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LABOR REQUIREMENTS OF POTATOES GROWN ON
NEW YORK COST-ACCOUNT FARMS, 1914-1935

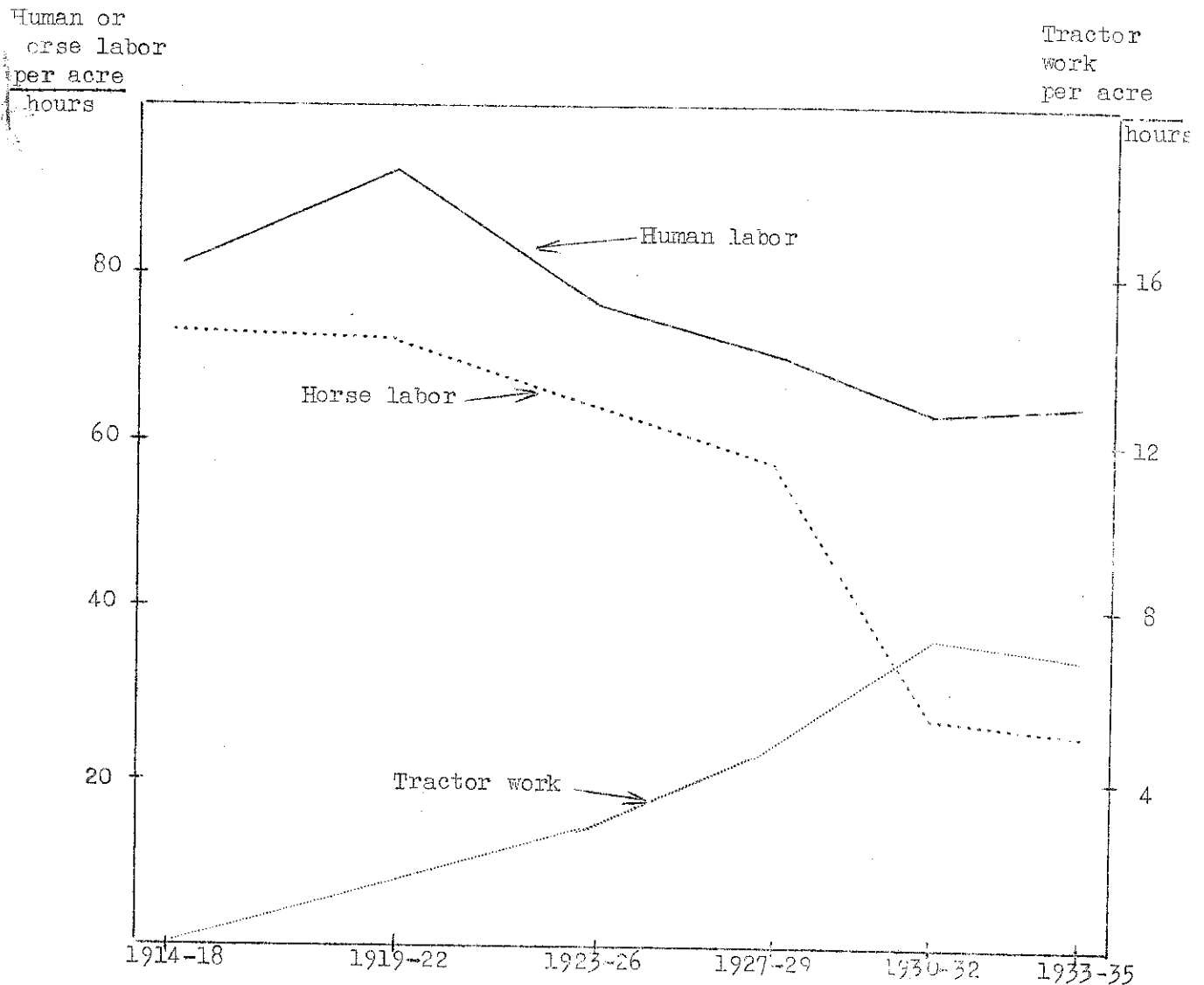


FIGURE 1. HUMAN LABOR, HORSE LABOR, AND TRACTOR WORK REQUIRED TO GROW AND HARVEST AN ACRE OF POTATOES, 1914-1935

Prepared by

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National Research Project of The Works Progress Administration

LABOR REQUIREMENTS OF POTATOES GROWN ON NEW YORK COST-ACCOUNT FARMS
1914 - 1935

Human Labor per Acre of Potatoes

Human labor required to grow and harvest potatoes on the farms of New York cost-account cooperators averaged from 56 to 110 hours per acre during the period from 1914 to 1935 (Table 1). The greatest amounts of labor were used in the years from 1918 to 1921 and the least amounts in the years from 1930 to 1935. The average for the former period was 98 hours per acre; the average for the latter period was about 64 hours per acre; while the average for the whole twenty-two-year period was 76.4 hours to grow and harvest an acre of potatoes.

Figure 1 indicates that the trend in the amount of labor required for the potato crop has in general been downward since 1914. This does not mean that the trend has been continuously downward. More labor per acre was used in the 1919-1922 period than in the 1914-1918 period, and also more was used in the 1933-1935 period than in the 1930-1932 period; but 15.9 hours per acre less was required in 1933-1935 period than in the first five years covered by the data. Figure 1 also indicates that over the twenty-two-year period, tractor work has displaced about two-thirds of the horse labor used during the pre-war and war periods. It is evident that this has resulted in a considerable saving of human labor and that not all of this saving has been spent in a more intensive culture of the crop.

Why was more labor per acre used in growing and harvesting potatoes in the years 1918-1921 than in those years preceding? Was there a greater supply of cheap labor or of family labor during the later period? Labor was by no means plentiful in 1918 during the World War. From 1931 to 1934, a

TABLE 1. HUMAN LABOR REQUIREMENTS PER ACRE OF POTATOES, 1914 - 1935

Year	Yield per acre	For growing and harvesting		For storing and selling	Total
		Quantity	Proportion of total cost	Quantity	Quantity
	<u>bushels</u>	<u>hours</u>	<u>per cent</u>	<u>hours</u>	<u>hours</u>
1914	162	80.9	29.8	17.4	98.3
1915	77	69.9	34.4	6.5	76.4
1916	88	72.1	31.6	5.9	78.0
1917	92	79.7	27.7	8.9	88.6
1918	138	102.6	35.1	11.7	114.3
1919	100	87.8	33.0	8.9	96.7
1920	209	109.1	29.6	7.9	117.0
1921	132	93.2	32.2	12.1	105.3
1922	122	81.6	27.6	11.1	92.7
1923	144	74.8	28.9	9.7	84.5
1924	175	78.7	31.1	10.1	88.8
1925	129	74.1	30.0	10.0	84.1
1926	159	78.3	24.7	16.5	94.8
1927	118	69.7	25.7	7.5	77.2
1928	169	71.2	24.8	9.7	80.9
1929	157	71.1	27.9	14.7	85.8
1930	175	60.6	22.9	10.5	71.1
1931	199	73.9	26.1	6.9	80.8
1932	193	56.2	25.0	16.3	72.5
1933	160	61.0	24.9	7.5	68.5
1934	192	70.2	25.5	10.0	80.2
1935	155	64.2	29.4	7.4	71.6
<u>Averages:</u>					
1914-1918	111	81.0	31.7	10.1	91.1
1919-1922	141	92.9	30.6	10.0	102.9
1923-1926	152	76.5	28.7	11.6	88.1
1927-1929	148	70.7	26.1	10.6	81.3
1930-1932	189	63.6	24.7	11.2	74.8
1933-1935	169	65.1	26.6	8.3	73.4
1914-1935	148	76.4	28.5	10.3	86.7

comparatively large supply of labor failed to induce potato producers to employ more labor in the production of potatoes than they had used in the 1923-1929 period; rather, they used less. Labor was by no means cheap in terms of dollars from 1918 to 1920, but it was cheap in terms of commodities. Table 2 shows the cost of all human labor per hour on cost-account farms

TABLE 2. COST OF HUMAN LABOR PER HOUR ON COST-ACCOUNT FARMS

Year	Cost of human labor per hour on cost-account farms	Index of labor cost per hour on cost-account farms 1914=100 (Index A)	Index of prices paid by farmers for commodities used in production* 1914=100 (Index B)	Ratio of labor cost index to index of prices paid for commodities used in production (Index A ÷ Index B)
	<u>cents</u>			
1914	25.1	100	100	1.00
1915	26.0	104	105	.99
1916	30.3	121	125	.97
1917	35.6	142	153	.93
1918	39.6	158	176	.90
1919	41.4	165	194	.85
1920	43.7	174	176	.99
1921	39.0	155	142	1.09
1922	37.7	150	140	1.07
1923	37.8	151	142	1.06
1924	39.0	155	144	1.08
1925	39.5	157	148	1.06
1926	42.8	171	147	1.16
1927	41.4	165	146	1.13
1928	43.4	173	149	1.16
1929	42.6	170	148	1.15
1930	42.8	171	141	1.21
1931	36.5	145	123	1.18
1932	30.2	120	108	1.11
1933	28.0	112	109	1.03
1934	27.9	111	126	.88
1935	28.2	112	127	.88

* Based upon data from The Agricultural Situation, Vol. 20, No. 2, page 20, February 1, 1936.

from 1914 to 1935, expressed both in monetary value and as an index with the 1914 cost equal to 100. The ratio of this labor cost index to an index of prices paid by farmers for commodities used in production has been worked for the individual years of the twenty-two-year period. This ratio may be said to represent the cost of labor per hour on cost-account farms relative to the prices of other factors in production. In 1919 it took only 85 per cent as much fertilizer, seed, gasoline, farm machinery, etc. to pay for a month's

wages as it took in 1914. Cost-account producers of potatoes tended to use greater amounts of labor during the years 1918 to 1920, because the cost of such labor was low relative to other production costs and to the total returns realized from the enterprise. From 1914 to 1918, human labor constituted 31.7 per cent of the total cost of growing and harvesting potatoes (Table 1), and from 1919 to 1921, human labor was still 31.6 per cent of the total cost of growing and harvesting, although the amount of labor used was 15.7 hours per acre greater than the amount used during the previous five years.

A possible explanation of the downward trend in the use of human labor since 1920 concerns the acreage of potatoes raised per cost-account farm from 1920 to 1935 (Table 11). Acreage per farm increased from 2.4 in 1920 to 27.9 in 1932. In the 1930-1935 period, an average of 23.5 acres of potatoes per farm was grown, while during the four years from 1918 to 1921, only 3.1 acres of potatoes per farm were grown. The most rapid increase came between 1927 and 1932, when the acreage of potatoes per farm tripled. Savings in labor in late years have been the result of both larger acreages and improved labor-saving machinery. Increasing the size of acreage per farm would not have decreased labor requirements per acre appreciably without the use of improved machinery, and was not the direct cause of the labor saving. On the other hand, improved machinery could not have been used most efficiently on the small acreages.

If the trend in the amount of labor per acre to grow and harvest potatoes has been downward, what operations have been shortened to permit such a saving? For the years 1927 to 1935, data are available showing the labor used in growing operations separate from that used in harvesting (Table 3). Labor used per acre in growing potatoes declined from 35.3 hours in 1927-1929 to 27.2 hours in 1933-1935, while the labor used in harvesting potatoes actually increased during the same period, though probably not

TABLE 3. HUMAN LABOR REQUIREMENTS FOR GROWING AND HARVESTING POTATOES,
1927 - 1935

Year	Yield per acre	For growing		For harvesting	
		Quantity	Proportion of	Quantity	Proportion of
		per acre	total cost of growing and harvesting	per acre	total cost of growing and harvesting
	<u>bushels</u>	<u>hours</u>	<u>per cent</u>	<u>hours</u>	<u>per cent</u>
1927	118	38.8	14.6	30.9	11.1
1928	169	34.7	12.4	36.5	12.4
1929	157	32.3	13.2	38.8	14.7
1930	175	29.1	11.4	31.5	11.5
1931	199	29.6	11.3	44.3	14.8
1932	193	24.4	11.3	31.8	13.7
1933	160	24.8	11.0	36.2	13.9
1934	192	29.9	11.1	40.3	14.4
1935	155	26.9	12.8	37.3	16.6
Averages:					
1927-1929	148	35.3	13.4	35.4	12.7
1930-1932	189	27.7	11.3	35.9	13.4
1933-1935	169	27.2	11.6	37.9	15.0
1927-1935	169	30.1	12.1	36.4	13.7

significantly. Figure 2 shows this same data graphically. Labor used for growing distinctly declined; while labor used for harvesting and also labor used in marketing varied considerably from year to year, but neither decreased nor increased noticeably during the period. A very large proportion of the work of harvesting potatoes is picking them up after the digger has deposited them on the surface. Picking up potatoes is still largely hand work.

Table 1 shows the amount of human labor per acre used in storing and selling potatoes from 1914 to 1935. These figures are quite variable and have various faults. In the first place, they are "per acre" figures rather than "per bushel" figures. Second, the data do not include labor spent in marketing the crop after the annual date of closing the account book, which is usually some date between January 1 and April 15. Then, again, many potato growers

Human
labor
per acre
hours

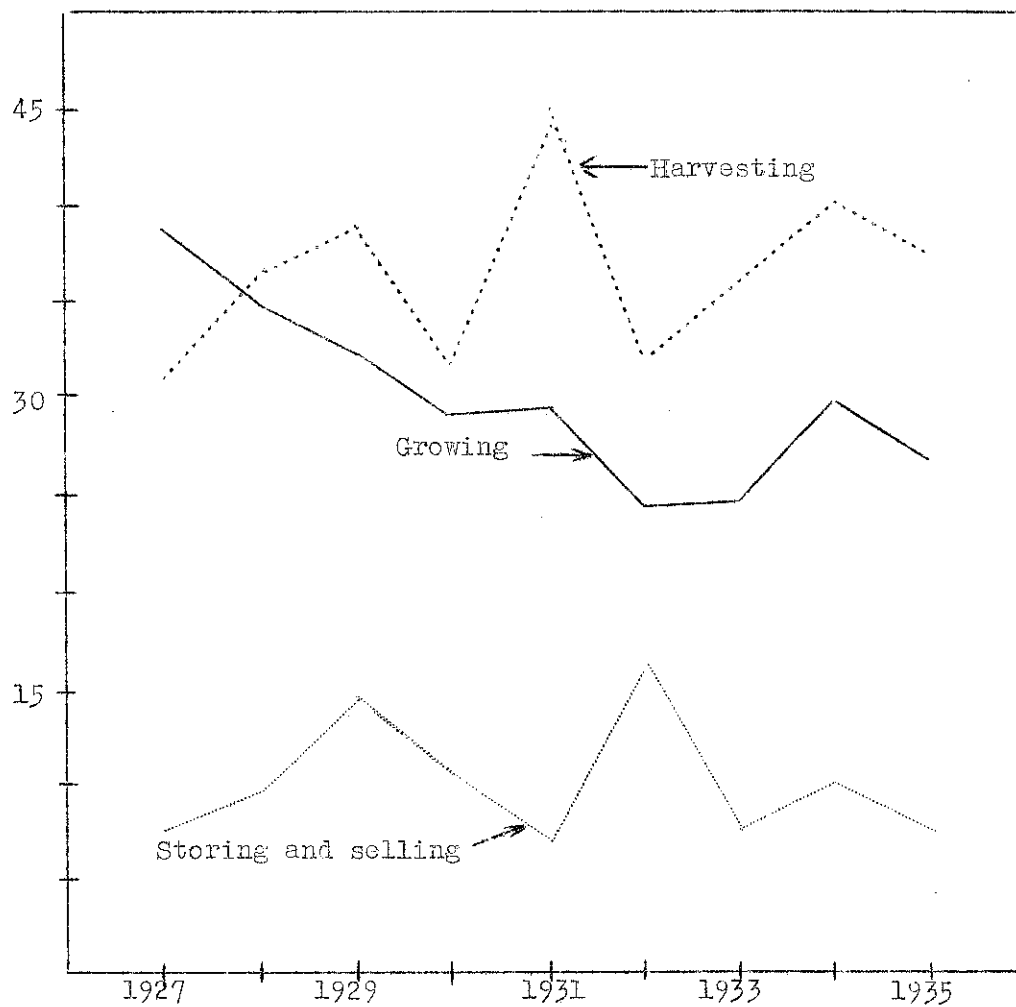


FIGURE 2. HUMAN LABOR REQUIRED FOR GROWING, HARVESTING, AND STORING AND SELLING POTATOES, 1927-1935

change their marketing policies greatly from year to year. In Figure 3 are shown the average amounts of labor used per acre to store and sell potatoes in the different periods since 1914. Note that, whereas the labor used to grow and harvest an acre has definitely decreased since 1914, there has been no marked trend either upward or downward in the labor used in marketing an acre of potatoes. One should keep in mind, however, that an acre in the 1914-1918 period was on the average about 111 bushels, while the average

Human
labor
per acre
hours

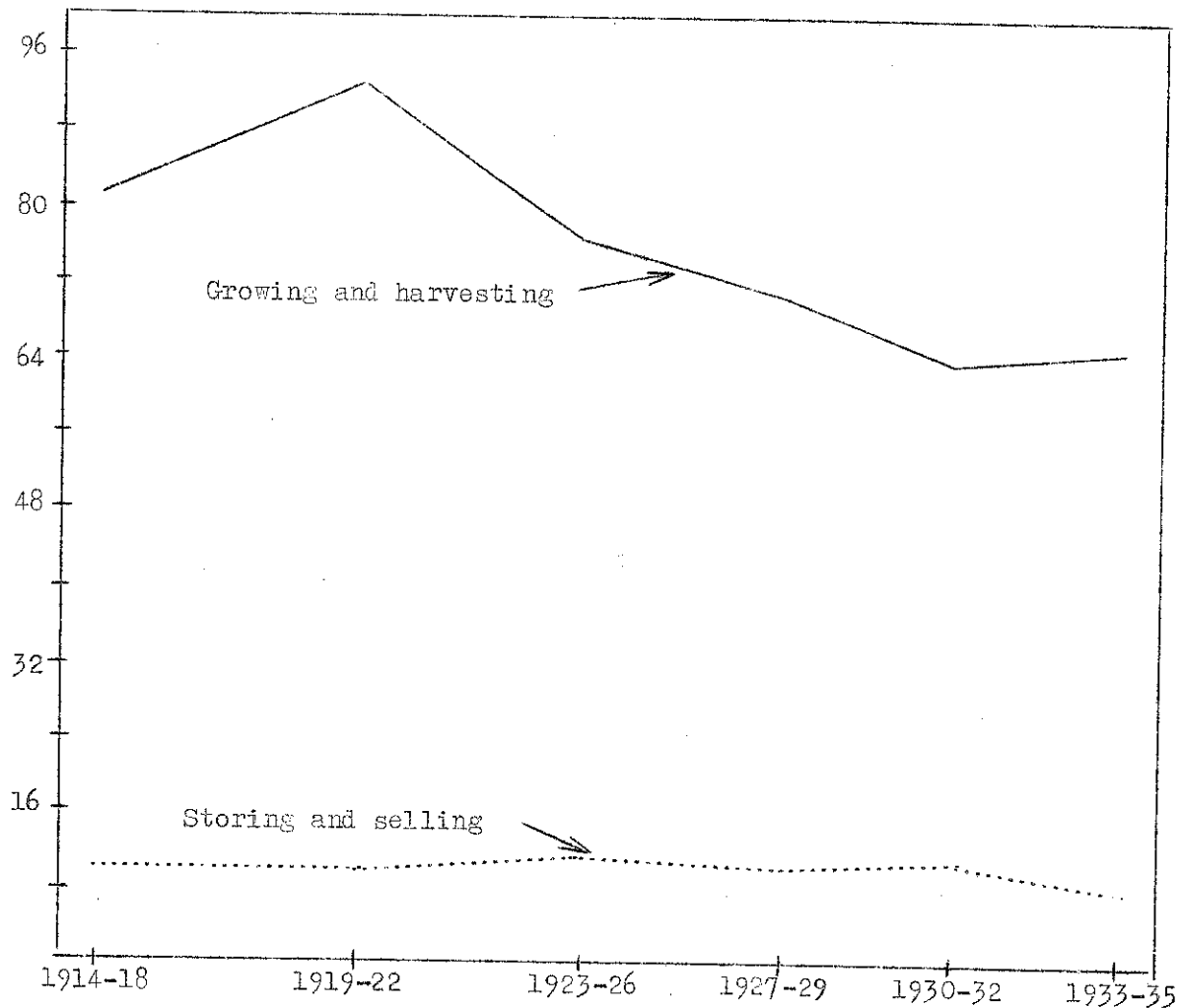


FIGURE 3. HOURS HUMAN LABOR TO GROW AND HARVEST AND TO STORE AND SELL AN ACRE OF POTATOES, 1914-1935

yield per acre during the 1933-1935 period was about 169 bushels.

Yield of Potatoes per Acre

Yields of potatoes per acre on cost-account farms varied from 77 bushels in 1915 to 209 bushels in 1920 (Table 1). The trend in yield has been definitely upward since 1914. For some reason, production was especially low in 1915, 1916, and 1917; but even if these three low yields are not considered,

the trend is still unmistakeably upward. Yields during the seven years, 1914 to 1920, averaged 124 bushels per acre; while yields during the five years, 1931 to 1935, averaged 180 bushels per acre.

Human Labor per 100 Bushels of Potatoes

The amount of labor required to grow and harvest 100 bushels of potatoes, which is shown in Table 4 and Figure 4, has declined by about one-half since the war-time period. In Figure 5, labor used per 100 bushels of potatoes for storing and selling is compared with labor used for growing and harvesting. Cost-account farmers have in late years used slightly less labor per bushel in marketing potatoes than they did twenty years ago, but the decrease is not as great as one might expect. It is probable that some potato growers use more labor storing, sorting, or bagging than formerly and thus use some part of the labor saved in marketing by the substitution of motor transportation for horse transportation.

Proportion of Total Cost of Growing and Harvesting Potatoes
Spent for Human Labor

During the twenty-two-year period from 1914 to 1935, an average of 28.5 per cent of the cost of growing and harvesting potatoes was spent for human labor (Table 1). This proportion varied annually from 22.9 per cent in 1930 to 35.1 per cent in 1918. The principal reason for wide variations from year to year was the fluctuation in the amount spent for seed potatoes. This amount varied from \$4.68 per acre in 1915 to \$43.06 per acre in 1920. In 1930, when the proportion of total cost spent for human labor was only 22.9 per cent, seed potatoes cost \$28.22 per acre, or more than 25 per cent of the total cost of growing and harvesting. In 1918, when 35.1 per cent of the total cost was for labor, seed cost \$15.11 per acre, or only 9.7 per cent of

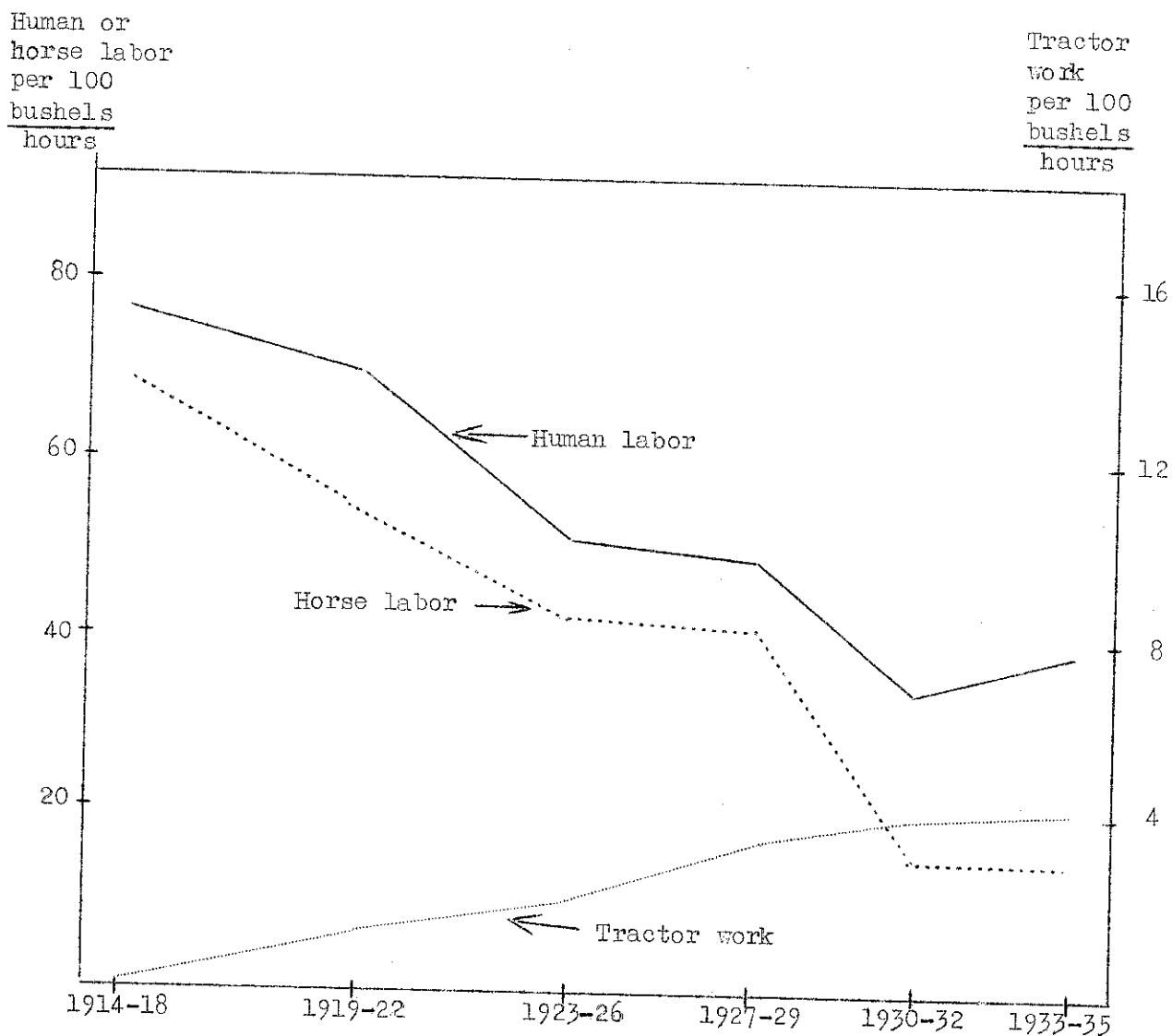


FIGURE 4. HUMAN LABOR, HORSE LABOR, AND TRACTOR WORK REQUIRED TO GROW AND HARVEST 100 BUSHELS OF POTATOES, 1914-1935

the total cost. Likewise, in 1926 seed was 27 per cent of the total cost and labor was only 24.7 per cent; in 1915 seed was only 9 per cent of the total cost and labor was 34.4 per cent.

Over the twenty-two-year period, human labor has become a somewhat less important factor in the production of potatoes. In the 1914-1918 period, labor was 31.7 per cent of the total cost of growing and harvesting, while in the 1933-1935 period, labor was 26.6 per cent of the total cost.

TABLE 4. HUMAN LABOR, HORSE LABOR, AND TRACTOR WORK TO GROW AND HARVEST
100 BUSHEL OF POTATOES, 1914 - 1935

Year	Yield per acre	Quantity per 100 bushels of potatoes		
		Human labor	Horse labor	Tractor work
	<u>bushels</u>	<u>hours</u>	<u>hours</u>	<u>hours</u>
1914	162	50	47	0
1915	77	91	89	0
1916	88	82	73	0
1917	92	87	77	0
1918	138	74	61	0.4
1919	100	88	69	0.5
1920	209	52	38	0.4
1921	132	71	56	1.4
1922	122	67	54	2.5
1923	144	52	40	2.2
1924	175	45	41	1.5
1925	129	57	49	2.7
1926	159	49	40	1.7
1927	118	59	63	3.5
1928	169	42	34	2.5
1929	157	45	26	3.8
1930	175	35	18	4.1
1931	199	37	12	3.9
1932	193	29	14	3.6
1933	160	38	16	3.8
1934	192	37	14	3.8
1935	155	41	15	4.6
<u>Averages:</u>				
1914-1918	111	77	69	0.1
1919-1922	141	70	54	1.2
1923-1926	152	51	42	2.0
1927-1929	148	49	41	3.3
1930-1932	189	34	15	3.9
1933-1935	169	39	15	4.1
1914-1935	148	56	43	2.1

During the nine-year period from 1927 to 1935, human labor was about 25.8 per cent of the total cost of growing and harvesting potatoes (Table 3). Twelve and one-tenth per cent of the total cost was for labor used in growing operations and 13.7 per cent was for labor used in harvesting. The three-year averages in Table 3 indicate that the labor for growing

Human
labor
per 100
bushels
hours

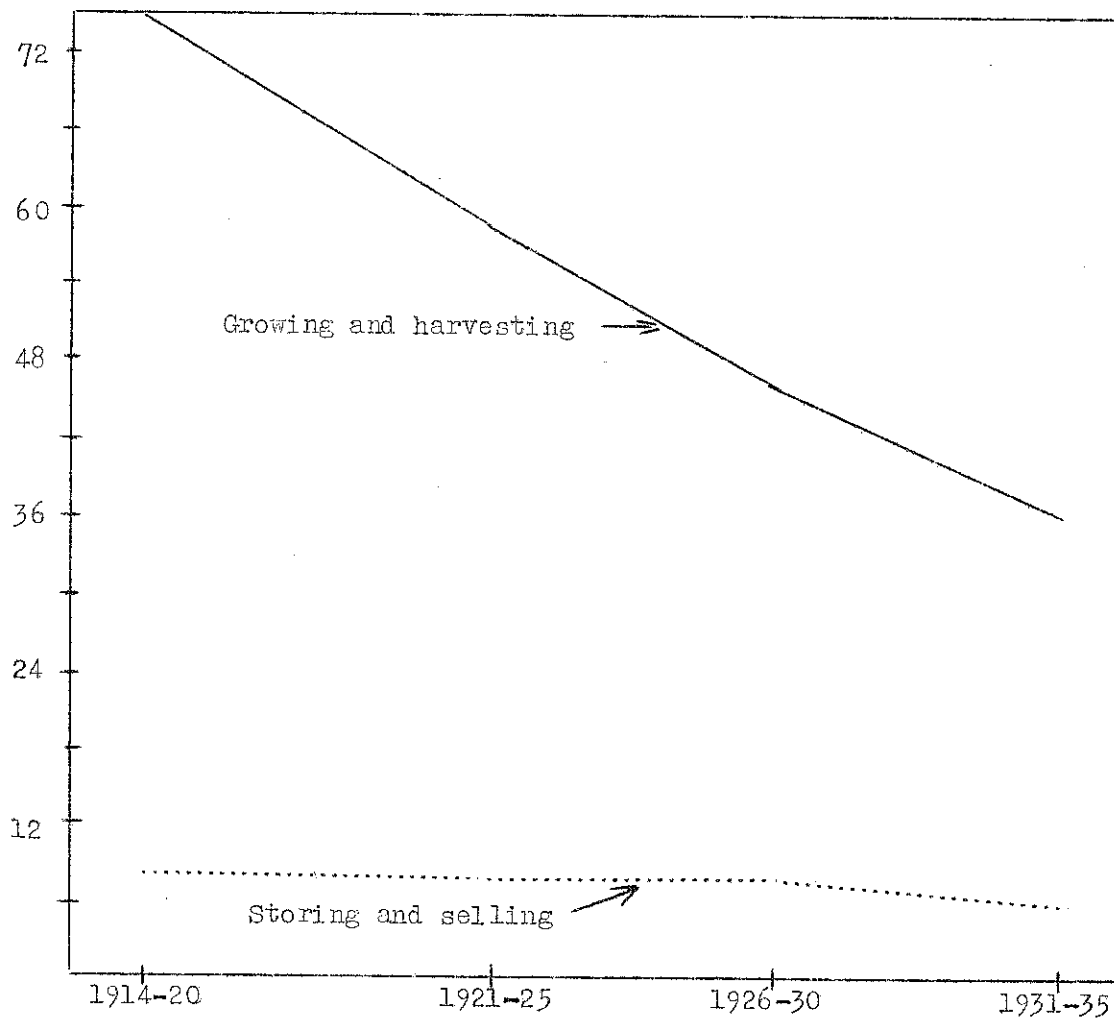


FIGURE 5. HUMAN LABOR TO GROW AND HARVEST AND TO STORE AND SELL 100 BUSHELS OF POTATOES, 1914-1935

operations has become less of the total cost and that the labor for harvesting has become a larger share of the total cost.

Variations in Labor Requirements

Though the trend in the labor requirements of a crop may be said to be in this direction or that, fluctuations from year to year are usually wide. Variations in weather conditions, in soil conditions, and in the prevalence of

disease and insects are all obvious causes of fluctuations in the labor requirements of a crop. Variations in the amount of labor required to harvest and market potatoes are traceable in part to fluctuations in the yield per acre, though the effect of these fluctuations is often overshadowed by changes in farming practices and especially by changes in marketing policies. A New York farmer may choose to sell his potatoes one year during the harvesting season, while he may the very next year store them for several months.

Not only are there wide fluctuations from year to year in the labor requirements of the potato crop, but there are much greater variations among individual farms in any one year. In Tables 5 and 6, the amounts of human labor used per acre of potatoes are shown for individual farms in the years 1928, 1930, 1932, and 1934. In general these amounts varied from about one-half to about one and three-fourths the average for all the farms in the given year. The amount of labor required per acre to grow a crop is less variable among the individual farms than is the total labor required for the crop. Note that in Table 6 a large proportion of the items for the various years covered by the data are clustered about the median items. In Table 5 a much smaller proportion is grouped close to the median items.

Distribution of Human Labor by Operations

In Table 7, data from a study of 355 Steuben County, New York farms in 1912 are compared with data from cost accounts in the 1913-1915 period and data from cost accounts in 1934. Growing operations took from 6 to 8 hours less labor per acre in 1934 than in the earlier years, while harvesting and marketing operations took considerably more labor per acre in 1934 than in 1912, but about 25 per cent less labor per 100 bushels in 1934 than in 1912. The yield for the 355 farms in the 1912 study was 107 bushels per acre, while the yield on the 36 cost-account farms in 1934 was 192 bushels per acre.

TABLE 5. TOTAL HUMAN LABOR PER ACRE OF POTATOES ON INDIVIDUAL FARMS
NEW YORK FARM COST ACCOUNTS, 1928-1934
(arranged from high to low)

	<u>1928</u>	<u>1930</u>	<u>1932</u>	<u>1934</u>
	hours	hours	hours	hours
	146	130	135	127
	125	120	120	119
	120	105	106	113
	120	99	104	111
	117	98	104	110
	111	98	101	105
	107	98	95	104
High	104	93	95	103
third	104	92	90	103
	101	91	90	95
	100	90		86
	100	89		83
	100	88		
	97	88		
		87		
	<u>93</u>	<u>87</u>	<u>85</u>	<u>82</u>
	86	87	85	80
	85	87	81	80
	83	84	78	80
	83	83	72	80
	79	82	72	77
Middle	78	80	72	75
third	78	78	71	74
	76	78	68	74
	74	78	62	73
	70	77	60	72
	70	73		72
	68	72		
	<u>67</u>	<u>71</u>		
	64	71	60	70
	60	69	58	69
	60	67	58	69
	56	66	55	68
	56	66	51	67
	56	63	50	64
	55	63	49	59
Low	53	62	49	58
third	52	59	48	56
	50	59	47	53
	50	57		52
	49	55		41
	44	48		
	30	42		
		30		
Averages:				
High third	111	98	104	105
Middle third	78	80	73	77
Low third	52	58	53	60
Weighted average of all farms	81	71	72	80
Number of accounts	42	44	31	36
Total acres potatoes	483	966	865	762
Acres per farm	11.5	22.0	27.9	21.2

TABLE 6. REQUIREMENTS OF HUMAN LABOR TO GROW AN ACRE OF POTATOES
ON INDIVIDUAL FARMS, NEW YORK FARM COST ACCOUNTS, 1928 - 1934
(arranged from high to low)

	1928	1930	1932	1934
	hours	hours	hours	hours
	89 (4 A.)	80 (1 A.)	55	57
	73	65	51	55
	60	60	49	52
	56	60	45	51
	56	50	38	46
	51	47	38	43
	49	44	36	41
High	45	44	33	41
third	44	42	33	41
	43	42	31	36
	43	42		34
	43	40		34
	42	40		
	41	37		
		36		
	40	35	30	33
	40	35	29	33
	39	34	28	33
	39	34	28	33
	39	33	28	33
	38	33	27	32
Middle	38	32	26	31
third	37	32	24	31
	36	32	23	30
	35	32	22	30
	35	31	21	29
	34	31		28
	33	31		
	30	30		
	30	30	21	28
	30	30	20	28
	30	29	19	27
	28	28	19	26
	27	28	17	26
	26	28	17	24
Low	26	27	17	24
third	26	27	16	23
	23	26	13	23
	20	24	12	23
	19	23		19
	18	21		12
	18	20		
	17	17		
		16		
Averages:				
High third	52	49	41	44
Middle third	37	32	26	31
Low third	24	25	17	24
Weighted average of all farms	35	29	24	30
Number of accounts	42	44	31	36
Total acres potatoes	483	966	865	762
Acres per farm	11.5	22.0	27.9	21.2

TABLE 7. DISTRIBUTION OF HUMAN LABOR ON THE POTATO CROP BY OPERATIONS

	Steuben County* New York	New York farm cost accounts	New York farm cost accounts
Number of accounts	355	15	36
Total acres	5,227.1	183.6	762
Year	1912	1913, 1914, 1915	1934
<hr/>			
	hours of human labor per acre		
<hr/>			
Growing operations:			
Plowing	5.8	6.3	3.0
Fitting operations	3.6	3.5	2.6
Preparation of seed	{ 11.3	{ 13.2	7.5
Planting			4.3
Cultivating, weeding and hoeing	10.4	8.6	8.4
Hilling	3.9	1.5	0.6
Pest control	1.0	0.5	3.2
Other	---	4.1	0.3
Total growing operations	36.0	37.7	29.9
Harvesting	28.9		40.3
Marketing	14.7		19.0
<hr/>			
Total of all operations	79.6		89.2
<hr/>			
	hours of human labor per 100 bushels of potatoes		
<hr/>			
Growing	33.6	32.7	15.6
Harvesting	26.9		21.0
Marketing	13.7		9.9
<hr/>			
Total for the crop	74.2		46.5
<hr/>			
Yield per acre	107 bushels	115 bushels	192 bushels
Potatoes per farm	14.7 acres	12.2 acres	21.2 acres

* Fox, D. S., An Analysis of the Cost of Growing Potatoes, Memoir 22, May 1919, Cornell University Agricultural Experiment Station, Ithaca, New York.

Plowing and fitting operations together took about 60 per cent as much labor in 1934 as they did in 1912 and in 1913-1915. Preparation of seed and planting together took about the same amount of labor in 1934 as in the earlier years. Apparently any labor savings which might have resulted from the use of improved potato planters have been devoted to greater attention to selection and treatment of seed. Cultivating, weeding, and hoeing and hilling took somewhat less labor in 1934 than in 1912-1915, principally because fewer growers followed the practice of hilling potatoes in 1934. From two to three hours per acre more labor was used in 1934 in the control of pests of the crop than in the 1912-1915 period.

The data in Table 7 indicate that the amount of human labor per acre required for growing potatoes has decreased and that the amount of human labor per bushel required for harvesting and marketing potatoes has also decreased.

Distribution of Human Labor by 10-Day Periods

Table 8 and Figure 6 show the distribution of human labor spent on the potato crop by 10-day periods, for 1914-1917, 1926-1928, and 1933-1935. The highest peak of labor use on the potato crop came in all three cases during the harvesting season. In 1914-1917, this peak came during the last 10-day period in October, while in 1926-1928 and in 1933-1935, the peak came during the second 10-day period in October. In the latter three-year period, a greater proportion of the harvesting was done during the peak 10-days than in the case of the 1926-1928 and the 1914-1917 periods. Perhaps this was made possible by a large supply of piece labor during this latter period. Possibly higher yields were also a factor. Yields for the three periods were:

1914-1917	105 bushels
1926-1928	149 bushels
1933-1935	169 bushels

TABLE 8. DISTRIBUTION OF HUMAN LABOR ON POTATO CROP BY 10-DAY PERIODS

Period		1914-1917*	1926-1928	1933-1935
Number of accounts		109	50	107
Total acres		623.8	713.0	1,826.8
month	10-day period	hours of human labor per acre		
January	1	.5	.8	.7
	2	.9	.9	.7
	3	.7	.7	.9
February	1	1.0	.5	.7
	2	.7	.3	.8
	3	.7	.1	.6
March	1	.5	.5	.8
	2	.6	1.0	.8
	3	.6	1.4	.8
April	1	.7	1.7	.8
	2	1.1	1.9	1.6
	3	1.8	1.7	2.0
May	1	2.5	1.7	2.6
	2	4.4	2.7	3.8
	3	5.1	4.5	4.6
June	1	6.1	4.2	3.6
	2	5.5	2.8	2.6
	3	4.0	2.1	1.9
July	1	2.7	2.1	1.6
	2	3.2	2.4	1.7
	3	3.7	1.8	1.9
August	1	2.2	1.3	1.8
	2	1.8	1.3	1.6
	3	1.3	1.6	2.6
September	1	.9	1.5	1.7
	2	1.4	1.6	2.9
	3	2.5	4.0	4.1
October	1	2.5	6.1	7.7
	2	5.6	9.2	13.3
	3	11.1	8.6	6.6
November	1	8.3	4.7	1.6
	2	3.3	1.9	.9
	3	1.0	1.1	.6
December	1	.7	1.1	.6
	2	.4	.8	.3
	3	.5	.6	.3
Total for year		90.5	81.2	82.1

* From Cost Accounts for Six Years on Some Successful New York Farms. By G. F. Warren, V. B. Hart, W. I. Myers, R. L. Gillett, C. V. Noble, and others. Cornell Bulletin 414, page 40, 1923.

Hours human
labor per acre

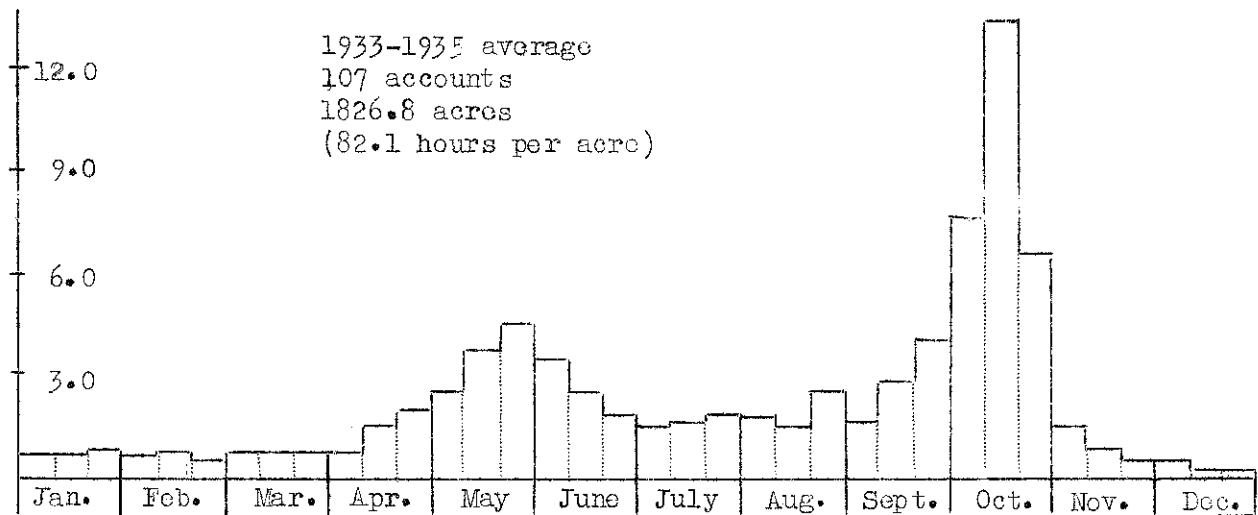
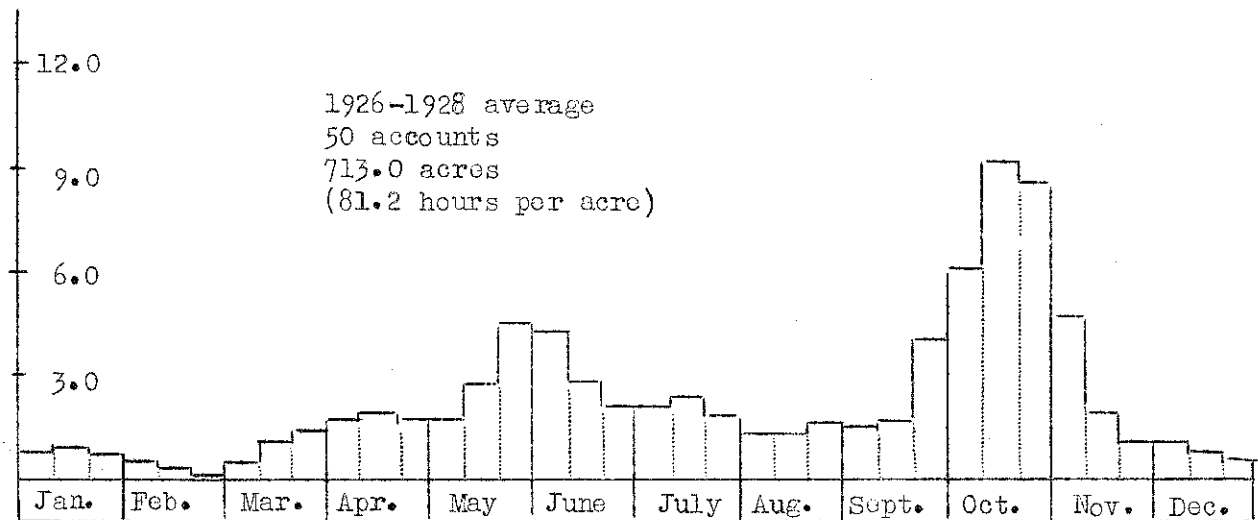
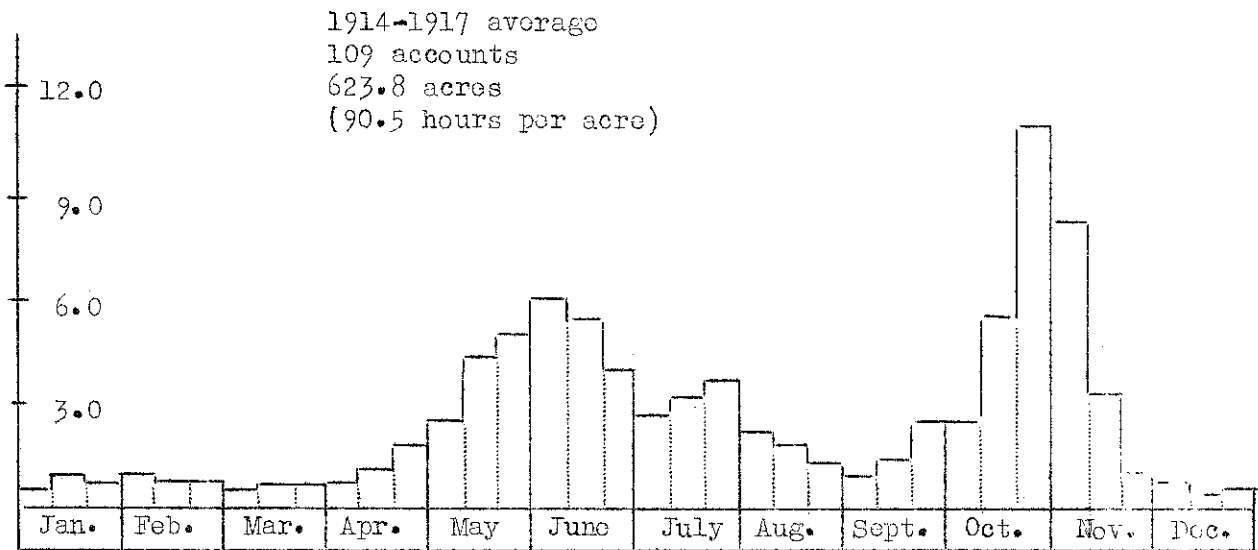


FIGURE 6. DISTRIBUTION OF HUMAN LABOR ON POTATO CROP BY 10-DAY PERIODS

There may have been greater uniformity in the varieties grown by cost-account farmers in 1933-1935 than formerly.

Another peak in the use of labor on the potato crop came in the planting season during the first 10 days of June, as in the case of the 1914-1917 period, or during the last 10 days of May, as in the case of the other two periods. There is some indication here that cost-account farmers have during recent years been planting potatoes a few days earlier in the season than they did twenty years ago. Note that more labor was used in growing operations during the 1914-1917 period than in either of the later periods.

Horse Labor

About one-third as much horse labor per acre of potatoes was used in 1933-1935 as was used in 1914-1918. In the growing and harvesting of potatoes, 73.0 hours per acre were required in the earlier period and only 25.5 hours per acre in the later period (Table 9). Whereas about 6.0 hours of horse labor was used in the marketing of potatoes from one acre in the 1914-1918 period, scarcely any horse labor was used for that purpose in the 1933-1935 period. Figure 1 shows the decline in the use of horse labor in the growing and harvesting of potatoes. The most rapid decline came between the 1927-1929 and 1930-1932 periods when horse labor declined from 57.5 hours to 27.3 hours per acre. According to the data in Table 10, about two-thirds of the horse labor used in the growing and harvesting of potatoes from 1927 to 1935 was for growing operations and about one-third for harvesting. The most rapid decline in the use of horse labor in growing operations came between 1927 and 1931. The use of horse labor in harvesting declined very rapidly between 1928 and 1931.

About 69 hours of horse labor were required in growing and harvesting 100 bushels of potatoes in the 1914-1918 period and only about 15 hours per

TABLE 9. HORSE LABOR REQUIREMENTS PER ACRE OF POTATOES, 1914 - 1935

Year	Yield per acre	For growing and harvesting		For storing and selling	Total
		Quantity	Proportion of total cost	Quantity	Quantity
	bushels	hours	per cent	hours	hours
1914	162	76.9	17.8	10.8	87.7
1915	77	68.9	20.4	4.2	73.1
1916	88	64.3	15.5	4.7	69.0
1917	92	71.1	13.5	3.1	74.2
1918	138	83.8	16.3	7.4	91.2
1919	100	68.6	16.0	3.3	71.9
1920	209	79.6	11.8	4.1	83.7
1921	132	74.2	11.3	1.8	76.0
1922	122	65.8	10.3	2.3	68.1
1923	144	58.3	11.2	4.4	62.7
1924	175	71.6	11.8	2.3	73.9
1925	129	62.7	10.4	2.7	65.4
1926	159	63.3	9.2	1.7	65.0
1927	118	74.0	12.0	1.0	75.0
1928	169	57.5	9.9	0.7	58.2
1929	157	41.0	7.7	0.4	41.4
1930	175	30.8	5.1	0.5	31.3
1931	199	24.4	4.6	0.1	24.5
1932	193	26.8	5.8	0.1	26.9
1933	160	25.4	5.9	0.1	25.5
1934	192	27.4	6.0	0	27.4
1935	155	23.5	5.7	0	23.5
<u>Averages:</u>					
1914-1918	111	73.0	16.7	6.0	79.0
1919-1922	141	72.0	12.4	2.9	74.9
1923-1926	152	64.0	10.6	2.8	66.8
1927-1929	148	57.5	9.9	0.7	58.2
1930-1932	189	27.3	5.2	0.3	27.6
1933-1935	169	25.5	5.9	0	25.5
1914-1935	148	56.4	10.8	2.5	58.9

100 bushels in the years 1933-1935 (Figure 4).

From 1914 to 1918, horse labor was on an average 16.7 per cent of the total cost of growing and harvesting potatoes (Table 9). From 1930 to 1935, horse labor was only 5.5 per cent of all costs.

TABLE 10. HORSE LABOR REQUIREMENTS FOR GROWING AND HARVESTING POTATOES,
1927-1935

Year	Yield per acre	For growing		For harvesting	
		Quantity per acre	Proportion of total cost of growing and harvesting	Quantity per acre	Proportion of total cost of growing and harvesting
	<u>bushels</u>	<u>hours</u>	<u>per cent</u>	<u>hours</u>	<u>per cent</u>
1927	118	50.4	7.9	23.6	4.1
1928	169	35.2	6.1	22.3	3.8
1929	157	27.3	5.1	13.7	2.6
1930	175	19.5	3.2	11.3	1.9
1931	199	15.0	2.8	9.4	1.8
1932	193	17.5	3.7	9.3	2.1
1933	160	17.1	3.9	8.3	2.0
1934	192	18.8	4.2	8.6	1.8
1935	155	16.2	4.1	7.3	1.6
<u>Averages:</u>					
1927-1929	148	37.6	6.4	19.9	3.5
1930-1932	189	17.3	3.2	10.0	2.0
1933-1935	169	17.4	4.1	8.1	1.8
1927-1935	169	24.1	4.6	12.7	2.4

Use of Tractors and Other Equipment

The use of tractors in the growing and harvesting of potatoes on cost-account farms increased quite rapidly from 1918 to about 1931. About one-half of this increase came in three years from 1928 to 1931, this rapid increase corresponding to the very rapid decline in the use of horse labor during those years (Table 9), and to the rapid increase in acreage of potatoes grown per cost-account farm during that period (Table 13). Since 1930, tractor work has averaged about 7.0 hours per acre of potatoes (Table 11). Of this 7.0 hours, about 5.6 hours has been for growing operations and about 1.4 hours for harvesting (Table 12). The use of the tractor in harvesting began about 1927 and has been increasing steadily since that time. The use of the tractor in growing operations seems to have reached a peak in 1931.

TABLE 11. THE USE OF EQUIPMENT PER ACRE OF POTATOES GROWN AND HARVESTED,
1914 - 1935

Year	Yield per acre	Use of tractor	Proportion of total cost going for equipment expense*
	<u>bushels</u>	<u>hours</u>	<u>per cent</u>
1914	162	0	5.6
1915	77	0	5.8
1916	88	0	4.6
1917	92	0	3.9
1918	138	0.5	6.4
1919	100	0.5	6.1
1920	209	0.9	6.0
1921	132	1.9	11.6
1922	122	3.0	10.6
1923	144	3.2	10.8
1924	175	2.7	12.2
1925	129	3.5	11.0
1926	159	2.7	9.3
1927	118	4.1	12.6
1928	169	4.2	11.9
1929	157	6.0	13.7
1930	175	7.2	13.4
1931	199	7.8	15.9
1932	193	6.9	19.0
1933	160	6.0	15.9
1934	192	7.2	14.1
1935	155	7.2	17.4
<u>Averages:</u>			
1914-1918	111	0.1	5.3
1919-1922	141	1.6	8.6
1923-1926	152	3.0	10.8
1927-1929	148	4.8	12.7
1930-1932	189	7.3	16.1
1933-1935	169	6.8	15.8
1914-1935	148	3.4	10.8

* Including farm expenses of tractors, trucks, automobiles, and all other equipment used.

Tractors are used in many of the field operations in the growing and harvesting of potatoes. They are well adapted to most plowing and fitting operations. They are used to a varying extent in drawing potato planters, cultivators, and sprayers and to an increasing extent in drawing potato diggers.

TABLE 12. THE USE OF EQUIPMENT FOR GROWING AND HARVESTING POTATOES,
1927 - 1935

Year	Yield per acre	Use of tractor per acre		Proportion of total cost of growing and harvesting going for equipment expense in*	
		growing	harvesting	growing	harvesting
	<u>bushels</u>	<u>hours</u>	<u>hours</u>	<u>per cent</u>	<u>per cent</u>
1927	118	4.0	0.1	9.0	3.6
1928	169	4.0	0.2	8.4	3.5
1929	157	5.2	0.8	10.3	3.4
1930	175	6.1	1.1	9.6	3.8
1931	199	6.4	1.4	11.3	4.6
1932	193	5.5	1.4	13.3	5.7
1933	160	4.5	1.5	11.1	4.8
1934	192	5.5	1.7	9.7	4.4
1935	155	5.5	1.7	11.4	6.0
<u>Averages:</u>					
1927-1929	148	4.4	0.4	9.2	3.5
1930-1932	189	6.0	1.3	11.4	4.7
1933-1935	169	5.2	1.6	10.7	5.1
1927-1935	169	5.2	1.1	10.5	4.4

* Including farm expenses of tractors, trucks, automobiles, and all other equipment used.

From 1914 to 1918, equipment expense, including expenses of tractors, trucks, automobiles, and all other equipment used, was 5.3 per cent of the total cost of growing and harvesting potatoes (Table 11). From 1930 to 1935, this proportion was 16.0 per cent. Of this 16 per cent, 11.1 per cent was for equipment used in growing operations and 4.9 per cent was for equipment used in harvesting. This latter item has been increasing with the greater use of tractors and tractor-drawn machinery in digging potatoes.

For the whole twenty-two-year period from 1914 to 1935, the proportion of the total cost of growing and harvesting going for equipment expense averaged 10.8 per cent and the proportion going for horse labor also averaged 10.8 per cent. The proportion of total cost going for horse labor

TABLE 13. MISCELLANEOUS AVERAGES FROM ACCOUNTS WITH POTATOES, 1914-1935

Year	Number of accounts	Yield per acre	Potatoes per farm	Cost to grow and harvest an acre	Total cost per acre	Return per hour of man labor	Labor return per acre
		bushels	acres	\$	\$	\$	\$
1914	13	162	7.0	68	75	-0.01	- 1
1915	37	77	6.5	52	55	0.38	29
1916	24	88	5.7	69	72	1.34	105
1917	27	92	4.9	102	106	0.18	16
1918	29	138	2.7	116	123	0.54	62
1919	30	100	3.0	108	114	0.95	92
1920	24	209	2.4	161	168	0.45	53
1921	24	132	4.1	109	120	0.59	62
1922	26	122	4.0	102	109	-0.01	- 1
1923	18	144	5.4	94	100	0.56	47
1924	22	175	9.4	99	108	0.16	14
1925	20	129	9.3	99	106	2.33	196
1926	11	159	10.0	142	156	1.39	132
1927	47	118	9.0	111	120	0.63	49
1928	42	169	11.5	119	131	-0.04	- 3
1929	43	157	17.1	106	118	1.33	114
1930	44	175	22.0	110	123	0.56	40
1931	44	199	23.1	95	107	-0.21	- 17
1932	31	193	27.9	67	79	0.02	1
1933	28	160	24.5	64	73	0.88	60
1934	36	192	21.2	73	81	-0.08	- 6
1935	28	155	22.2	60	68	0.52	37
<u>Averages:</u>							
1914-1918	130*	111	5.4	81	86	0.49	42
1919-1922	104*	141	3.4	120	128	0.50	52
1923-1926	71*	152	8.5	108	117	1.11	97
1927-1929	132*	148	12.5	112	123	0.64	53
1930-1932	119*	189	24.3	91	103	0.12	8
1933-1935	92*	169	22.6	65	74	0.44	30
1914-1935	648*	148	11.5	97	105	0.57	49

* Totals.

and equipment expense together has remained quite constant throughout the whole period. This proportion was 22.0 per cent in the 1914-1918 period and 21.5 per cent in the 1930-1935 period, but in the earlier period about three-fourths of the 22.0 per cent was for horse work and one-fourth for equipment

expense and in the later period, three-fourths was for equipment expense and one-fourth for horse work.

Summary

1. The growing and harvesting of an acre of potatoes required 81.0 hours of human labor in the 1914-1918 period and only 65.1 hours of labor in the 1933-1935 period.

2. Although the trend in the labor requirements per acre of potatoes has been downward since 1914, there has been a tendency for potato producers to use more labor in growing and harvesting the crop when labor was cheap relative to other production costs than they used when labor was high relative to other costs.

3. Since 1927, the amount of human labor required to grow an acre of potatoes has declined, while the amount of labor required to harvest and market an acre of potatoes has not changed appreciably.

4. The yield of potatoes on cost-account farms increased from an average of 124 bushels per acre during the years from 1914 to 1920 to 179 bushels per acre during the six years from 1930 to 1935.

5. The amount of labor required to grow and harvest 100 bushels of potatoes has decreased about one-half since 1914, while the amount of labor required to market 100 bushels of potatoes has decreased only slightly.

6. Plowing and fitting operations required less labor per acre, while controlling pests took more labor per acre in 1934 than in the 1912-1915 period. Both the amount of human labor per acre required in growing operations and the amount of human labor per bushel required in harvesting and marketing potatoes have decreased during the last two decades.

7. Potatoes on cost-account farms were both planted and harvested during the 1933-1935 period a few days earlier in the year than during the