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BUREAU OF RAILWAY ECONOMICS

Established by Railways of the United States
for the Scientific Study of Transportation Problems

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BULLETINS OF THE
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1. Summary of Revenues and Expenses of Steam Roads in the United States for July, 1910. (Monthly Report Series, Bulletin No. 1.)
2. Summary of Revenues and Expenses of Steam Roads in the United States for August, 1910. (Monthly Report Series, Bulletin No. 2.)
3. Summary of Revenues and Expenses of Steam Roads in the United States for September, 1910. (Monthly Report Series, Bulletin No. 3.)
4. A Comparative Statement of Physical Valuation and Capitalization.
5. Preliminary Bulletin for November, 1910—Revenues and Expenses.
6. Railway Traffic Statistics, 1900-1909. (See No. 31.)
7. Summary of Revenues and Expenses of Steam Roads in the United States for October, 1910. (Monthly Report Series, Bulletin No. 4.)
8. Summary of Revenues and Expenses of Steam Roads in the United States for November, 1910. (Monthly Report Series, Bulletin No. 5.)
9. Summary of Revenues and Expenses of Steam Roads in the United States for December, 1910. (Monthly Report Series, Bulletin No. 6.)
10. Summary of Revenues and Expenses of Steam Roads in the United States for January, 1911.
11. (Out of Print.)
12. Summary of Revenues and Expenses of Steam Roads in the United States for February, 1911.
13. Summary of Revenues and Expenses of Steam Roads in the United States for March, 1911.
14. Summary of Revenues and Expenses of Steam Roads in the United States for April, 1911.
15. The Conflict Between Federal and State Regulation of the Railways.
16. Summary of Revenues and Expenses of Steam Roads in the United States for May, 1911.
17. (Out of Print.)
18. Capitalization and Dividends of the Railways of Texas, Year Ending June 30, 1909.
19. Summary of Revenues and Expenses of Steam Roads in the United States for June, 1911.
20. Summary of Revenues and Expenses of Steam Roads in the United States for July, 1911.
21. The Cost of Transportation on the Erie Canal and by Rail.
22. Summary of Revenues and Expenses of Steam Roads in the United States for August, 1911.
23. Analysis of the Accident Statistics of the Interstate Commerce Commission for the Year Ending June 30, 1911.
24. Comparative Railway Statistics of the United States, the United Kingdom, France, and Germany.
25. Summary of Revenues and Expenses of Steam Roads in the United States for September, 1911.

Railways and Agriculture
1900-1910

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In the preparation of this bulletin use has been made of the latest available official statistics. It is impossible to make comparisons at this time to cover years subsequent to those indicated.

SUMMARY

During the last Census decade the miles of main track of the railways increased at nearly double the rate of increase in improved farm land, and at three times the rate of increase in the area devoted to crops.

Measured in the aggregate, the output of the railways—ton-miles and passenger-miles—increased 80 per cent and 102 per cent respectively, while the output of the ten principal crops averaged an increase of about 9 per cent.

While the railway output per mile increased 40 per cent and 56 per cent respectively, the output per acre of the ten principal crops averaged a decrease of about 1 per cent.

Measured per one thousand inhabitants, the output and the revenue of the railways—that is, the work performed and money received—increased at very nearly the same ratio. The output of five of the ten principal crops, however, measured per one thousand inhabitants, decreased from 5 to 21 per cent, while the farm value increased from 37 to 80 per cent. The output of the remaining five crops increased, in the same relation, from one-half of 1 per cent to 20 per cent, while the farm value increased from 34 to 83 per cent.

The increase in the farm value of the crops was at a greater ratio than the increase in the prices of the staple commodities. For example, one thousand bushels of corn in 1910 would purchase greater quantities of all commodities by 52.4 per cent than would one thousand bushels of corn in 1900, one thousand bushels of wheat greater quantities by 43.8 per cent, and one thousand bales of cotton greater quantities by 63.4 per cent. One thousand bushels of corn would purchase in 1910 75.7 per cent more ton-miles and 87.6 per cent more passenger-miles than would one thousand bushels in 1900; one thousand bushels of wheat 65.8 per cent more ton-miles and 77.1 per cent more passenger-miles; one thousand bales of cotton 88.4 per cent more ton-miles and 101.1 per cent more passenger-miles.

Conversely the purchasing power of the receipts from one thousand ton-miles in 1910 of all commodities was 13.3 per cent less than that of one thousand ton-miles in 1900, and the purchasing power of one thousand passenger-miles was 18.8 per cent less.

RAILWAYS AND AGRICULTURE.

1900-1910.

INTRODUCTION.

Bulletin No. 39 of the Bureau of Railway Economics, entitled "Comparison of Capital Values—Agriculture, Manufactures and the Railways," makes certain comparisons that are concerned mainly with the capital value of these three major industries of the United States, and the return on capital in the case of the manufacturing industry and the railways. The statistics of the Interstate Commerce Commission and the Bureau of the Census permit of a serviceable comparison of the return on railway capital and manufacturing capital, but there are not available data which would permit a similar comparison with the return on capital in agriculture.

Official statistics do, however, record the output of the principal agricultural crops, so that the output can be computed per acre. This is the unit of area by which land is measured, and in connection with the unit of output constitutes the basic unit for statistics of the productivity of agriculture, that is, bushels per acre, bales per acre, etc.

In the case of the railways, a mile of main line track may be taken as the unit of operation and together with a unit of traffic as constituting a basic unit for statistics of the density of railway traffic. That is, as one ton carried one mile, *i. e.*, a ton-mile, is a traffic unit, and one passenger carried one mile, *i. e.*, a passenger-mile, is also a traffic unit, the railway output may be measured by ton-miles per mile of main track, and by passenger-miles per mile of main track.

The available official data permit the relation of the total agricultural output of the country to the total acreage; that is, the land under cultivation may be taken as one large farm. This for the purposes of the present comparison may be considered the agricultural plant.

The available official data also permit the relation of the total ton-miles and the total passenger-miles to the total main track of

the railways; that is, the railways of the country may be taken as one large system. The total main track for the purposes of the present comparison may be considered the railway plant.

It is different with the manufacturing industry. Because of the great diversity in the nature and size of manufacturing plants, the kind of power used by them, and especially because of the infinite variety of the products, some of which are measured by the yard, some by the pound or ton, and some by the dozen, and because of other complications, it is impossible to relate the entire manufacturing output to the entire manufacturing plant, except in terms of value. This is done in Bulletin No. 39.

The present study is a comparison of the increases in the plant and output of agriculture with the increases in the plant and the output of the railways. Bushels and bales are so different from ton-miles and passenger-miles that there cannot be any direct comparison between them, but it is fair to compare in a general way the respective ratios of increase. That is, if during an extended period the ton-miles and the passenger-miles per mile of main track have increased at a substantially greater ratio than have the bushels per acre or the bales per acre of a particular crop, it is fair to say that the railways have made greater progress in efficiency than has agriculture as measured by that particular crop. In this way, by considering the ratios of increase in the production per acre of the various crops, a rough but significant and serviceable comparison of their relative productivity can be made between agriculture and the railways. Then, again, it is perhaps true that an acre of even the most fertile soil does not have an elasticity of production comparable with the range of traffic that can be moved over a mile of railway. The practice of European agriculture, however, demonstrates a vastly greater productivity per acre than has been obtained in the United States. Therefore the present comparison of the increase in productivity is well within the limits of practicable achievement.^a

^a Light is thrown on the possibilities of intensive agriculture by the records of corn production per acre made by farmers of the United States under the auspices of the Bureau of Plant Industry of the Department of Agriculture. In a number of instances over 200 bushels of corn have been raised on a single acre of land, the record for the season of 1912 being 207 bushels. Per-acre yields of from 175 to 200 bushels are not uncommon. These records may be contrasted with the average corn crop of the United States per acre in 1910 of about 26 bushels. Over a century ago one Paul Hathaway raised 124.5 bushels of corn on a single acre of land in southern Massachusetts.

Within certain limitations increased productivity means increased efficiency. Greater production per unit of plant, other things equal, means greater serviceability to the users and consumers of the product. There are radical differences between industries however, in the extent to which the application of human effort and of machinery and appliances increases efficiency in this sense. Before proceeding to the comparison of the relative productivity of the railway and the agricultural industries, attention should be directed to differences in addition to those already pointed out.

In the railway industry so large an initial investment in fixed plant is required in order to operate at all, that for a considerable time after being opened for traffic the plant is likely not to be fully utilized, and hence additional applications of labor and equipment are rewarded by a more than proportionate increase in output. In other words, efficiency tends steadily to increase up to the time that the plant is completely utilized. No such large initial investment is required in agriculture, and the point is more quickly reached where there is even a less than proportionate reward for each new application of capital and labor. That the point of diminishing return has been reached in the case of many railways is undoubtedly true.

It is frequently asserted that the farmer suffers from the disadvantage that the quantity of land is fixed, and that he cannot increase it at will. This impression, only in part true, probably arises from the fact that the governmental policy of free land is practically at an end, and that if the farmer wants more land, he must, as does the railway when it extends its lines, invest more capital. There is still opportunity open to the farmer to extend his productive area.

But efforts to develop efficiency meet hampering restrictions not alone in agriculture. Agriculture is not subject to such public regulation as the railways, and in the railway field much in the way of unproductive or relatively unproductive investment is demanded in the public interest. These investments, being to a considerable degree beyond the control of the railway, may hamper that development of physical plant which is best fitted to handle traffic efficiently. Again the output of the agricultural plant, eliminating natural forces, is within the control of the farmer; within a practicable limit he can produce as much or as little as he chooses, and hence the responsibility for a large or a small product per acre within this limit is his alone. The railway, on the other hand, performs a *service*, is, there-

fore, dependent upon patronage for its output, and hence its output is not under its sole control. The fact that it is a service which the public are obliged to use modifies the force of this contention, but does not remove the fact that the intensiveness of traffic depends largely upon the volume of traffic offered.

These fundamental differences in the character of the agricultural and railway industries would seem on first thought to destroy the value of any comparison of their efficiency. But it must be remembered, as has been said, that the two industries are not being compared directly with each other; rather the *increase in the efficiency* of each is being compared over a series of years. The record for efficiency of each industry is compared at one period with its record at another. Account is taken of the degree in which the plant of agriculture and the plant of the railways have been extended, of the aggregate increases in output, of the increases in output per unit of plant, of increases in value in relation to output, and of the relation that extensions of plant and increases in output bear to the growth of population.

As the census of the United States is taken decennially the comparison cannot now be made of any more recent period than that indicated by the years 1900 and 1910.^a It would not, however, be fair to utilize the results of these two years in this comparison between the railways and agriculture, unless they were normal years in both industries. As to agriculture the following is the opinion of John L. Coulter, expert special agent for agriculture, Bureau of the Census, expressed in an article in the *Quarterly Journal of Economics* for November, 1912:

“After a very extensive study of climatic conditions and general agricultural conditions for the two years thus necessarily selected, I am ready to state my belief that they were typical or representative years, not abnormal in any material respect. In some districts conditions were exceptionally bad or exceptionally good in 1899 (the farm year covered by the census of 1900), and the same was true of 1909 (covered by the census of 1910). For the United

^a The agricultural census of 1900 was taken as of the date of June 1, 1900, and that of 1910 as of the date of April 15, 1910. The inventory statistics of these censuses—statistics of farm land, improved land, livestock, and the like—relate to the dates indicated. The crop statistics of each census cover as nearly as possible the preceding calendar year—that is, the years ending December 31, 1899, and 1909, respectively. All the railway statistics in the present study are of fiscal years ending June 30th.

States as a whole, and for all crops which it is possible to bring into the analysis here presented, these years are as comparable as it is possible to find two years any distance apart."

It may also be said in a general way that 1900 and 1910 were normal years for the railways of the United States. Freight traffic showed steady and continuous increases each year from 1897 to 1907, indicating that 1900 was one of a series of normal years; in 1908 and 1909 there was a recession, but the traffic of 1910 again presented a growth over the preceding years. Passenger traffic increased steadily each year from 1897 to 1910.

COMPARISON OF PLANT.

The physical plant of the railways of the United States comprised 206,631 miles of main track in 1900. By 1910 this had grown to 266,185 miles, an increase of 59,554 miles, or 28.8 per cent.

Improved land in the farms of the United States amounted to 414,498,000 acres in 1900 and 478,451,000 acres in 1910, an increase of 63,953,000 acres between 1900 and 1910, or 15.4 per cent.^a

It is evident that the railway plant has increased at nearly double the rate of the agricultural plant. Additional light is obtained by showing the rates of increase separately for the three principal districts of the United States—Eastern, Southern, and Western.^b

INCREASE IN RAILWAY TRACK MILEAGE AND IN IMPROVED FARM LAND
EASTERN, SOUTHERN, AND WESTERN DISTRICTS.

Item.	1900.	1910.	Increase, 1900-1910.	
			Amount.	Per cent.
Eastern district:				
Railway main track. . . .	64,537	75,129	10,592	16.4
Improved farm land. . . .	90,921,000	89,641,000	<i>d</i> 1,280,000	<i>d</i> 1.4
Southern district:				
Railway main track. . . .	33,117	43,694	10,577	31.9
Improved farm land. . . .	82,061,000	88,353,000	6,292,000	7.7
Western district:				
Railway main track. . . .	108,977	147,362	38,385	35.2
Improved farm land. . . .	241,516,000	300,458,000	58,942,000	24.4

^d Decrease.

^a The extent to which the farmer utilizes his plant is indicated by a statement of the amount of land devoted to crops, or aggregate crop area. In some respects crop area better represents the agricultural plant than does the acreage of improved land, but as statistics of crop area are not available for all agricultural products, it is not a wholly satisfactory index. The area covered by the crops for which acreage statistics were secured by the Census Bureau in 1910 showed an increase of 9.9 per cent over the area covered by the same crops in 1900.

^b The Eastern district comprises the New England States, New York, New Jersey, Pennsylvania, Delaware, Maryland, the District of Columbia, Ohio, Indiana, and Michigan. The Southern district includes all the States south of the Potomac and Ohio and east of the Mississippi rivers. The Western district comprises the States of Illinois and Wisconsin, and all States west of the Mississippi. As regards railway operation, the Eastern district corresponds very closely to combined Groups I, II, and III of the territorial classification of the Interstate Commerce Commission; the Southern district to Groups IV and V combined; the Western district to Groups VI, VII, VIII, IX, and X combined. The boundaries of the groups that lie along the borders of these districts do not always follow state boundaries; but the districts specified above so closely correspond to the combined groups of the Interstate Commerce Commission that there is no appreciable variation from strict comparability.

Of the increase in improved farm land, over nine-tenths was in the West, where new lands are being put into cultivation through irrigation and settlement. The South shows a substantial increase, but in the older and more closely settled East there was a decrease. The improved land in the farms of the United States amounts to but one-half of the total farm area. Although it must be recognized that a certain area must always be held out of cultivation, yet it is clear that it is not because the farmer has no more land to cultivate that he has not enlarged his field of operations. The increase in railway trackage was distributed over the three sections of the country, the rate being about twice as great in the South and West as in the East.

The conclusion is clear that the railways have been extending their plant with greater vigor than the farmers in all sections of the United States, especially so in the older sections of the country, east of the Mississippi River.

COMPARISON OF AGGREGATE OUTPUT.

Railway output in the United States in 1900 and 1910, expressed in terms of ton-miles and passenger-miles, was as follows:

	Output in—		Per cent of increase, 1900-1910.
	1900.	1910.	
Ton-miles	141,596,551,000	255,016,910,000	80.1
Passenger-miles	16,038,076,000	32,338,496,000	101.6

The immediate comparison in the case of agriculture will be concerned with the ten principal crops, those which enter into universal use and consumption and constitute over 80 per cent of the value of all crops—corn, wheat, oats, barley, rye, buckwheat, potatoes, hay and forage, tobacco, and cotton. The area devoted to these ten crops in 1900 aggregated 274,380,000 acres, while in 1910 it was 297,865,000 acres. This area of the ten crops, representing over four-fifths of the total crop area of the United States both in 1900 and 1910, increased 23,485,000 acres during the decade, or 8.6 per cent.

The increases in the respective crops are shown by the following table:

	Production in—		Per cent of increase, 1900-1910.
	1900.	1910.	
Corn (bushels).....	2,666,324,000	2,552,190,000	^d 4.3
Wheat (bushels).....	658,534,000	683,379,000	3.8
Oats (bushels).....	943,389,000	1,007,143,000	6.8
Barley (bushels).....	119,635,000	173,344,000	44.9
Rye (bushels).....	25,569,000	29,520,000	15.5
Buckwheat (bushels).....	11,234,000	14,849,000	32.2
Potatoes (bushels).....	273,318,000	389,195,000	42.4
Hay and forage (tons).....	79,252,000	97,454,000	23.0
Tobacco (pounds).....	868,113,000	1,055,765,000	21.6
Cotton (bales).....	9,535,000	10,649,000	11.7

^d Decrease.

The rate of increase in gross railway output, between 1900 and 1910, is shown to be from 80 to 100 per cent. The increase in the output of the ten crops combined, each crop being assigned a weight proportionate to its acreage, was about nine per cent.

COMPARISON OF OUTPUT PER UNIT OF PLANT.

It may be asserted as a general principle that an increase in output per unit indicates a gain in efficiency.

However, this statement is subject to qualifications, for a loss in output per unit does not always denote lowered efficiency. Agriculture is affected directly and railway operation indirectly by climatic changes, seasonal variations, and calamities of one kind or another—factors that can neither be anticipated nor controlled. The pushing of agriculture into new fields may for a time increase output per unit, while the extension of railway lines into new territory may temporarily decrease output per unit, yet in neither case does this influence play any necessary part in determining for the time being the actual efficiency of operation.

With this condition clearly in mind, it will be interesting to compare the output of agriculture and railways per unit of plant.

Railway output per mile of main track in 1900 and in 1910 was as follows:

RAILWAY OUTPUT PER MILE.

	Output per mile of main track in—		Per cent of in- crease, 1900-1910.
	1900.	1910.	
Ton-miles	685,263	958,044	39.8
Passenger-miles	77,617	121,489	56.5

The output per acre of the ten crops in 1900 and 1910 and the rates of increase or decrease during the decade are indicated in the following table:

OUTPUT PER ACRE.

	1900.	1910.	Per cent of in- crease, 1900-1910.
Corn (bushels).....	28.1	25.9	<i>d</i> 7.8
Wheat (bushels).....	12.5	15.4	23.2
Oats (bushels).....	31.9	28.6	<i>d</i> 10.3
Barley (bushels).....	26.8	22.5	<i>d</i> 16.0
Rye (bushels).....	12.4	13.4	8.0
Buckwheat (bushels).....	13.9	16.9	21.5
Potatoes (bushels).....	93.0	106.1	14.1
Hay and forage (tons).....	1.285	1.345	4.7
Tobacco (pounds).....	788.1	815.3	3.5
Cotton (bales).....	0.393	0.332	<i>d</i> 15.5

d Decrease.

The rate of increase in railway efficiency from 1900 to 1910, measured by the increase in traffic per mile of main track, is shown to be 39.8 per cent in respect to ton-miles and 56.5 per cent in respect to passenger-miles—that is, the increased efficiency of railway operation as a whole was not less than 40 per cent for the decade. When each crop is given a weight proportionate to its acreage, it will be found that the average of the increases and decreases in the output per acre for the ten crops combined shows a decrease of about one per cent. None of the ten crops shows as great an increase in output per acre as 40 per cent, while the output per acre of four of the ten crops decreased.

The highest rate of increase of any of the ten crops was that of wheat, the production per acre increasing 23.2 per cent. The reason for this increase should be carefully noted. Had the land devoted to wheat remained the same in quality, this would have indicated a real increase in output. But as a matter of fact the rate of average increase is due in part, probably, to the fact that the later year was a somewhat better crop year for wheat than the earlier, and in part, also, to the withdrawal of poorer wheat land from wheat cultivation in the East and South during the decade, and the substitution of newer and better for older and poorer wheat land in the West. In a number of states the extent of the transfer of land planted in wheat in 1900 to other crops or to pasturage in 1910 is very striking, and the fact that in practically all such states the average output of wheat per acre increased during the decade proves that it was the poorer wheat land that was so transferred. For example, the wheat area of Minnesota decreased three million acres between 1900 and 1910, or over 50 per cent, while the average of wheat per acre rose from 14.5 bushels to 17.4 bushels; in Ohio the wheat area decreased 1,400,000 acres, or 43 per cent, while the average production per acre rose from 15.7 bushels to 16.8 bushels; in Indiana the wheat area decreased 810,000 acres, or 28 per cent, while the average per acre rose from 12.1 bushels to 16.3 bushels. These examples can be multiplied to include nearly all the states whose wheat acreage decreased.

Buckwheat production per acre increased 21.5 per cent; potato production per acre increased 14.1 per cent; rye, hay and forage and tobacco showed small increases—less than ten per cent—while in the case of four crops—corn, oats, cotton, and barley—there were decreases in production per acre. Without exception the in-

crease in railway efficiency between 1900 and 1910, as measured by increased output per mile, seems to have been greater than the increase in the efficiency in the production of the ten crops. Four of the crops decreased in output per acre, indicating not only that there was no gain in efficiency of production, but probably an actual loss.

Comparison by Geographical Districts.

That the same general conclusion is applicable to each of the three great geographical districts of the United States—Eastern, Southern, and Western—is made clear by the comparison given below. Wherever it appears that one of the three districts produced less than a tenth of the total output of any one of the ten crops, the production of that crop per unit is not shown for that district.

OUTPUT PER UNIT.

Eastern District.

	1900.	1910.	Per cent of increase, 1900-1910.
Railways:			
Ton-miles	1,162,810	1,664,134	43.1
Passenger-miles	134,689	191,669	42.3
Agriculture:			
Corn (bushels).....	36.9	37.3	1.1
Wheat (bushels).....	13.7	17.3	26.3
Oats (bushels).....	33.6	29.3	^d 12.8
Rye (bushels).....	12.9	13.7	6.3
Buckwheat (bushels).....	14.3	17.5	22.6
Potatoes (bushels).....	92.0	113.3	23.2
Hay and forage (tons).....	1.175	1.305	11.1
Tobacco (pounds).....	1004.8	970.8	^d 3.4

Southern District.

Railways:			
Ton-miles	516,251	774,487	50.0
Passenger-miles	45,340	73,762	62.7
Agriculture:			
Corn (bushels).....	15.7	16.8	7.0
Tobacco (pounds).....	725.9	767.3	5.7
Cotton (bales).....	0.395	0.386	^d 2.3

Western District.

Railways:			
Ton-miles	453,841	652,486	43.8
Passenger-miles	53,636	99,860	86.2
Agriculture:			
Corn (bushels).....	30.9	26.7	^d 13.6
Wheat (bushels).....	12.8	15.4	20.3
Oats (bushels).....	33.5	29.7	^d 11.3
Barley (bushels).....	26.8	22.5	^d 16.0
Rye (bushels).....	12.8	14.2	11.4
Potatoes (bushels).....	97.5	101.9	4.5
Hay and forage (tons).....	1.370	1.404	2.5
Cotton (bales).....	0.390	0.272	^d 30.3

^d Decrease.

In the Eastern district the gain in railway efficiency ranged above 40 per cent. The efficiency of production of the eight crops, which were raised in sufficient quantities in the Eastern district to warrant comparison with the railways of that district, without exception increased at a lower rate than the 40 per cent of the railways.

For the Southern district comparison is made between railways and the three principal crops of that district—cotton, tobacco, and corn. Railway efficiency as a whole increased something more than 50 per cent. The corn and tobacco crops show small increases in efficiency measured by production per acre—less than 10 per cent—while the cotton crop shows a slight decrease in per-acre production, indicating no gain in efficiency of cultivation and handling.

Comparison is offered for the Western district between the railways and eight crops. Railway efficiency as a whole may conservatively be said to have gained more than 45 per cent. Of the four crops showing increased efficiency, no one has as high a rate of increase as this in output per acre, and four crops show decreases in output per acre.

Conclusion of Comparison of Output.

While emphasis must again be laid on the fact that the foregoing comparisons are not absolute and are at best of the most general type, yet the constancy with which the rate of increase in the production per acre of the several crops has lagged behind the rate of increase in railway traffic per mile of main track is significant. The same tendency is shown when attention is directed to all the crops of the United States for which returns of acreage and production for 1900 and 1910 are available. The following table covers all the crops for which the indicated data are given in reports of the Census Bureau:

PER CENT OF INCREASE: 1910 OVER 1900.

Crop.	Total Acreage.	Total Output.
Cereals	3.5	1.7
Other grains and seeds (beans, peas, peanuts, and flaxseed).....	24.6	23.4
Hay and forage.....	17.2	23.0
Tobacco	17.6	21.6
Cotton	32.0	11.7
Sugar-beets	230.5	395.7
Sorghum and sugar-cane.....	35.4	29.0
Broom corn.....	82.6	<i>d</i> 13.2
Hemp	<i>d</i> 52.3	<i>d</i> 36.3
Hops	<i>d</i> 19.6	<i>d</i> 17.3
Potatoes	24.8	42.4
Sweet potatoes and yams.....	19.3	39.3
Small fruits (strawberries, blackberries, raspberries, cranberries, etc.).....	<i>d</i> 12.1	<i>d</i> 7.9

d Decrease.

Scrutiny of this table will show that the cereal crops, to which over three-fifths of the total crop area is devoted, did not quite hold their own, acreage increasing at a slightly higher rate than output. The general conclusion warranted by the table, when the importance of each crop is considered in connection with its relative increase in acreage and output, is that the crop production of the United States increased at no greater rate from 1900 to 1910 than did the crop area. The same fact is presented from a different angle by the Census Bureau in the statement that there was practically no difference in the average quantity of crops produced per acre in 1900 and 1910. In contrast is the record of the railways, in which the increase of 28.8 per cent in miles of main track was far less than the increases of 80.1 per cent in ton-miles and 101.6 per cent in passenger-miles; that is, the average output per mile of main track in 1910 was considerably greater than in 1900.

That the efforts put forth by the farmers of the United States during the past decade have only barely maintained the production of crops at the same level, without leading to any appreciable increase in efficiency of production, is the opinion expressed by John L. Coulter, in the article cited in the introduction. He says: "It is true that the *hope* has been, and I believe I may say that the *belief* has been, that agriculture was increasing rapidly, if not keeping pace with the increase of population. The people of the United States have been more than willing to supply the Department of Agriculture, State agriculture experiment stations, and a great

variety of agricultural schools, colleges, and lecturers with all of the funds necessary, believing that all this pointed towards a larger production of goods as a basis for the food, beverage, and clothing supply of our people. Hundreds of millions of dollars have been expended for this purpose. It may seem that this expenditure has been in vain, since the average production of agriculture has not increased. But without it doubtless there would have been far-reaching decreases due to depreciation of the soil and failure of the farmers to maintain the average production secured when they first took charge. Tho hundreds of millions of pages of literature have been distributed among farmers; only a small percentage has actually been read, and only a small percentage of that read has been put into practice. It has taken almost all, if not all, of the education which has reached the farmers to date to prevent any downward movement in the quantity produced per acre of land actually cultivated."

CROP VALUES AND PURCHASING POWER.

In the light of this agricultural record, which shows an absence of increased efficiency in crop production, it is of interest and significance to note the extraordinary increase in agricultural prices and, in consequence, of the capital value of the agricultural industry.

According to the United States Department of Agriculture the average value of an acre's output of the ten important crops of the United States was \$9.13 in 1899 and \$15.51 in 1911, an increase of \$6.38, or 69.9 per cent.

The details for each individual crop are as follows:

Crop.	Value of an acre's output, 1911.	Per cent of increase over 1899.
Corn	\$14.79	73.8
Wheat	10.96	50.1
Oats	10.98	38.3
Barley	18.38	70.2
Rye	12.96	105.1
Buckwheat	15.29	97.5
Potatoes	64.60	78.1
Hay	11.38	11.8
Tobacco	84.13	61.7
Cotton	20.32	52.3

Compared with the prices of things which farmers buy, the purchasing power of the crop of an average acre was greater in 1911 than in 1899 by 41.6 per cent. In other words, while there has been an increase in the market prices of such commodities as the farmer purchases in considerable quantity, the increase in the prices he receives for his crops has been so much greater that his purchasing power has been increased in considerably greater proportion. Expressing this situation in terms of the several important crops, the purchasing power of an average acre's output of corn in 1911 was 50.7 per cent greater than in 1899; that of an average acre's output of wheat was 30.2 per cent greater than in 1899; that of an average acre's output of cotton was 32.3 per cent greater than in 1899.

This comparison of a farmer's purchasing ability at different periods has been carried a step further by the Department of Agriculture, to apply to specific commodities purchased and used by the farmers of the United States. While many of these commodities vary widely in grade, quality, or size, that grade or quality has in

each case been selected which represents what is most generally sold to farmers, and the comparisons from year to year are always of retail prices of the same grades or qualities.

The following table shows the increase in purchasing power in 1911 over that of 1899 of the output of the average acre of corn, wheat, cotton, and of all crops, respectively, in terms of these specific commodities.

PER CENT OF INCREASE, 1911 OVER 1899, IN THE PURCHASING POWER.

Of these Commodities—	By an average acre's output of—			
	Corn.	Wheat.	Cotton.	All crops.
Coal-oil	112	83	86	99
Coffee	11	<i>d</i> 4	<i>d</i> 3	4
Flour	33	20	18	25
Lard	25	8	10	18
Salt	44	23	26	35
Sugar	37	19	20	29
Tin pails.....	63	41	43	53
Overalls	30	13	14	23
Calico	33	15	16	25
Axes	60	38	40	50
Nails	68	45	47	58
Shovels	57	37	38	48
Steel wire.....	70	47	49	60
Hose	46	26	27	37
Lime	47	28	29	38
Paints	9	<i>d</i> 7	<i>d</i> 4	4
Twine	71	48	50	61
Stoves	51	30	32	42
Harness	45	20	22	30
Wagons—single	55	34	35	46
Wagons—double	42	23	24	33

d Decrease.

The 21 representative commodities entered in this table were taken from a list of 83 commodities in the report of the Department of Agriculture. Between 1899 and 1911 the purchasing power of the output of the average acre of crops increased in the case of 82 of these 83 staple commodities—that is, the price received for an average acre's crop rose at a greater rate than the price paid for these commodities. The only commodity, the price of which rose faster than the prices of agricultural products, was brooms. This increase in the purchasing power of the farmer took place in face of the fact that the prices of 79 of the 83 commodities advanced.

POWER OF AVERAGE ACRE'S CROP TO PURCHASE TRANSPORTATION

The amount of transportation purchasable by the output of an average acre of these same crops in 1899 and 1911 is shown in the following table:

	Corn.		Wheat.		Cotton.		All crops.	
	1899	1911	1899	1911	1899	1911	1899	1911
Ton-miles	1175	1954	1008	1448	1843	2684	1261	2049
Passenger-miles	442	749	379	555	693	1029	474	786

The percentages of increase in the amounts of transportation purchasable with the average output of an acre are as follows:

	Corn.	Wheat.	Cotton.	All crops.
Ton-miles	66.3	43.7	45.6	62.5
Passenger-miles	69.5	46.4	48.5	65.8

PURCHASING POWER OF 1,000 CROP UNITS AND 1,000 TRAFFIC UNITS

Taking the purchasing power of the farm value in 1900 of 1,000 bushels of the crops indicated, and of 1,000 bales in the case of cotton, as 100, the relative quantities of the commodities named below purchasable at wholesale with 1,000 bushels of the same crops and 1,000 bales of cotton in 1910 are as indicated in the following table:

RELATIVE PURCHASING POWER IN 1910

Of these commodities.	By 1,000 bushels of—			
	Corn.	Wheat.	Seven food crops.	Cotton (bales.)
Farm products	120.7	114.0	100.1	129.5
Food	146.9	138.7	121.9	157.5
Cloths and clothing	156.7	147.9	130.0	168.0
Fuel and lighting	175.0	165.2	145.1	187.6
Metals and implements	170.2	160.6	141.2	182.5
Lumber and building materials	137.0	129.4	113.7	147.0
Drugs and chemicals	179.4	169.4	148.9	192.4
House-furnishing goods	172.5	162.9	143.1	185.0
Miscellaneous	149.7	141.3	124.2	160.5
All commodities	152.4	143.8	126.4	163.4
Ton-miles	175.7	165.8	145.7	188.4
Passenger-miles	187.6	177.1	155.6	201.1

Taking the purchasing power of the receipts of the railways from 1,000 ton-miles and 1,000 passenger-miles in 1900 as 100, the relative quantities of the commodities named below purchasable at wholesale with 1,000 ton-miles and 1,000 passenger-miles respectively in 1910 are as indicated in the following table:

RELATIVE PURCHASING POWER IN 1910

Of these commodities.	By the Receipts from—			
	1,000 ton-miles.		1,000 passenger-miles.	
	1900.	1910.	1900.	1910.
Farm products.....	100	68.7	100	64.4
Food.....	100	83.6	100	78.3
Clothes and clothing.....	100	89.2	100	83.5
Fuel and lighting.....	100	99.6	100	93.3
Metals and implements.....	100	96.9	100	90.7
Lumber and building materials.....	100	78.0	100	73.1
Drugs and chemicals.....	100	102.1	100	95.7
House-furnishing goods.....	100	98.2	100	92.0
Miscellaneous.....	100	85.2	100	79.8
All commodities.....	100	86.7	100	81.2

The purchasing power of the value of 1,000 bushels of corn has risen from 100 in 1900 to 152.4 in 1910, an increase of 52.4 per cent; similarly the purchasing power of wheat has risen from 100 to 143.8, or 43.8 per cent; the purchasing power of cotton has risen from 100 to 163.4, or 63.4 per cent; the purchasing power of the seven principal food crops, covered by earlier tables, has risen from 100 to 126.4, or 26.4 per cent. The purchasing power of the receipts from 1,000 ton-miles has fallen from 100 in 1900 to 86.7 in 1910, a decrease of 13.3 per cent; the purchasing power of the receipts from 1,000 passenger-miles has fallen from 100 in 1900 to 81.2 in 1910, a decrease of 18.8 per cent. These statistics have reference to purchasing power in general—*i. e.*, power to purchase all commodities. When specific groups of commodities are considered, such as food, clothing, and the like, it is perceived that the purchasing power of the various crops indicated largely increased during the decade, while the power of the receipts from ton-miles and passenger-miles to purchase these same commodities with but one exception decreased.

The increase in the purchasing power by crops of transportation is of course explained by the fact that in contrast to the rapid increase in the average value of farm products during the period, there has been no more than a slight variation in average receipts per ton-mile and in average receipts per passenger-mile.

Correlative with the increase in value of farm crops, and in large measure as a direct result of such increase, the value of farm property greatly increased during the decade ending in 1910. This value as a whole, including land, buildings, implements and machinery, and livestock, increased 100.5 per cent, or practically doubled. The value of farm land alone increased 118.1 per cent, an increase in average value per acre of 108.1 per cent. In the same period the cost of road and equipment of the railways increased 40.2 per cent, their gross capitalization increased 60.3 per cent, and their net capitalization increased 63.3 per cent.

NOTE.—In the preceding paragraphs retail prices as computed by the Department of Agriculture have been used for the comparison between 1899 and 1911. The fact that such prices were not computed for 1900 compels the utilization of wholesale prices for the comparison between 1900 and 1910.

SERVICE OF AGRICULTURE AND THE RAILWAYS IN RELATION TO THE GROWTH OF POPULATION.

There is another basis upon which the comparison of the development and efficiency of the great industries that serve the people of this country should be made; this is in relation to the growth of the population. That is, as the service of agriculture and the railways is to the whole people, it is appropriate and significant to measure that service in relation to the population to which it is rendered.^a For example, the production of 25,000,000 more bushels of wheat in 1910 than in 1900 might seem a gratifying increase. But an addition of sixteen million to the population reduced the per capita supply in 1910 to eighty-six per cent of what it was in 1900. And so also should facilities of the railways be measured. There was an increase of 25 per cent in the miles of line, 29 per cent in the miles of main track, and 36 per cent in the miles of all tracks between 1900 and 1910. But if the comparison be made in relation to the population we find that in 1900 there were 2.53 miles of line for each one thousand inhabitants, and in 1910 2.62 miles of line, an increase in proportion to population of only 3.4 per cent. Miles of main track on the same basis increased 6.4 per cent, and the miles of all tracks 12.3 per cent.

The following tables bring out the ratio of increase in plant and output of the agricultural industry and in the plant and output of the railways in relation to the population.

^a Part of the crops are exported and part of the traffic of the railways is for export. As exported products are bartered for imports, or enter into the settlement of international balances, it is not considered unfair to include the export traffic in the aggregates of production and service that are related to the population.

ACREAGE OF AGRICULTURE PER 1,000 INHABITANTS.

(Ten Principal Crops.)

	1900.	1910.	Per cent of increase.
Corn	1,248.9	1,069.7	<i>d</i> 14.4
Wheat	692.0	481.3	<i>d</i> 30.5
Oats	388.7	382.3	<i>d</i> 1.7
Barley	58.8	83.7	42.3
Rye	27.0	23.9	<i>d</i> 11.7
Buckwheat	10.6	9.5	<i>d</i> 10.1
Potatoes	38.7	39.9	3.1
Hay and forage.....	811.8	785.9	<i>d</i> 3.2
Tobacco	14.5	14.1	<i>d</i> 2.9
Cotton	319.4	348.4	9.1

d Decrease.

TRACK AND EQUIPMENT OF THE RAILWAYS PER 1,000 INHABITANTS.

	1900.	1910.	Per cent of increase.
Miles of line.....	2.534	2.619	3.4
Miles of main track.....	2.719	2.894	6.4
Miles of all track.....	3.405	3.825	12.3
Locomotives (number).....	.406	.641	29.2
Locomotive tractive power (lbs.)..	^a 10,112.6	17,275.8	70.8
Freight cars (number).....	17.97	23.21	29.2
Freight car capacity (tons).....	^a 556.5	832.6	49.6
Passenger cars (number).....	.457	.512	12.0

^a 1902.

The acreage of seven of the ten crops under consideration decreased between 1900 and 1910 in relation to the population. These crops were corn, wheat, oats, rye, buckwheat, hay and forage, and tobacco. The remaining three crops show increases in acres planted per thousand inhabitants, namely, barley, potatoes, and cotton. The acreage of these three crops with the exception of cotton is comparatively small. All the track and equipment factors of railway operation in the United States increased between 1900 and 1910 in relation to population. The increases in mileage have already been indicated. Locomotives per thousand inhabitants increased 29.2 per cent and the tractive power of locomotives 70.8 per cent; freight cars per thousand inhabitants increased 29.2 per cent and their capacity in tons 49.6 per cent, while passenger cars per thousand inhabitants increased 12 per cent.

The next two tables present the increase or decrease in output of agriculture, and the increase in output of the railways, in relation to population, during the decade 1900 to 1910.

OUTPUT OF AGRICULTURE PER 1,000 INHABITANTS.

(Ten Principal Crops.)

	1900.	1910.	Per cent of increase.
Corn (bushels).....	35,085.7	27,749.6	<i>d</i> 20.9
Wheat (bushels).....	8,665.5	7,430.3	<i>d</i> 14.3
Oats (bushels).....	12,413.9	10,950.5	<i>d</i> 11.8
Barley (bushels).....	1,574.3	1,884.7	19.7
Rye (bushels).....	336.5	321.0	<i>d</i> 4.6
Buckwheat (bushels).....	147.8	161.5	9.2
Potatoes (bushels).....	3,596.5	4,231.7	17.7
Hay and forage (tons).....	1,042.9	1,059.6	1.6
Tobacco (pounds).....	11,423.4	11,479.2	0.5
Cotton (bales).....	125.5	115.8	<i>d</i> 7.7

d Decrease.

OUTPUT OF THE RAILWAYS PER 1,000 INHABITANTS.

	1900.	1910.	Per cent of increase.
Ton-miles	1,863,256	2,772,759	48.8
Passenger-miles	211,042	351,611	66.6

The output of five of the ten crops increased in relation to population during the ten years ending 1910. The largest increase per thousand inhabitants was that of barley, which was 19.7 per cent. Potato production per thousand inhabitants increased 17.7 per cent, and the production of buckwheat, hay and forage, and tobacco less than ten per cent. The remaining five crops decreased in output as related to population, rye showing a decrease of 4.6 per cent per thousand inhabitants, cotton of 7.7 per cent, oats of 11.8 per cent, wheat of 14.3 per cent, and corn of 20.9 per cent. The output of the railways for the same period increased per thousand inhabitants, ton-miles by 48.8 per cent and passenger-miles by 66.6 per cent.

The value of the output of these ten crops and of that of the railways in relation to population is shown in the next two tables. Value in the case of agriculture is the farm value, that is, the estimated price at the farm for the crops. In the case of the railways value represents the receipts for handling traffic, and is expressed in terms of freight and passenger revenue.

VALUE OF THE TEN CROPS PER 1,000 INHABITANTS.

	1900.	1910.	Per cent of increase.
Corn	\$10,898	\$15,641	43.5
Wheat	4,868	7,151	46.9
Oats	2,857	4,509	57.8
Barley	548	1,005	83.4
Rye	162	222	37.3
Buckwheat	76	101	34.1
Potatoes	1,295	1,810	39.8
Hay and forage.....	6,372	8,959	40.6
Tobacco	750	1,134	51.2
Cotton	4,260	7,650	79.6

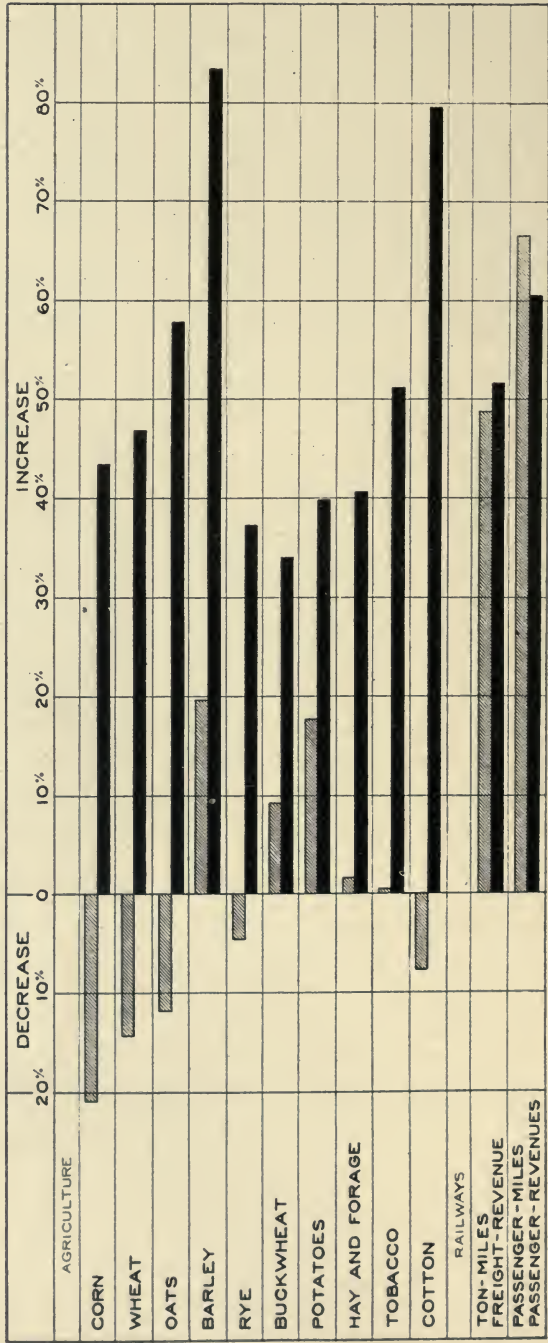
VALUE OF OUTPUT OF THE RAILWAYS PER 1,000 INHABITANTS.

Freight revenue.....	\$13,807	\$20,936	51.6
Passenger revenue.....	4,260	6,839	60.6

The average value of the ten crops per thousand inhabitants increased 50.2 per cent. It should be noted that this relative increase in the farm value of crops has been due entirely to the increased prices received by farmers. The five crops that relatively increased in quantity increased in value at a far greater ratio, and the value of the remaining five crops materially increased, notwithstanding the decrease in quantity. In the case of the railways, however, the increase in revenues per thousand inhabitants is about the same as the increase in ton-miles and passenger-miles, indicating that the increased revenues were due almost entirely to the increase in traffic. This contrast is presented graphically on the next page.

The following diagram shows the increases or decreases in quantity per inhabitant, and the concurrent increase in value per inhabitant, of the ten principal crops, and of railway traffic, expressed in percentages.

1900-1910



The foregoing diagram presents output and value in relation to population. The situation in detail in respect to three of the most important crops is as follows:

The cotton production in 1900 was of 125.5 bales per thousand inhabitants; in 1910 it was 115.8 bales, a decrease in the quantity of cotton per thousand inhabitants of 7.7 per cent. The value of the cotton crop, however, which was \$4,260 per thousand persons in 1900, had risen to \$7,650 in 1910, an increase of 79.6 per cent. That is, while cotton production had fallen off 7.7 per cent per inhabitant, the value of the product had increased 79.6 per cent per inhabitant.

There were produced in 1900 8,666 bushels of wheat per thousand inhabitants, while in 1910 there were produced but 7,430, a falling off in bushels per thousand inhabitants of 14.3 per cent. The value of the wheat crop, however, that was \$4,868 per thousand inhabitants in 1900, had risen to \$7,151 in 1910, an increase of 46.9 per cent. That is, while the wheat crop had decreased 14.3 per cent per inhabitant, its value increased 46.9 per cent per inhabitant.

The corn crop amounted in 1900 to 35,086 bushels per thousand inhabitants, but had dropped by 1910 to 27,750 bushels, a decrease in quantity of 20.9 per cent. The value of the corn crop, however, that was \$10,898 per thousand inhabitants in 1900, was \$15,641 in 1910, an increase of 43.5 per cent. That is, while the quantity of the corn crop had fallen off 20.9 per cent per inhabitant, its value had increased 43.5 per cent per inhabitant.

An incidental point in this connection is that the railways are dependent to a very great extent on the farm products of the country for their traffic.

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BUREAU OF RAILWAY ECONOMICS

(Continued from page 2 of cover.)

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