Two-row cultivators were first introduced for horse use, and corn binders and pickers were handled by four- or five-horse teams.

With high-grade tractors of 12 or 15 drawbar horse power, the corn farmer can prepare his land for planting at a rate practically twice as fast as was possible even with his efficient team methods. This is because a tractor can pull an equal or greater load and move at a speed about twice that of a good farm team. As an experimental beginning, two double-row planters were hooked together behind the tractor, and now implement manufacturers are putting out both four-row and three-row planters. When it comes to cultivation, a similar adaptation of the two-row riding cultivator to a four-row or three-row cultivator, with tractor power, is rapidly coming into use. One man with a two-horse team and riding cultivator could cover 8 to 10 acres a day. With a tractor and four-row cultivator he can cover 60 to 65 acres.

Corn-husking has always been a labor-consuming operation, frequently calling for outside seasonal help similar to that of shocking and threshing in the wheat belt. For some years back, this situation has been partially modified by the increasing use of the silo and the "hogging down" of corn. The horse-drawn corn picker was introduced nearly twenty years ago, and showed a constant though moderate increase in use. The number sold during the last five years about doubles the previous rate of adoption. Its employment is somewhat facilitated by the availability of greater horse power under tractor-farming conditions, and also

[19] "It is officially expected that 6,500 of the 8,500 harvesters sent to Canada will remain as a permanent addition to the British citizenship of the Dominion." *Britannia*, September 28, 1928, p. 9.

the change of corn sheller design, which makes possible satisfactory shelling of corn which has a considerable amount of husk remaining.

The silo has become standard equipment on livestock and dairy farms, and has done much toward extending the corn belt to the north. The corn binder and the silo filler applied machine power to this process. The handling of corn, however, from the field to the silage cutter has always been a disagreeable task because of the heavy labor involved in handling the corn bundles. Progress is now being made toward lightening this work by the introduction of tractor-drawn corn harvesters which gather and shred the stalks directly in the field, dumping the cut silage into wagons or trucks which haul it to the barnyard. There it is simply dumped on the feed platform of a silo filler, which blows it into the silo. This eliminates one of the most costly and disagreeable tasks of the corn farmer.

Where corn must be husked for dry feeding or cash sale, the modern type of corn sheller, run by belt power from the tractor engine, makes possible rapid and economical handling of the work, and permits of speed and economy in husking, owing to the lessened necessity for complete removal of the husks. Portable elevators and moderate-priced feed grinders carry the mechanization of the corn farmer's labors through to the final disposal of his product.

The tendency of the tractor to displace horse power is at its maximum in such a one-crop area as the wheat belt, where there is a heavy seasonal demand for labor, and the maintenance of horses over a 12-month period presents many and serious difficulties. As we go into the corn belt and the region of general farming, we find farmers who expect to remain on the job 12 months in the year and who can provide pasturage on the rougher parts of their farms and raise feed crops at a minimum of expense in connection with their other farm operations. While, of course, the demand for horse labor is not uniform throughout the year, it is fairly heavy for more than half the year, and teams, if properly managed, can be maintained quite cheaply during the rest of the time. Those who are interested in the horse industry are now carrying on an active campaign to teach farmers the most economical methods of horse management and to instruct them in the use of "big team hitches," whereby the savings in man labor secured by the use of the tractor can be realized without turning from horse power. Thus a 10-horse farm might range from 250 to 320 acres and furnish 8-horse teams for big machinery, such as is drawn by tractors of the type most popular in this region. Even 12-horse teams are advocated and used to some extent. But eight horses driven four abreast will handle a three-bottom plow with a harrow attached behind, preparing 8½ acres of ground per day with the labor of one man. The extent to which this transition is taking place in the Mississippi Valley is indicated by the figures in the following table,

furnished by Prof. O. G. Lloyd, of Purdue University, showing percentage of acreage worked by teams of various sizes in recent years as compared with the situation six years earlier.

Size of team	Discing		Plowing		Cultivating corn	
	1919 to 1921	1925 to 1927	1919 to 1921	1925 to 1927	1919 to 1921	1925 to 1927
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
2-horse	....	....	1.8	0.2	80.0	72.4
3-horse	1.7	1.0	60.6	40.1	19.1	20.7
4-horse	88.9	67.8	27.6	33.3	0.9	6.9
5-horse	2.7	10.1	7.3	16.7	....	....
6-horse	6.7	19.4	2.7	9.1	....	....
8-horse	....	1.7	....	0.6	....	....

The repercussions of all this upon the economic organization of farming in the corn belt are somewhat less striking than the changes in wheat growing. The type of farming is much more intensive, with livestock occupying a large place in the program. And yet the effects of the development of larger power and machine units are highly significant. Even under general farm conditions, the 160-acre farm has become a small farm rather than a large one. The grain and livestock farm of the corn belt has been able to grow by the addition of "an 80" or a quarter section at the same time that it has reduced its demand for hired labor. Close observers of these developments are looking with more and more favor on the 640-acre tract as a family farm, and even coming to the conclusion that the better type of business farmers in this section can and should, for maximum efficiency, operate units of 1,000 to perhaps 2,500 acres. Such a farm permits a reasonable specialization in the labor force, a full line of modern equipment without excessive overhead, and the services of a practical manager who devotes his time fully to supervision of the technical and business operations of the farm without himself engaging in much, if any, manual labor.

As in the case of wheat, we find in the corn and livestock region of the great Middle West the gradual evolution of a type of skillful and adequately powered farming, which follows closely the developments of scientific research in the agricultural experiment stations. This will assure an abundant and moderate-priced supply of corn and livestock for home consumption, and will furnish for export those products for which this country offers superior advantage, such as lard, cured pork products, and oleo oil. Under such methods, farming will offer satisfactory returns to a declining number of workers, each performing the necessary labor on an increasing acreage with relatively large machine equipment.

The transition is being effected only at the expense of considerable recasting of the structure of land values and at a great deal of personal

cost to those who are being forced to change their residence and occupation in the process. The farmers upon whom the demand falls for increasing their investment in equipment are finding difficulty in meeting the situation in a period when farm produce prices are low as compared to operating and overhead costs. It is extremely unfortunate that the war profits of the section could not have been more fully diverted into this channel. In far too many instances they were dissipated in unwise investments before those who had secured them as a legitimate incident of war-time developments realized the trend of events which lay just ahead of them. If a magic wand could restore to Iowa alone the wealth which was taken out of the state in the years immediately following the war by fake promoters, oil stock salesmen, and the yeggs who garnered millions in Liberty Bonds from the none-too-strong-boxes of the country banks where farmer buyers had left them for safe-keeping, it would make an appreciable contribution toward equipping farmers adequately for taking advantage of the possibilities for more efficient production which lie technically within their reach.

VII. THE COTTON BELT

For a century after the invention of the cotton gin, the cotton industry expanded itself steadily but with negligible change in its basis of organization. While the Civil War marked the passing of slavery, it did not significantly change the methods or equipment by which cotton land was cultivated and the crop harvested.

It was the boll weevil, introduced about 1892 but not producing widespread infestation until more than a decade later, that marked the beginning of the period of rapid adjustment and readjustment within the industry. The depredations of the boll weevil, as it spread into the eastern, moister regions of the cotton belt, were so severe as to call for additional acreage elsewhere, and this was forthcoming in the western part of the belt. Expansion was particularly noticeable in Texas and Oklahoma (Table 7). The World War, of course, produced serious derangement of the world cotton market, with curtailment in several important

TABLE 7.—CHANGES IN COTTON ACREAGE IN SELECTED STATES, 1918–1928[a]

(In thousands of acres)

State	1918	1920	1922	1924	1925	1926	1927	1928[b]
South Carolina	3,001	2,964	1,912	2,404	2,654	2,648	2,356	2,487
Georgia	5,341	4,900	3,418	3,046	3,589	3,965	3,413	3,798
Oklahoma	2,998	2,749	2,915	3,861	5,214	4,676	3,601	4,630
Texas	11,233	11,898	11,874	17,175	17,608	18,374	16,176	17,631
Arizona, New Mexico, and California	180	380	168	411	438	449	362	527

[a] United States Department of Agriculture, *Yearbooks*.

[b] Preliminary estimates.

consuming countries. These years were the period, likewise, in which boll weevil damage attained its full force. The resultant curtailment of the crop and high war and postwar prices stimulated such expansion of the producing area that the present size of the industry induces keen competition between two sections which show marked diversity in natural conditions, producing methods, and general economic organization.

The less simple and routine methods of farming called for in the eastern states under boll weevil conditions have brought out sharply the inadequacy of old methods and the shortcomings of negro labor. Meanwhile, the strong demand for unskilled labor in industrial towns and cities of the North and, in increasing degree, in the southeastern states, together with our policy of immigration restriction, has created such a pull upon plantation labor as to bring about the abandonment of considerable areas previously given over to cotton growing. A study, conducted by the Georgia experiment station, showed that between 1910 and 1925 whole counties in that state had lost from 60 to 75 per cent of their negro farmers.

At the same time, the westward spread of cotton growing had been effected largely by white farmers of a vigorous pioneer type, who were vigorously exploiting the possibilities of their topography and climate to produce cotton with much less man labor, and at a cost which would yield them a profit even with the decline of prices which has recently been taking place. The westward movement of the cotton industry brought it into a region of comparatively cheap and very level land upon which machine methods could be introduced with a lowering of production costs and satisfactory net returns, even where yields were relatively low and methods of gathering the crop not such as to produce the highest quality.

The standard of the old cotton belt was an 8-inch plow, pulled by a single mule and manned by a negro field hand, who worked hard with crude methods over short periods but who, with his beast, had to be maintained for a 12-month period both on food and feed products which were largely imported from outside the cotton-growing section. This system was hardly conducive to high returns to land, capital, or management, or to a minimum cost of production. War-time demand and boll weevil scarcity put cotton prices at a point which made prosperous years for the cotton grower, but prices which were disproportionately high in an age of scientific achievement, mechanical advance, and high-pressure management.

Then the stone rejected by the builders became the head of the corner. The formerly submarginal lands of the Texas Panhandle and nearby Oklahoma, and the level coastal plain farther south which had yielded a sparse return as cattle range, were cut up into cotton farms. Moderate-sized tractors and appropriate tillage implements took the place of the

mule and 8-inch plow. Cotton was gathered by swifter and "dirtier" methods, and the product was cleaned by a special apparatus which was promptly added to the standard gin equipment. In extreme conditions of late crop or short labor supply, this section even makes extensive use of the cotton "sled," which strips the cotton bolls, opened and unopened, at a single operation. The first crude types of this implement are gradually being perfected, and have apparently made a permanent place for themselves in the practice of this region, though by no means taking the place of hand picking even in West Texas and Oklahoma. The enormous saving in time effected is indicated by the fact that the cotton necessary to make a bale can be "sledded" in seven hours,[20] whereas hand picking would take at least ten times as long. Making proper allowance for the cost of cleaning and for some lowering of quality, the saving still is enormous. And even where this extreme labor-saving method is not resorted to, the general installation of cleaning equipment at the gins permits of much quicker and cheaper methods of snapping and hand picking.

The general mechanization movement has spread itself in varying degrees over the whole South,[21] and old methods have been discarded or modified in a variety of ways. Mechanical cotton choppers of several types have been introduced. Some cotton is being "checked in," according to the long-established custom for corn, so that it can be cross cultivated. Mechanical cotton pickers of both the suction and the spindle type have been aggressively experimented with for some years, and it seems probable that commercially practicable machines will, within a few years at least, be available and economically feasible on at least the high-grade types of cotton. Their coming would tend to restore the competitive position of the eastern cotton section, in which the "sledding" method of the subhumid West cannot be used because of climatic difficulties.

What has happened in the cotton industry seems to reveal cotton-growing resources so abundant under modern methods of cultivation and harvesting as to put us in a position to continue our predominance among the world's sources of supply for many years to come. It has already forced the abandonment of a very considerable acreage in the

[20] United States Department of Agriculture, *Yearbook*, 1927, p. 224.

[21] "Tractor farming is rapidly coming to the front in the South . . . Last year a solid trainload of tractors went into the Delta section of Mississippi, and they are being operated successfully all over the South. In many small towns it is nothing unusual to see a carload of them driven down the streets in different directions and all of them headed for cotton farms. On a recent trip to a number of cotton farms where tractors are being operated, I was pleased to learn that every man interviewed was well pleased with the results. And in every instance the owners expect to cultivate larger areas with tractors and to get rid of some of the mules." *The Progressive Farmer*, November 3, 1928.

eastern part of the cotton belt, and challenged much of the district east of middle Texas to revise their methods and recast farm organization if they are to survive in competition with the new born western cotton belt. This new cotton region presents striking examples of tractor cultivation and mechanical harvesting on moderate-priced land with mile-long or half-mile rows, and a 160- to 320-acre family farm in lieu of the 10-acre patch, planted, chopped by hand, and hand-picked by the immemorial methods of the old cotton belt.[22]

Although large areas in the southern and eastern portion of the old cotton belt have gone out of cotton production, it is too much to assume that cotton growing will pass or become a minor factor in this region. Even though belatedly, the planters and farmers of the section are adjusting themselves to meet the new competition. Long-established traditions of economic organization must overcome a good deal of friction in such readjustment. There is a large area in the West which still can be turned to cotton production, if prices are maintained on present or higher levels. On the other hand, if the eastern part of the cotton belt can get production costs down to a point where that section can persist in competition with newer areas, the prices for the quantity of cotton which will come forward from the present area of production will probably discourage any rapid taking over of these new lands.

The South has always maintained a large stock of mules, mainly on expensive purchased feed, to deliver a small amount of power annually. Hence, any general introduction of tractors must have an enormous effect on production costs and incidentally on the northern farmer's feed market. Likewise, where cotton growing is displaced in the older sections there is considerable pressure toward the growing of forage crops, peanuts, and truck, and the development of dairy and livestock enterprises. Much of the coastal plain section is well adapted to the use of tractors. Among other things, they have great adaptability to the work of terracing—an undertaking of much importance in southern agriculture. All in all, it would seem that the coming of power farming holds as much promise, both of betterment and of disruption, in the South as in any other section.

VIII. OTHER BRANCHES OF AGRICULTURE

What has been said of the sweeping changes coming about in the production of cereals and cotton applies in varying, though generally in

[22] See L. P. Gabbard and F. R. Jones, "Large-scale Cotton Production in Texas," Texas Agricultural Experiment Station, *Bulletin*, No. 362.

Professor Gabbard writes the author (October 25, 1928): "I was in the Corpus Christi area recently, and an interview with dealers showed that at least 1,000 tractors of the farmall type will be in operation for that area this season. Four-row planters and four-row cultivators are fast becoming standard equipment with tractors. One dealer had taken up and shipped out eight carloads of mules."

less, degree to the other branches of American agriculture. Tractors, trucks, and other forms of mechanical equipment are widespread in their sphere of operation. Such appliances (including notably the milking machine, cream separator, and equipment for making silage) have been influential in the field of dairying, and it seems possible that, with the spread of rural electric lines, artificial refrigeration may before long achieve a rather important place in the picture. Likewise, in local milk plants, many of them co-operative, the installation of better equipment permitting the utilization of by-products in the form of dried or powdered skim milk and buttermilk, the building up of the ice cream business, and the transportation of fresh milk and cream economically and over long distances in glass-lined railroad tank cars is improving quality and reducing costs.

In the horticultural field, the introduction of certain new insulating materials and the development of small electric refrigerating units have resulted in eliminating a considerable amount of waste and permitting a longer season of marketing in many instances. The orchardist and truck grower are likewise benefitting from the use of tractors and better tillage implements and spray outfits, and from the use of the motor truck.

In the case of tobacco, sugar beets, and other products which have always required a large amount of hand labor, relatively little change has thus far been found possible, although mechanical "blockers" and the employment of the tractor in tillage, and the truck in harvesting, have had some value.

In recent years, the producers of electric current have become very much interested in the possibilities of "rural electrification."[23] This move has two major objectives. One looks to the supplying of power for pumps, feed grinders, and other light farm machinery. The other is concerned with domestic lighting and household appliances. Where population density in a country community is fairly high, and the type of farming such as to make numerous or heavy demands for the use of the current, service can be delivered at a moderate price and very satisfactory results obtained. This seems particularly to apply to regions of intensive agriculture where heavy machine work in the field is at a minimum and stationary power important. Artificial lighting of poultry houses, or artificial refrigeration of fruit or vegetables prior to marketing, are important operating factors in commercial poultry or truck raising districts, and cause a comparatively large demand for current. In general farming sections, however, the cost of distribution is ordinarily so high as to militate against the widespread use of electricity on American farms at the present time.

[23] See Guy E. Tripp, *Electric Development as an Aid to Agriculture.*

IX. ADJUSTMENTS OF PRODUCTION TO MARKET DEMAND

It is true that, in the past eight years, American farmers have been waging a courageous and resourceful battle to readjust their industry to new and rapidly-changing conditions. In this they have been rendered a splendid service by the Department of Agriculture, the state experiment stations, the extension service, and other educational agencies. Even with full appreciation of this effort, and admiration for those who have made it, the writer cannot find much cause for optimism or a belief that satisfactory adjustment will speedily be attained. It is difficult to move men from the farms, to adjust their property interests, and to absorb them into reasonably satisfactory industrial positions at a rate fast enough to balance the increase in technical efficiency and the spread of labor-saving appliances on the farm.

Farmers in a large number of lines have come to the decision that it is desirable to adjust downward from the present scale of production, but find it very difficult to select a substitute product or the crop to be adjusted upward. Shall the livestock man shift from unprosperous swine production to cattle growing or feeding because for the moment that industry is enjoying a touch of long-deferred prosperity? Many have already shifted toward dairying and poultry production, but poultry profits to-day are precarious, and the dairy industry, in spite of having developed an astonishing increase in the consumption of butter, fluid milk, and ice cream, finds itself facing the possibility of an export surplus and impairment of its whole price structure. Grain farmers have been struggling to find a profitable substitute for their redundant oats and corn acreage, while the expansion in wheat is forcing us further into a low-price world market instead of permitting our withdrawal. The horticulturist's problem of adjustment is complicated by the fact that prune acreage is excessive, peaches overdone, vineyard area outrunning the absorptive power of the market, grapefruit far in excess of profitable demand, and most other branches of the industry so close to market saturation that the advent of newcomers threatens the prosperity of all. Not all the surplus cotton acreage can be put into peanuts, and the raising of corn and livestock in the South introduces bitter competition for the harassed farmers of the corn belt.

On the production side, it seems at least dubious whether the American farmer is making or can make, during the next few years, his adjustments fast enough to catch up or keep up with the rate of change in technique and market situation.

X. COSTS OF DISTRIBUTION

Much is heard of the reduction of distribution costs as a possible means of improving the situation as to agricultural income. Con-

siderable agitation and experimentation has turned in this direction during the past few years, but without fully satisfactory results. Even those recent changes which have produced positive economies seem to have a somewhat ambiguous meaning as applied to the farmer's problem.

The speed and economy of truck hauling in certain instances has already been referred to. As an offset to this, however, the development of automotive vehicles and the coming of hard roads has resulted in the abandonment of a considerable mileage of branch line railways, and in the disappearance or dwindling activity of many small country villages such as formerly afforded a local market for many farmers' products. While this may ultimately effect such a reduction in the cost of handling goods as to redound to the benefit of the producer, the first benefits seem to go largely to the carrying agencies, and the effects most noticeable for the farmer are to require further readjustment of his business to meet these changed transportation conditions. Frequently the change in our transportation system means remoter markets to which a farmer may perhaps not find it feasible to go at all with a small quantity of his product, or which he must expend additional time and effort to reach if he does go. On the other hand, it is doubtless true, in some cases at least, that the concentration of business in the larger towns tends to give a brisker, more competitive primary market, which reflects more accurately the trend of values at the terminal.[24]

In many sections the loss of railroad service through the closing of stations where business was small, or the entire abandonment of lines, has worked a hardship on the farmers. They have also complained that the general level of freight rates upon farm products is unduly high in view of the present prices of many agricultural products and in comparison with rates charged on other classes of railway traffic. In the final analysis, they agree that the quality of service is so important that the roads must have earnings which will defray not merely operating costs but permit the installation of facilities which will give to agricultural products a service of maximum speed and minimum possibility of deterioration.

While the Hoch-Smith resolution has called for a complete review of this situation, the whole question of the rate structure is so intricate and involves such controversial issues between economic groups and geographic localities as to afford little hope of extensive reductions on the farmer's product. The railroads are already at a level of technical efficiency which precludes any sweeping changes from that direction, and the lowering of labor charges, which would be the other chief avenue of approach, seems clearly out of the range of possibilities.

[24] The exact character of the shift in town and village population is extremely difficult to ascertain. A good deal of light is shed on the movement by the discussion contained in Sect. II, Chap. V, of this volume.

The real question at issue involves theories of rate-making on the one side and some very fundamental issues of agricultural economics on the other. Traditionally we have leaned toward the idea of making freight rates on the rather low-priced and bulky products of the farm which would stimulate the most rapid development of resources, no matter how remote from consuming centers. Farmers, especially in this period of agricultural distress, are inclined to urge this traditional policy. Some serious thought, however, needs to be given to the implications of this theory under present conditions. Since wheat and cotton are both depressed industries, and the competition is from the geographically more remote fringes of the producing areas, it is at least interesting to speculate on what would be the effect of a stricter application of the cost-of-service theory of rate making. If, as has been suggested earlier in the chapter, the present trend of events threatens to undermine values in the older sections, cost-of-service rates might tend to conserve the interests of a rather large agricultural section. On the other hand, so far as higher freight rates on food commodities and agricultural raw materials impose a burden on the distant consuming centers, the maintenance of higher rates might conceivably tend to stimulate the decentralization of population toward the agricultural producing sections to their ultimate benefit. As a single example, low freight rates on cotton would inure to the advantage of the New England mills; high rates, to the southern mills. Which do the cotton-growing states want?

Co-operative marketing has been widely turned to as a solution of the farm marketing problem.[25] In cotton, dairy products, livestock, and numerous horticultural commodities, these efforts have been productive of results of relative and in some cases striking value. Considerable improvement in standardization, processing, transportation, market distribution, and merchandising have been effected. In one important particular, however, co-operative effort has been signally unsuccessful. This is in the perception of the relation of supplies to prices and in the devising of any means by which such supplies could be adjusted upon a satisfactory price basis.

In the case of certain small and strongly-placed groups, the problem has been reasonably well met, temporarily at least. On the other hand, it must be recognized that the attempt to organize any large group of scattered independent producers so as to achieve any effective adjustment of supplies to market needs is almost out of the question. Co-operation in agriculture is therefore faced by a serious dilemma. Certain definitely discernible economies in marketing and increases in efficiency in the market process can be attained only through the adherence of a rather large percentage of the producer group. So long, however, as prices of the commodity remain on a generally unsatisfactory level, and the

[25] See, on co-operative buying and selling, Chap. V, Marketing, pp. 374–389.

co-operative organization shows no clear ability to better the farmer's situation, it appears to be humanly impossible to secure the adhesion and permanently constructive support of the very farmers who need the half loaf of more economical and efficient marketing, just in proportion as they are unable to get the whole loaf of market-price enhancement.

Conceivably, the trends which apparently exist, toward a smaller number of farm operating units under a higher type of management, and toward a higher degree of commercial specialization in agricultural production, will lead to improved distributive conditions for both the producer and the consumer. Both these trends would facilitate the progress of co-operative organization, with the added benefits that such a group movement would make possible. The development, during the last few years, of buying departments or subsidiaries of chain-store systems, and the movement toward mergers of distributing concerns, notably in the dairy industry, sharply raise the question whether whatever improvements in condition are destined to take place may not come mainly with the spread in efficient business organization from the central markets out to the smaller centers, absorbing many of the petty buyers, brokers, and traders now operating at local shipping points. That such a move might be productive of savings in the distributive process seems quite possible, but to what extent such gains would inure to the benefit of the consumer, the producer, or of the promoter and stockholders of the distributive organization itself, is a matter on which little more than snap judgment is possible at the present time. Many farmers are awaiting the outcome of events with no little trepidation. Ordinarily, the producer occupies an uncomfortable position in a buyers' market, and the persistent tendency toward overproduction which has characterized the postwar years in American agriculture puts a considerable number of farm producers recurrently or persistently into a buyers' market.

With the growth of large manufacturing and merchandising units and a general merger tendency in the market in which they sell, farmers have become increasingly impressed with the importance of effecting organizations on the selling side, which would be large enough to secure the maximum economy in handling, storage, and processing, the highest degree of skill in market distribution and salesmanship, and a bargaining power which might cope with that which they must meet on the buying side. More and more the objective has come to be an organization coextensive with the boundaries of the given industry. In default of such organization purely along lines of producer co-operation, efforts have in the last few years turned toward a horizontal integration of shipping and selling interests which would embrace private dealers as well as co-operative associations. Since the initial phases of the plan emphasize

the assembling of the fullest possible information as to market supplies and movements, and contemplate the equalization of supplies through co-ordinated action in the best interests of the whole group, these organizations pass under the attractive title of "clearing houses."

How fully they will meet the hopes of their organizers, or how long their component elements will subordinate individual interest to the welfare of the whole group, is a question still in the stage of practical determination. They constitute, however, the latest thrust of organizational effort. If they fail, it seems a reasonable supposition to expect that they will be followed by a more determined effort than has thus far been witnessed to secure legislative authorization for marketing arrangements which would remedy the impotence of voluntary co-operation by requiring all those engaged in a given line of production to participate in a common scheme of market distribution.

XI. RURAL CREDITS AND FARM CAPITAL

Great emphasis has been laid on the farmer's credit situation as a factor in his problem. The question is no doubt important, and yet much that has been said on the subject has been ill considered. Undoubtedly, many rural districts were inadequately served with credit in the years shortly before the World War, when the rural credit agitation first came to an acute stage. With the passing of the Federal Reserve Act, the Federal Farm Loan Act, and the Intermediate Credit Act, the way has been paved for the removal of many of these difficulties, though obviously no mere piece of legislation can create a desired volume of credit or suitable administration of its extension. In practice, "sympathetic" officials in some of these institutions have extended lines of credit not justified by subsequent events, and credit losses of some magnitude have resulted. Such losses, however, have had the effect of cushioning, for certain unfortunate individuals, the shock of a distressing period in our agricultural history, and will doubtless be absorbed in our credit structure without serious harm, distributing scarcely avoidable losses to shoulders more able to bear them than those upon which they originally fell.

The main point, however, is how the extension of credits is to be suitably adjusted to the productive organization of our agriculture in the future. Perhaps we may grant in a broad way that the several pieces of rural credit legislation already enacted have tended to put the credit resources of the country at the disposal of the agricultural industry, upon terms as advantageous as those available to other industries, and adapted to the peculiar requirements of the business and those who are engaged in it. We must not, however, put the cart before the horse. Adequate credit facilities will not create a satisfactory credit situation for agriculture, but on the other hand a satisfactory basis of credit must precede the extension of loans. Even those farmers who, in the years just follow-

ing the war, laid stress on the ability of liberal credit extension to serve them in the deflation period have seen the limitations of such relief measures and coined the phrase, "You can't borrow yourself out of debt."

The modern farmer is more of a capitalist than his predecessor, and needs to develop the art of financial management along with his general business education. Likewise, the growing mechanization of agriculture and the tendency toward larger operating units is constantly enlarging the size of individual requirements, and presumably the business capacity of individual operators. The passing of many small villages as marketing centers tends to bring the farmer more in contact with banks which serve the general business public, which are ordinarily larger in size, and which are manned by officials who are better trained and are closer students of the general business situation than is likely to be the case with the small country banker.[26] The farmer who shifts to this sort of banking connection is likely to find himself held to a stricter standard of procedure in producing a credit rating and making a showing as to the financial plan under which he expects to employ the funds which he comes to borrow.

What seems to producers at times a Bourbon attitude on credit extension has sometimes proved merely the reflection of a sounder analysis of the trend of market values than that which the interested borrower could bring himself to accept. The farmer's dependence upon banks of a general commercial character is likely to curtail the liberality of credit lines which he can secure, unless these larger town and city banks include within their executive staff officers who are sufficiently acquainted with crop and livestock operations to enable them to judge, without too great conservatism or too slavish adherence to mercantile banking principles, what are the liquidating possibilities of the prospective farm operations which are presented to them for financing.

To some extent, there has been a revival of "dealer credit" during the last few years to enable farmers to purchase machinery, fertilizer, or the like to an amount which their own resources or their bank credit would not permit. This is particularly true in connection with the sale of tractors, combines, and other large machinery equipment. In sections of the Great Plains states, the tangible basis for bank credit was severely constricted at the same time that heavy expenditures for power machinery were needed, if production costs were to be so reduced as to enable farmers to re-establish themselves on a sound basis. The great farm implement companies had been going through a period of rather lean sales, and needed to stimulate demand in every way possible. Under these conditions, they backed their faith in the section and in the new methods of power farming to the extent of placing such equipment in the hands of a large number of farmers on extremely small initial payments. Since dealers in the locality were not much better able than farmers to carry

[26] Cf. Chap. V, p. 335.

this credit load, it was passed back directly to the implement companies who, in the main at least, handled it as a part of their general business rather than by forming subsidiary finance corporations after the manner of the automobile companies. In general, the method was to take initial payments of as little as 15 or 20 per cent of the purchase price, the buyer obligating himself to pay the balance from the proceeds of the crops of the two following years. The agricultural recovery of the section, under its new technique of farming, has been such as to justify the faith of the manufacturers and to reinforce their belief, often proved in the past, that the farmer is an excellent risk on a "character loan."

In both the implement and the fertilizer field, it is evident that the seller, with the profitable operation of his business at stake, may in difficult times like this be expected to go farther in the extension of credit than commercial banking agencies. This calls attention to the fact that a large element in the extension of credit to farmers is the knowledge which the lender has of technical aspects of the business, and the faith which he has in the profit-making possibilities of the given line of agriculture. This point is of considerable importance in connection with the discussions of branch banking as a possible improvement in our rural credit situation. In California, where the system has been tried, it seems clear that a branch banking system tends to be strictly run on formal rules which make it safe but not very elastic in adapting itself to the expansion of new sections or types of production. The line between technically safe banking and aggressive financing of worthy new developments is finely drawn.

Farmers in general, and not a few of the bankers who serve rural constituencies, are unable to wrench their minds free of traditional attitudes with reference to the profitableness of particular farm operations and to the accepted scale of land values. The number of rural banks which failed during the deflation period reflects somewhat sadly upon the professional competence of the officials in charge, or their ability to keep their minds undisturbed by popular sentiment through the changing stages of the economic cycle.

Agricultural financing appears to be in a transition period. Federal legislation has paved the way for agriculture to attain a more advantageous position in the financial structure of the country as a whole. Banks likewise have manifested considerable interest in better adapting their practices to the needs of agriculture, at the same time that they encourage agriculture to put its operations on a sounder business basis. A third constructive possibility emerges from the side of the co-operative organizations. They have been influential in mobilizing large blocks of farm products for safe and economical financing. This in itself tends to give the farmer a more flexible and advantageous position with reference to his commercial farm operations. The co-operatives, however,

have gone still farther in becoming the agency through which production credit could be made available to their members, at a cost much below that which had generally been required in the past.

These movements are as yet hardly past their experimental stages. It would seem, however, that the legislative modification of our credit institutions, the constructive attitude of many bankers, the progress in the economic organization of agriculture, and the growth of co-operative groups should produce substantial improvement in conditions of rural financing during the coming years.

XII. CREDIT AND LAND VALUES

The sweeping readjustment process now under way in agriculture challenges the whole capital structure of the industry. Formerly, the farmer was a man of terrific industry and grinding thrift. Land was his bank, and an unencumbered title the heaven he sought to attain. In the process, the right to be his own boss was capitalized at an inordinately high rate, and frequently residence values of a sentimental and almost ancestor-worshiping kind were spread over the whole farm, no matter how meager the yield as a matter of plant operation. The time appears to be at last drawing near when we shall cease to view land in this exaggerated speculative-investment light, when adequate outlays for equipment and working capital become of prime importance in determining the return to labor and management, and when current income commensurate with that obtainable in other callings will be insisted upon by farmers and their families. "The fact that we cannot expect a complete recovery of farm land prices does not necessarily mean that agriculture will not be prosperous. Prosperity and high land prices do not necessarily go together. It does mean that in the future we shall have to look to annual profits rather than to increases in land value for farm prosperity."[27]

One of the most striking features of the postwar development of agriculture has been its spread into comparatively low-grade lands with fairly extensive methods of use, while land values in the older sections have ceased to advance through the capitalization of a scarcity value of such sections under the intensive piling up of large amounts of poorly-paid human labor. For this development to have followed so swiftly on the heels of the war-time inflation of farm prices has of course involved a rather lengthy muddle of foreclosure proceedings, credit losses, and uncertainty as to the equilibrium points toward which the readjustment was tending. If it has done nothing else, however, it should shake faith in the time-worn slogan prevalent in many parts of the country that "our land values have always gone up and they always will," and induce a rechecking, on the part both of farmers and of lending agencies,

[27] Editorial in *The Prairie Farmer*, August 18, 1928.

of the relations, respectively, of land and of capital goods to the production of net farm income.

There is in most quarters only very inadequate realization of the nature and extent of the decline in land values which has taken place in the Middle West. Furthermore, the implications and results of this price decline are still less understood. The land boom broke in 1920, but many circumstances contributed to prolong its effect through a series of subsequent disturbances and settlings. Much of the land had been transferred under contracts, or with second and third mortgages on which first payments were not due for anywhere up to five years. As settlement under these contracts or mortgages came due, there was a succession of defaults which strung along over several years. Land went back to the seller or to the mortgagee, and in this way banks, trust companies, insurance companies, and other investors found themselves the involuntary holders of land on which payments were in arrears.

For some years during the early nineteen twenties, the tendency was very strongly toward granting extensions and helping the nominal owner or mortgagor to retain title and, with it, the burden of ultimately paying up on the capitalization established during the boom period. More and more, such efforts became ineffective as the period of unsatisfactory prices for farm products and income to farmers lengthened. Eventually, supervisory agencies required banks to divest themselves of such properties or to go into complete liquidation. This brought a wave of foreclosures, bank failures, and forced selling of lands, which drove prices to a half or even a quarter of what they had been at the peak. The significant thing in all this, however, is that prices have shown but little tendency to recover, and meanwhile a very large number of involuntary owners are still holding on to this property, uncertain what policy to pursue. There is probably not a single large insurance company, if it loaned on real estate in the Middle West, which does not have substantial holdings of farm land in some of these states, and the total runs to many millions. That the Federal Farm Loan system has also become deeply involved in the situation is shown by the following table of farms which have come completely or practically into their ownership, the data being gleaned from annual reports of the Federal Farm Loan Board:

Banks	Jan. 1, 1926	Jan. 1, 1927	Jan. 1, 1928
Federal Land Banks:			
Farms owned outright	1,598	2,763	4,086
Sheriffs' certificates	1,160	1,260	1,088
Joint Stock Land Banks:			
Farms owned outright	211	440	533
Sheriffs' certificates	176	222	357
Total number of farms owned outright and subject to redemption	3,145	4,685	6,064

Such distress selling as has already taken place has enabled the more provident, well-financed farmers to increase the size of their farms at reasonable prices. But a large number of the larger holders are unwilling to take the losses which would be involved in disposing of all of their land in the present market situation. Should they attempt to do it, it is inevitable that values would again crumble and their losses be even greater than they now appear. As a result, many of them are renting these properties to such advantage as they can and, in order to bolster up the situation, are not infrequently appointing farm managers or supervisors to work with the tenants on these farms to assist their efforts sufficiently so that rent payments may be met and the farm kept in reasonably good condition.

In some areas, also, individual investors or companies, formed for the purpose, have looked upon this as a favorable opportunity for securing lands at bargain prices, to be held speculatively for the "return" of values. Generally speaking, the farms are too small and too widely scattered to permit of effective joint operation or any distinctive economies such as might conceivably be introduced under modern conditions of machine operation. The situation, at the moment, seems to be that these optimistic purchasers or holders of lands are supporting the general level of land values, have somewhat cushioned the shock of distress selling, and are supplying farms to tenants on fairly liberal terms. To some extent, even, such properties are obliged to go tenantless.

As we said at the beginning, the whole structure of capitalization of the agricultural industry over considerable parts of our country has been shaken by the events of the last few years, and it can by no means be said that such recovery as has taken place has yet given a clear indication of future trends or a firm foundation on which to re-erect any reasonably permanent and dependable scale of values. This can be clearly seen in the accompanying table of index numbers of land values in certain selected states (Table 8). This shows the comparative height to which prices rose during the war-time boom and the fact that these values are still declining in some states most severely affected by the advance. On the other hand, Kansas appears to have stabilized values, and Montana is one of the few states which shows a slight upturn.

If the changes in technique which are now upon us prove to be of as revolutionary a character as has been suggested in the present chapter, the result would apparently be to alter permanently the schemes of valuation in different agricultural sections, which were built up under the older traditions of American farming. From the immemorial past, the predominance of hand-labor methods in farming has given great differential superiority to those well-watered and fertile lands which showed the greatest capacity to absorb large amounts of human toil. But much as in the field of mining the progress of scientific metallurgy and

TABLE 8.—INDEX NUMBERS OF LAND VALUES[a]

State	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1916	1927	1928
Connecticut	98	100	102	100	102	110	116	121	137	134	140	137	140	137	137	138	139
Indiana	98	100	102	101	110	116	128	135	161	147	119	115	108	102	95	87	84
Illinois	97	100	103	102	105	111	119	130	160	153	126	123	116	115	109	99	96
Iowa	96	99	104	112	128	134	145	160	213	197	162	156	143	136	130	121	117
North Dakota	97	100	103	103	112	118	124	130	145	141	136	128	114	109	105	100	99
Nebraska	98	100	102	101	104	110	127	145	179	166	144	139	128	123	123	119	117
Kansas	101	99	99	103	109	115	122	132	151	149	130	127	118	115	113	113	113
Montana	97	100	103	100	94	100	106	114	126	105	96	87	81	75	72	70	71
South Carolina	101	98	101	94	98	107	122	162	230	186	126	128	136	138	128	113	110
Georgia	98	101	101	94	105	116	131	172	217	172	136	125	123	116	112	104	102
Mississippi	97	102	102	97	111	121	131	155	218	150	148	143	134	136	134	126	123
Kentucky	97	100	103	100	111	127	146	170	200	172	151	147	141	140	139	134	130
Oklahoma	98	101	101	95	104	114	130	140	166	160	139	133	125	131	130	128	127
Texas	95	100	105	103	103	115	133	141	174	156	133	128	137	146	146	141	139
California	93	99	108	111	116	130	136	142	167	168	166	165	164	164	163	162	161

[a] "The Farm Real Estate Situation, 1927–28," United States Department of Agriculture, *Circular*, No. 60.

heavy power machinery have made profitable the utilization of low-grade ores, so the development of scientific and machine agriculture have brought into cultivation considerable areas of formerly submarginal land, and have indeed put a premium upon extensive methods of utilizing lighter soils, the remoter agricultural areas, and regions of scanty rainfall. Profits are being found by going rapidly over large areas of comparatively low-yield land, and the scarcity value of lands in the older sections has quite possibly lessened as a result. Their differential superiority has shrunk under the new technique, and market values must ultimately establish themselves in the light of this fact.

One other factor which tends to affect land values very widely is the heavier burden which taxation now bears upon farming land. Costs of government have risen not only with the advance of the general price level, but in response to the enlarged activities in road building or the amplification of services in the way of education or otherwise. With the continued reliance upon the general property tax, these burdens tend to fall heavily on agriculture.

> The farmer's property is of a sort that is readily discoverable by the assessor and that bears a heavier proportional share of the general property tax than do many other classes of property. In some sections of the country, an almost intolerable tax burden rests on the farmer. Figures recently compiled for a number of rented farms in several Michigan counties show that for the last seven years taxes have taken about 90 per cent of what otherwise would have been the net return to the owners of these farms. It is believed that this is an exceptionally bad condition, but other studies in various sections indicate that in recent years a tax burden which takes from one-third to two-thirds of the return is by no means unusual.[28]

As long as this situation continues, it tends to hold down the net income from land, and hence the sum at which it is capitalized as a purchase price.

XIII. THE COMPARATIVE IMMOBILITY OF AGRICULTURE

With the basic problem of agriculture to-day one of drastic adjustment to a new technique and an altered commercial situation, one must be impressed with the fact that these sweeping adjustments are rendered difficult by reason of the immobility which, to a large degree, always has characterized the farmer's calling. There are several reasons why this immobility may be expected to continue.

In the first place, farmers to a much greater extent than mechanics, clerks, or other wage and salaried workers have their property, whether large or small, invested in the business in which they are working. They practically always must be owners of equipment, and almost universally desire to hold an equity in the plant with which they work. Since such

[28] United States Department of Agriculture, *Yearbook*, 1926, p. 698.

investments can be liquidated only slowly, or at heavy sacrifice, the farmer is peculiarly tied to his job as well as to his locality.

Furthermore, his technical training and experience have always been wrapped up in a particular type of farming to an extraordinarily high degree. The carpenter, machinist, salesman, or low-skilled factory worker can move from one line of city employment to another with much less struggle of readjustment than farmers as a class can switch from one branch of farming to another or from farming to town employment. Agriculture is to many of its followers a whole scheme of life and not a business in the ordinary commercial sense. A not inconsiderable number of farmers are concerned with the primary job of producing subsistence for themselves and their families. Such operators continue to farm whether prices be good or bad, and their operations tend to yield persistent but rather unpredictable surpluses of product which are marketed in competition with the products of those who are attempting to organize their operations on the basis of reasonable returns to labor, management, and invested capital. Any attempt to make significant readjustments in such lines of agricultural production encounters sufficient difficulty before it can get a rationalization of operations on the part of commercial producers, but even their efforts may be checkmated by the uncontrollable fringe of operators whose activities cannot be brought within any such scheme of organization. The very success of the better grade of producers to adjust on the basis of prices which will yield a reasonable return to that class of operators tends to peg prices at a level sufficiently satisfactory to attract still more of the cutthroat competition of the squatter type of farmer.

In the second place, the fact that actual direction of agricultural enterprise is determined by the decision of a number of operators, which embraces about 60 per cent of the total number of workers in the industry and whose capital resources are rather rigidly limited, means that neither the decision nor the means of making changes rapidly may be expected. If it had been left to a majority vote of the craftsmen in any industrial line to decide when they would abandon the tools or the character of product which they had been accustomed to make in favor of the manufactured products and the tools and machines by which they are made to-day, is it reasonable to expect that changes would have been made with any such celerity as has been the case under the capitalistic and managerial system which we have in industry?

To-day we are recognizing that "agriculture must be organized as other industries have been," but, beyond this platitude, thought divides sharply as to the direction this process of organization should or can take. Shall we strive for a maximum of efficiency under a system of decentralization and individual autonomy, or shall we direct our energies toward seeing how fully and skillfully efficiency through centralization

may be brought to the solution of certain of our agricultural difficulties? Already an enormous number of tasks, which originally were classed as part of agriculture, are performed in town under industrial methods. The passing of milling, butchering, and churning from the farm to the city was long ago effected. The coming of the combine and the truck are now raising the question whether any storage and processing received by the grain between harvest and ultimate use can be done economically and effectively on the farm, or whether cleaning, drying, and storing shall be centralized at the terminal markets and milling centers. The supplanting of horse power by internal combustion engines has been a striking transfer from country to town of an important process in the task of getting our living from nature.

The struggle of the older farm management was toward filling up the valleys between seedtime and harvest peaks of the labor load. It seems quite conceivable that the newer agriculture will tend to maintain a skeleton force on the land, and transfer labor from town to country to meet seasonal requirements. Since the farmer more and more tends to require labor skillful in the handling of machinery or capable of performing manual tasks of the most routine character rather than to require those trained in the ancient lore of farming, the easier way seems the shift of tractor men and practically unskilled harvest hands into the country during short periods of special need, with the same groups productively fitted into industrial callings of the town during agriculture's slack season.

All in all, it seems that the hard and fast line between agriculture and other industries, and between rural and urban residence, will tend to disappear with the program of changes now under way in agriculture. A tendency is noticeable among some manufacturers to get their plants distributed in towns and villages adjacent to agricultural land, where their food requirements can be more cheaply met, where living quarters are better and lower priced, and where the factory can draw upon the rural population for part of its labor requirements. The truck and automobile make it possible for industry thus to supply its needs, and at the same time afford an opportunity for a considerable number of both men and women to make profitable use of the time which can be spared from farm work under modern methods of production. It is impossible to show this approach of manufacturing toward the agricultural regions by statistical methods with as much clearness as would be desired. But it is apparent from the census of manufactures over the last few years that a drift away from the highly industrialized centers in the Northeast and toward the smaller towns and villages in the central, southern, and western states has been under way. In Table 9 there is shown a marked decline in manufacturing in the larger cities and in states which we have been accustomed to class as industrial, with a

clearly discernible growth of manufacturing in what have been regarded as agricultural states and in towns of less than 25,000 population.

TABLE 9.—PER CENT OF INCREASE AND DECREASE IN MANUFACTURING, IN SPECIFIED STATES, 1919–1925

Size group	New England States		Middle Atlantic States		Indiana	
	Number of establishments	Number of wage earners	Number of establishments	Number of wage earners	Number of establishments	Number of wage earners
Total	−11.7	−16.7	−17.5	−13.0	−19.9	+ 1.7
Over 250,000	− 3.3	−12.6	−16.6	−15.5	−10.7	−16.3
250,000–100,000	−10.7	−20.0	− 5.4	−16.8	.....	.....
100,000–25,000	− 5.4	−18.2	−14.7	−13.6	−15.6	+ 5.0
25,000–10,000	− 7.4	−15.1	−19.3	− 7.6	−10.6	− 6.7
Less than 10,000	−22.6	−14.8	−23.5	− 9.2	−27.2	+15.0

Size group	Michigan		North Carolina		South Carolina	
	Number of establishments	Number of wage earners	Number of establishments	Number of wage earners	Number of establishments	Number of wage earners
Total	−17.6	+ 9.6	−40.5	+17.1	−21.0	+27.2
Over 250,000	−16.9	+ 3.5	.....	.....	.....	.....
250,000–100,000	− 5.0	+ 8.5	.....	.....	.....	.....
100,000–25,000	− 9.4	− 0.2	− 1.8	+ 1.1	−34.7	−20.6
25,000–10,000	−11.1	−15.5	−10.7	+46.0	−24.0	+ 1.2
Less than 10,000	−24.5	+44.0	−47.2	+ 7.5	−17.7	+37.0

In this connection, it may be mentioned that the washing machine and numerous other farm appliances, together with the use of more store products in the country home, tend to release the labor of women in a way somewhat comparable to that which we have discussed with reference to the labor of men. Furthermore, paved roads tend to enable city population to move farther away from their places of employment, and to cause the main roads connecting cities and larger towns in our industrial districts to become practically continuous residence streets, lined with dwellings to which are attached small plots of ground from one-quarter of an acre to 5, 10, or even 20 acres in extent. It seems reasonable to suppose that, at least in important agricultural states from Ohio to Iowa, and including southern Michigan, Wisconsin, and Minnesota, this process may result in rather considerable diminution of population in the open country without any undesirable sacrifice in the quantity of the product, but with a very satisfactory lowering of production costs and more effective utilization of our total labor power.

In certain geographic regions and in various branches of agricultural production, there has been a quiet and very gradual increase in the number of large farming operations. In conformity with general business practice, such undertakings, if they pass the size compatible with individual proprietorship, tend to be organized as commercial corporations. This has aroused in some quarters unreasonable expectations, and in others unwarranted fears, of a rapid spread of corporation farming. It is much too early to attempt to prove conclusively just what this movement may amount to. Likewise, the space limitations of the present volume do not permit any extended analysis of what the author believes to be its possibilities and limitations. It is a matter of common knowledge, however, that corporate farming enterprises have demonstrated their ability to organize farming undertakings of moderately large size with efficiency and economy, and it would hardly be conceivable that agriculture, even with its peculiar needs, could completely escape the consolidation tendency of the age. Obviously, the technique of corporate organization and management must undergo considerable adaptation, if it is to spread in the field of agriculture. It would seem imperative also that, for its economic success as well as its social value, great attention must be given at each step of its development to seeing that conditions of domestic living, hours of labor, wages, opportunity for advancement, and conditions of community life be better rather than worse than those obtaining prior to the coming of the agricultural corporation. So much progress has been made along these lines in other fields of corporate endeavor that there would seem no real reason why, with alterations to conform to the somewhat different situation, these lessons should not be effectively put in practice in agriculture.

Even at its best, however, any trend toward the industrialization of agriculture is regarded in some quarters as a social loss and political danger, because of the decay of that "sturdy yeomanry" which is held to be the "last bulwark of true democracy." It is asserted also that such a transition would bring a larger proportion of our population into living conditions unsatisfactory from the standpoint of health as well as morals. But does not this rather sentimental reaction to the problem tend to idealize the best of country living conditions and to forget its flagrant shortcomings; to emphasize the city's evil repute in the matter of slum and sweatshop, without giving full weight to the achievements and potentialities of modern city efforts for better housing, health, entertainment, and regulation of working conditions?

The farmer may come to take as militant a stand with reference to an "American standard of living" as the trade unionist has done, and possibly to invoke the machinery of Government regulation toward this end. In such a move, the binding power of his own individualistic traditions would doubtless prove a serious obstacle, if any importance

may be attached to his repudiation of the child-labor law and his reaction to daylight saving. However this may be, it seems to the present writer that the *rapprochement* of city and country, which appears to be under way in response to new conditions of auto transportation, and to the organization of both farm and factory work, holds the possibilities for improved conditions on both sides. How far we shall fight the tendency, or how far we shall studiously endeavor to facilitate its constructive development, remains to be seen.

We have already referred to the sentimental attachment of the farmer to the soil and his unwillingness to abandon a highly traditionalized training for types of city employment which are strange to his habits of thought and mode of life. Even under unsatisfactory conditions, a farmer is likely to feel that he is in a position at least to provide his living from the soil where he is already established, and to shrink from the drastic changes necessary in any throughgoing move toward readjustment. Somewhat anomalously, there is a radical or pioneering group still to be found, at least in the western part of rural America, which, after a certain amount of dissatisfaction, is ready to jump to distant pastures which look green, with only a shoestring on which to operate, and nothing much more than vague optimism as the basis of its hopes of prosperity. This ultra group, like the ultra conservatives, gives us marginal or submarginal areas always offering cutthroat competition to operators who are attempting to organize their industry on a more stable and rational basis.

XIV. THE MOVEMENT FROM THE FARM

The process of adjustment to changed conditions which has been going on since 1920 has stimulated the rate of movement from farms to cities. Of course, there is a certain amount of movement in this direction all the time, owing to the excess of the country birth rate over the death rate and the gradual urbanization of our country which has been under way for 150 years. During the World War and the two years immediately following it, this process was temporarily reversed, only to be resumed at an accelerated rate which even yet has slackened but little.

The most careful studies of the whole matter have been made by Dr. C. J. Galpin, of the United States Department of Agriculture,[29] and his conclusions are summarized as follows:

> During 1920 there was a net gain in total farm population of approximately 500,000 people . . . The unusual prosperity attending the farm occupation during 1920 apparently restrained considerably the customary flow to cities of young people between the ages of 18 and 24, while the annual movement of prosperous retiring farmers to town was offset by the arrival of persons from cities, drawn to farming by its prosperous condition. The excess of births over deaths on farms resulted in a natural increase.

[29] United States Department of Agriculture, *Yearbook*, 1926, p. 592; 1927, pp. 28–29.

The year 1921 saw the beginnings of an unusual movement from farms to cities. While many persons who were tempted to leave farming stayed on farms in the hope that soon the tide of prosperous times would turn and flow farmward, others who were close to the margin of livelihood were compelled to go where there was profitable employment. The result was that though there was a net increase of farm population, it was only 200,000 instead of 500,000 as during 1920. In 1922 the department survey indicated . . . a net loss in the farm population of 460,000 persons. In 1923 the loss to cities continued in full force, causing a net decline in the farm population equal to or possibly somewhat exceeding that of the previous year. In 1924 forces were at work sending back from cities to farms a larger number than formerly. The result was a net loss to the farm population of 182,000. For 1925 a continued decrease in farm population was reported to the effect that 479,000 fewer people were on farms January 1, 1926, than January 1, 1925.

The large gross movement from farms to cities apparently still overbalances the gross movement from cities to farms even when the increase on farms by births over deaths is added in. In the last seven years the farm population of the United States has probably declined more than 3 million . . . But the loss is in large measure a product of natural conditions, which do not necessarily indicate that agriculture is a declining business but which are quite compatible with its progress in prosperity . . . As a matter of fact, it is a sign of progress when a given economic result can be achieved with fewer workers.

In some quarters there has been considerable fear lest the better classes of the rural population would be driven from the farms by the recent unprosperous condition, leaving an inferior population to carry on the industry. Many strident assertions to this effect have been made, but no statistical proof has been forthcoming, nor would it be easy to adduce conclusive evidence either in support or in refutation. A few suggestive phases of the matter, however, are apparent to anyone who examines actual farming conditions at all widely.

In the South, it is quite evident that the pronounced loss of negro farmers has taken a relatively poor rather than a relatively good class of agricultural workers out of the industry. At the opposite end of the cotton belt, it is equally apparent that those who have entrenched their position in the reorganized cotton industry of the last few years are a hardy, resourceful white American stock whose pertinacity in continuing in the industry and whose ingenuity in devising ways of meeting a critical situation revive the finest tradition of the American pioneer. In between these extremes one may find, let us say in the Mississippi delta region, a splendid group of business men continuing to operate their properties and holding to their position as successful cotton planters by adopting machine methods, dispensing with superfluous hand labor, and organizing their selling through an extremely well-managed co-operative association.

Certainly those who have remained in the business of growing wheat and are fighting their way back to prosperity are the men who have shown ability to handle larger farms, reduce costs, and put their finances on a stable basis. In the general farming region of the Mississippi Valley the phrase is frequently heard, "You've got to be a pretty good farmer to

stay in the game these days." But the good farmers of that section are staying in the business, are working with extension and experiment station specialists to keep financial records, analyzing their business with growing skill and understanding, and adjusting farm enterprises and operating methods in a manner calculated to win the highest respect.

It is obviously true that the man of highest qualifications for agriculture is likely to be a man whose opportunities for profitable employment elsewhere are likewise good, and that in the considerable reduction of the labor force in agriculture many instances will be found where the better-than-average farm operator is drawn away to some other calling. However, the writer could not look farmers, as he knows them in all parts of the country, straight in the face and give assent for a moment to the oft-reiterated statement that the quality of our farmer class generally is being lowered or that they are becoming peasants. Those who subscribe to such an idea must have known only particular groups in certain of the by-waters of agriculture where the industry as a whole was going distinctly backward. There are such spots, but a true appraisal must take into account the main body of the industry where it is effecting necessary adjustments, and also the inspiring frontier where expansion is taking place, not merely those spots where the process of adjustment is inevitably downward.

XV. THE EXPANSION OF NEW USES FOR AGRICULTURAL PRODUCTS

With the unsatisfactory prices which have followed the break of 1920, the suggestion has come forward from many sources that the farmer's difficulty is, in general, that he has been producing merely to fill the human stomach or to cover human backs—a highly inelastic market demand as compared with the expansible field of culture wants to which manufacturing industry so largely caters. We have already shown in this chapter that food and clothing wants, so far as they express themselves in a demand for agricultural products, have tended during the last few years to shrink rather than to expand. Industrial chemistry has been a potent factor in substituting raw materials of nonagricultural origin for those which were formerly produced on the farm. Indeed, the chemist is regarded not a little in the light of a wonder worker in the present age, and he is still looked to as the magician whose wand may yet open a new, expanding, and profitable outlet for farm products in other than food and clothing uses.

It has been suggested, for example, that the rapid rate of consumption of print paper might so outrun the rate of forest growth as to create a demand for paper-making materials from fibrous plants now produced or which might easily be produced on farms. Experiments along this line have met with reasonable success, and it has been demonstrated on a small commercial scale that excellent paper and insulating material may

be made from cornstalks, and quite striking success has been made in the utilization of bagasse, or sugar cane fiber from which the juice has been extracted. This takes the form of a lumber substitute of exceptional insulating qualities and great tensile strength. As a nonconductor of both sound and heat, it is finding a rapidly expanding market in connection with the growth of the radio and artificial refrigeration. It is argued that its general introduction for use as a building material would lighten in a substantial way the burden on our coal resources, and might pave the way for practicable cooling, during the warm season, of even private residences over the southern half of the United States and in tropical or subtropical countries elsewhere.

Waterproof glue is now made from both casein and soy bean cake, and the growth of the ply-wood industry and veneering have opened an encouraging market for these products. The automobile created a rapidly expanding new demand for linseed oil, but our tariff situation is such that about half the product used in this country is imported. Likewise, the ingenuity of the industrial chemist has developed paint formulas which introduce many substitutes for linseed oil, and a similar result has followed in the case of artificial leather, rayon, and numerous other products. The chairman of the division of chemistry of the National Research Council says:[30]

> The increased use of pulp from wood of almost the same cellulose content as cotton will make itself felt all the more seriously during the coming year. We may estimate that in 1927, for example, the equivalent of possibly a million bales of cotton will have been replaced in our American markets by the cheaper cellulose from spruce. Evidently the cotton crisis is yet before us . . . Up to the present the home use of cotton has been dropping, but its somewhat increased industrial use maintains the per capita consumption of cotton at about normal. New uses of cotton must be developed if we are successfully to counter the sudden and unexpected rise in the use of silk and the new form of artificial leather. In this respect the cotton planter dare not run ahead of the wheels of progress. He must abide that time when the demand for cotton asserts itself. This may or may not develop soon.

The harassed corn grower has looked with longing toward any one of half a dozen by-product uses. Technically a number of roads lie open, but commercially they lead nowhere, or come to an abrupt end after a very short distance. The chemist just quoted refers to these varied possibilities of the corn plant in the following words:

> The growing of corn for the kernel, whereby only about one-fifth of the total weight of the corn and stalk in the field is utilized, smacks of mediaevalism . . . The greater portion of both corn and stalk must be diverted to industrial use before we can consider this staple as secure for the future.
>
> The real future for the corn kernel itself lies in its adaptation, on the one hand, for the manufacture of starch and dextrose (corn sugar) together with corn oil and other

[30] *The Tariff Review*, May, 1927, p. 155.

by-products; and on the other hand, after degerminating, for direct fermentation into alcoholic compounds; the germ in this case also finding employment in production of corn oil. The residual material will be returned to the farmer as food for livestock.

The use of corn sugar, sometimes termed dextrose, glucose, or bearing the trade name of cerelose, is rapidly increasing. Over 300,000 pounds of this pure sugar is being manufactured daily in this country. Most of it finds use in bread and candies. In 1926, the corn products industry consumed only 76,000,000 bushels of corn, representing, however, an increase of 10 per cent over the year 1925. Our total corn crop averages 2,714,000,000 bushels annually; but only about 260,000,000 bushels reach the primary markets. Of this latter only 28 per cent enters the corn products industry.

With the coming into prominence of industrial alcohol, much hope was entertained by the corn farmers and also by potato and fruit growers that this might provide a profitable outlet for surplus and low-grade products. Such hopes have by no means been fully realized, largely owing to the low cost at which blackstrap molasses, a residue from the sugar mills of Cuba, can be imported for purposes of distillation. This provides a concentrated product of uniform quality from a single large and reliable source, whereas the waste and surplus products of this country which seek to compete for this market are of rather dilute character, uneven quality, and are widely scattered in such small quantities as to require undue costs of gathering and transportation, and to be processed in plants so small as not to compete effectively with the enormous tidewater plants now engaged in the business.

This, in fact, is one of the most serious problems in connection with the whole problem of by-product utilization. To gather straw or cornstalks from the field, bale them, and transport them to a plant for making strawboard, insulating material, or similar products, involves a cost generally disproportionate to their value in competition with other raw materials already available in great quantity. This type of problem has been solved in certain instances, notably the sugar cane bagasse already mentioned, and experimental work is being done in the corn belt with a fair measure of success.

The department of chemical engineering of the Iowa State College of Agriculture is operating a good-sized laboratory for experimental work on the industrial uses of cornstalks and cobs, and the agricultural engineering department of the same institution is working industriously on the problem of economical harvesting, baling, and delivery to the commercial user. In that state, and also in Illinois, commercial plants for the making of cornstalk paper, insulation, and other products, are in operation. The manager of one of these plants reports[31] progress as follows:

> We have proved on a commercial scale that the process used by this company can produce from cornstalks all the pulp required for paper consumed in the Middle West. We have demonstrated that this new industry, now in its infancy, can in time become a source of sound economic relief to a large part of the corn-growing area . . .

[31] Frank K. Gardner, "Paper from Cornstalks," *American Farming*, July, 1928.

Our first output is going into high-grade paper. A little later the company will be equipped to supply part of the requirements of the chemical cellulose industries—the raw material for manufacture of rayon or artificial silk, celluloid, motion picture and photographic film, lacquer, artificial leather, etc. This is a limited but rapidly expanding market . . .

Our first season's operations have taught us much concerning corn stalks as industrial raw material. We were told they could not be assembled at a price to compete with wood as raw material for pulp. We have proved, by gathering 10,000 tons of stalks, that it can be done . . .

The farmer will receive for his stalks all they are worth as fertilizer and a reasonable amount for his profit, besides a fair wage for his labor in harvesting them. What cornstalks are actually worth has become a much-debated question since science and industry discovered for the farmer a better outlet than burning cornstalks or turning them under for their doubtful soil-building value.

In the case of corncobs, oat hulls, and other milling by-products, the matter is somewhat simplified by the fact that such products accumulate in large quantities as a mill waste, and special appliances have been developed for burning them. Frequently, even in such cases, however, where the raw material cost is low and the process of reclamation is commercially feasible, the market for the product is so limited as to afford little relief to the farm producer. Furfural is readily produced from either oat hulls or corncobs, but "at the present time a few pounds of xylose, the parent substance of furfural, will satisfy the entire annual needs of the United States and, while the market for its derivative furfural is much wider, the present total demands of the entire world are not sufficient to make a dent in the available supplies of raw materials."[32] On this same point, the view expressed by experimental workers in Iowa stresses in somewhat more optimistic vein the future possibilities of expanding demand. They say[33] that furfural bids fair to become an important commercial chemical, and that quantity production and efficient by-product recovery will lower the price much below the cost estimates given by the various workers in the field.

Summarizing the situation, the chief of the bureau of chemistry of the United States Department of Agriculture says: "Many of the plans advocated to-day for the use of agricultural surpluses and residues are simply revivals of former agitations, dressed perhaps in new clothes, which often tend to hide the economic facts which must be recognized and be favorable if the industry is to survive."[34]

One of the outstanding cases in which the market demand has been sufficient in proportion to the more restricted volume of raw material

[32] Henry G. Knight, "A Survey of the Industrial Utilization of Farm Products for Other Uses Than Food and Clothing," a paper delivered before the Institute of Chemistry at Northwestern University, July 22, 1928.

[33] O. R. Sweeney, "The Commercial Utilization of Corncobs," Iowa Engineering Experiment Station, *Bulletin*, No. 73, pp. 41–42.

[34] Henry G. Knight, in the paper cited above.

to be turned to by-product use is that of the citrus industry. The California Fruit Growers' Exchange has developed very successful salvage plants for off-grade and surplus fruits. They yield a variety of products, including lemon and orange oil, concentrated juice, citric acid, pectin, and a residue fertilizer, and yield returns to the grower at rates of $10, $12, or occasionally even more per ton.

Undoubtedly the labor of the chemist, subsidized to some extent by both Federal and state funds, will produce further results in this line. But it is obvious that as an adequate program of immediate agricultural relief it cannot be much relied upon.

XVI. THE OUTLOOK FOR AGRICULTURE

With these several lines of analysis before us, a few words may perhaps be hazarded as to their significance for the general situation of agriculture to-day and to-morrow. What may the rest of the country expect from its agricultural group, and what may farmers expect for themselves?

We are told that agriculture is the paramount national problem, and that a fundamental remedy must shortly be forthcoming or the collapse of this industry will involve the whole nation in economic disaster. Mark Twain observed that everybody was always talking about the weather but that no one ever seemed to do anything about it. Agriculture threatens to rival the weather as a perennial topic of dolorous conversation. Obviously, farmers have suffered severely in the years since 1920 and are still finding recovery slow and rather unsatisfactory. The process of readjustment is too fundamental and far-reaching to be accomplished in any short period of time. Furthermore, we must not forget that the so-called depression of agriculture is not merely a phenomenon of the United States, but is an international problem, and many another country is as sorely perplexed as ours.

However great our sympathy with either the individual or the group during this trying period, it must be recognized that after ten years we can hardly think of the situation as an "emergency," but must address ourselves rather to the question of what sort of permanent organization of agriculture the nation demands and should expect in the modern economic age. What is actually happening is the slow adjustment of our farming to drastically changed conditions, a process in which the efficiency of agriculture bids fair to be sharply advanced, and the prosperity of those who can measure up to the larger needs of this new technique should be proportionately raised. The better farmers, who have adopted the modern methods, are in a large number of cases already enjoying this prosperity. For those, however, who are less adaptable to the new situation and in excess of numerical requirements, there is the serious problem of writing off their losses, effecting a shift in residence, and fitting into new lines of employment. Both public and private

interest should be taken in studying this problem and assisting the necessary movement and relocation.

Meanwhile, however, the country as a whole has been profiting by prices of farm products which were too low to remunerate the producer adequately, and, if the views expressed above are sound, it bids fair to continue to enjoy relatively low prices for farm products produced from rich natural resources by a skillful, well-equipped, and constantly better-organized farming class.

XVII. SUMMARY

While no single measure of the present depression in agriculture is possible, some idea is conveyed by the ratio of prices received to prices paid by farmers, as prepared by the Bureau of Agricultural Economics of the United States Department of Agriculture. With the average index number of the years 1910 to 1914 taken as 100, this index of rural prosperity rose to 118 in 1917, from which peak it dropped to 75 in 1921. Recovering from that point to 92 in 1925, it dropped to 87 in 1926 and 85 in 1927. Of course there is great diversity between commodity and commodity and section and section, but certain major influences may be discerned as being responsible for the rather generally unsatisfactory economic position of our farmers. These are: (1) Disruptions of demand through the impairment of foreign purchasing power, the competition of rival producing countries, and, in the domestic market, changes in consumers' habits and industrial processes and substitution of the gasoline engine for horse power; (2) the disproportionate rate of supply in many lines of agriculture owing to war stimulation, increased technical mechanical efficiency, and the unregulated exploitation of land resources; (3) expense factors, such as freight and wages, which keep distribution costs high in spite of the decline in farm prices.

Possibly the most outstanding factor in the whole situation is the rapid advance in power farming during and since the end of the World War. To some extent the use of larger machinery and the development of labor-saving methods has come through the introduction of "big-team hitches," but to a more striking extent this has been an accompaniment of the rapid increase in the number of tractors. In the decade since the war, the number of horses and mules has dropped from 26.4 millions to 19.5, and tractors have risen from 80,000 to 853,000. This change has been particularly pronounced in the western end of the cotton belt and in the Great Plains wheat-producing areas, but it calls for a sweeping recasting in the economic as well as technological organization of American farming. It permits enormous economies in the production of staple agricultural products, but its effective utilization demands larger operating units and a more specialized type of economic organization; it permits also of a considerable release of man power.

Naturally, in an industry with as slow a turnover as agriculture, it has been difficult to effect these changes with sufficient rapidity to avoid distress. Business reorganization on sound lines has made substantial progress, and this seems now to be accelerating in its rate. A considerable shift of population from sections where it had become redundant has also been effected. Neither process is complete, and it has not been possible to make these changes without acute distress in individual instances and widespread and severe depression in regions scattered practically over the whole country.

Inevitably the impairment of current income has been reflected both in the ability of the farmer to meet his operating charges and living costs and of the farm to meet capital charges. This has resulted in an unprecedented rate of farm bankruptcies and financial embarrassments which have involved a large number of banks in difficulties. It has also rocked the foundations of the farm land market, and has entangled mortgagees, insurance companies, and land banks, both Federal and joint stock, in a baffling problem of revising the structure of farm land values in accordance with the changed and still changing conditions of agricultural production.

In spite of faith in the ability of our farmers eventually to work themselves out of this situation, the prospect of swift or comprehensive relief of the situation does not seem bright. Individuals are showing their ability to make profits, and some localities are conspicuously prosperous. But there does not seem to be in prospect any such sweeping rise of prices or decline of production costs as will take care of the badly-located or less efficient producer or of the section which finds itself maladjusted to the present trend of economic developments. Basic difficulties have not yet been removed, whereas new complications are continually being thrust into the situation.

Considerable helpful legislation has already been enacted, and in only minor details can the program of legislative help be looked to for further assistance. On the other hand, an aggressive and sympathetic, but at the same time conservative and intelligent, administrative attitude within the limits of existing legislation would go far toward facilitating the continued process of readjustment. Meanwhile, a continuation and improvement of the extensive educational attack upon the problem, already highly developed by Federal, state, and private agencies, will be productive of important results. Farmers themselves will continue to give a good account of themselves in working out their individual problems within the possibilities, helpful or harmful, which are supplied by the general institutional setting.

The country as a whole has been profiting by prices of farm products too low to remunerate the producer adequately. How long this differential in favor of the nonagricultural classes will continue, it is impossible

to say. Obviously, the depression of the country has not paralyzed the town. On the other hand, abundant and low-priced food and raw materials of agricultural origin have had a stimulative effect. Inasmuch as the progress made since 1919 gives promise for the future of even greater efficiency and lower costs in agriculture,[35] accompanied by better economic organization and rising prosperity in the country, it would seem that the long-run prospect for the nation as a whole is distinctly favorable.

[35] The Secretary of Agriculture, in his annual report for 1927 (United States Department of Agriculture, *Yearbook*, 1927, p. 8), discusses the manner in which "the agricultural industry as a whole has been better adapted to market conditions," and sees in this "an augury of its future prosperity." The report also summarizes the factors which have contributed to the increased productivity of American farming.

"Technical progress in American agriculture has taken place at an extraordinary rate since the close of the World War, and in consequence the productivity of the individual farmer has increased . . . More productive crops have been planted. Livestock of increased productivity has become widely dispersed. Farm management has become more efficient, a better balance has been established among agricultural enterprises, and progress has been made in adjusting production to market requirements. The result is an increase in farm production more rapid than the rise in the country's population.

"This augmented production has been obtained on a decreased crop acreage and with fewer farm workers . . . From 1919 to 1924 there was a decrease of 13 million acres in crop land in the United States—the first decrease ever shown by census statistics in the agricultural area of the nation. There occurred at the same time a decrease in the number of farm animals, a decrease in the number of farms, and a decrease of farm population. Under such circumstances, one would hardly expect an increase in the volume of farm production. Yet an increase took place, and a very substantial one. It is estimated that crop production in the period 1922–1926 was nearly 5 per cent greater than in the period 1917–1921, although the aggregate acreage in crops decreased slightly. Likewise, the output of animal products is estimated to have increased fully 15 per cent. The increased productivity of the farm worker is estimated at about 15 per cent. This increase in labor efficiency, probably never before equalled, is attributable in part to the utilization of more productive livestock and crops, in part to the increased use of machinery and power on the farm."