UNIVERSITY OF MINNESOTA
Department of Agriculture

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TRACTOR COSTS AND RATES OF PERFORMANCE

A preliminary report of data secured in 1934 covering
the cost of operation and the rate of performance
of farm tractors in Minnesota

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Source of Data

The operators of 25 farm tractors submitted records covering the cost of operating their tractors and the amount of work done by them during the year 1934 to the Minnesota Agricultural Experiment Station. These records are from 21 farms. On four of these farms, two tractors were used. Since some of these records were started during the year, only 21 of the 25 records cover the full calendar year of 1934. The distribution of tractors by makes is as follows: Farmall 20, 9; McCormick-Deering 15-30, 5; John Deere General Purpose, 2; Farmall 30, 1; McCormick-Deering 10-20, 4; John Deere 15-27, 3; and Case Model L, 1. The date of purchase of these tractors ranged from 1923 to 1934. Monthly records of fuel consumption, of purchases of lubricants and repairs, of time spent servicing and repairing the tractors, and of the hours of use by operations and the amount of work done were kept. Those records were supervised and tabulated jointly by the Divisions of Agricultural Engineering and Agricultural Economics.

Cost of Tractor Operation

The cost per hour of operating these tractors is shown in Tables 1 and 2. Only tractors for which records for the full calendar year are available are shown in these tables. Fuel and lubricants were charged at the purchase price. Man labor spent in servicing and repairing was charged at 25 cents per hour. Annual depreciation was determined by dividing the purchase price of the tractor by the farmer's estimate of the number of years it would last. Interest is charged at 8 per cent on the average value of the tractor in 1934. Costs for each individual tractor in 1934 are shown and also averages for each size group for both 1933 and 1934.

There is a wide variation between different farms in each of the items of tractor cost. To a considerable extent this reflects differences in the ability of the farmers to handle their tractors effectively and to provide adequate work for them. To a lesser extent it reflects chance differences such as variations in fuel prices in different localities and the irregularity with which repairs and overhauling are necessary. The variation in fuel cost was greater than in any other items of operating cost. The amount of fuel used per hour was quite variable. For the two-plow tractors it ranged from 1.15 gallons to 1.99 gallons per hour. This variation reflects in part differences in the extent to which the tractors were operated to capacity and in part differences in efficiency in the use of fuel. Gasoline varied from 9.6 cents to 18.4 cents per gallon between different farms, kerosene from 8.5 cents to 10.9 cents, and distillate from 6.0 cents to 8.6 cents. The average prices of the three fuels were gasoline 13.3 cents, kerosene 9.7 cents, and distillate 7.2 cents. Of the total number of gallons of fuel used, 27 per cent was gasoline, 19 per cent kerosene, and 54 per cent distillate. The proportion of gasoline used varied from 2.6 per cent to 100.0 per cent. Fuel costs were materially lower for those tractors using largely kerosene and distillate.

The fixed charges per hour varied relatively more between farms than did operating costs. In each case, the owner's estimate of the life of the tractor was used in computing the annual depreciation charge. Some of the variation in

this item is the result of variations in the farmer's judgment as to the life of the tractor. In general, the larger the number of hours of work annually per tractor, the lower are the fixed charges per hour.

Rate of Tractor Performance

The rate at which various operations were performed with these tractors is shown in Tables 3 and 4. The rate of performing drawbar operations varied with the size of implement used, the kind and condition of the soil, the size and shape of field, the distance travelled to work, and the yield of crops. Undoubtedly, the rate for tillage operations varied somewhat with the amount of overlapping in case of such items as disking, harrowing, and field cultivating. In case of feed grinding, the output was expressed in bushels but the kind of grain was not specified. In these cases, the weight per bushel was estimated at 40 pounds. It is quite apparent that the proportion of the capacity of the tractor utilized for belt operations varies widely. These tables include all tractors for which records are available for any portion of the year. They do not include minor operations for which no output is recorded or which are performed by only one tractor or under conditions that vary widely from farm to farm. Average rates of performance in 1933 are shown in comparison with the 1934 average rate.

Use of Data

These summaries should be useful to the individual tractor operator for purposes of comparison with his own figures. They should point out cost items in which economies might well be adopted. They should also indicate to some degree, at least, the effectiveness with which he is securing a satisfactory rate of performance. Furthermore, they may suggest the possibilities of using the tractor for operations for which it is not now used and the advantage of using implements large enough to utilize the capacity of the tractor to best advantage. In some cases, full utilization of the capacity of the tractor may be secured by using a combination of two implements at the same time. Two operations may be performed at the same time at very little additional expense since none of the items of tractor cost except fuel would be materially affected by the heavier load and the rate of travel would probably be about the same.

Table 1

Cost per Hour of Operating Two-Plow Tractors, 1933 and 1934

Tractor Number:	1934													Average	
	3122	1132	1032	1152	1012	1182	1112	2022	1192	2132	1232	1082	1022	1934	1933
Operating Cost:															
Fuel	$.154	$.191	$.122	$.124	$.179	$.136	$.134	$.136	$.147	$.143	$.216	$.159	$.160	$.154	$.141
Lubricants	.035	.108	.037	.039	.057	.070	.053	.036	.084	.035	.039	.025	.037	.050	.037
Labor	.017	.030	.018	.022	.011	.020	.015	.023	.009	.015	.016	.011	.027	.018	.019
Cash repairs	.019	—	—	—	.067	.034	.020	.007	—	.025	.019	.056	.112	.028	.025
Total	.225	.329	.177	.185	.314	.260	.222	.202	.240	.218	.289	.251	.336	.250	.222
Fixed Charges:															
Depreciation	.365	.412	.248	.302	.187	.276	.148	.110	.117	.174	.166	.110	.162	.214	.233
Interest at 5% on avg. value	.100	.082	.149	.121	.143	.099	.097	.050	.055	.047	.073	.092	.015	.086	.110
Total	.465	.494	.397	.423	.330	.375	.245	.160	.172	.221	.239	.202	.177	.300	.343
Total cost per hour	.690	.823	.574	.608	.644	.635	.467	.362	.412	.439	.528	.453	.513	.550	.565
Hours of work per year	153¼	230½	258¼	273	329	427¼	458½	591½	629½	699¾	769¾	908	974½	515.6	587
Labor and Materials per 100 Hrs.:															
Servicing, hrs.	6.7	12.2	7.1	8.8	2.1	4.3	4.1	2.8	3.4	5.0	5.2	4.3	6.0	5.5	5.1
Repairing, hrs.	—	—	—	—	2.2	3.5	1.6	—	—	1.0	1.2	—	4.4	1.1	3.1
Fuel: Gasoline, gal.	41.1	157.3	8.3	48.7	5.8	12.0	23.7	21.9	33.9	5.7	53.0	14.2	93.5	40.0	54.0
Kerosene, gal.	—	—	106.5	8.4	149.2	—	—	48.5	—	132.6	8.1	—	4.7	35.0	22.0
Distillate, gal.	132.5	—	—	110.6	18.2	186.7	132.5	107.2	147.6	20.4	129.9	182.0	63.0	95.0	92.0
Total	173.6	157.3	114.8	167.7	173.2	198.7	156.2	177.6	181.5	158.7	191.0	196.2	161.2	170.0	168.0
Oil, gal.	6.5	9.2	5.6	7.7	8.4	8.5	6.0	7.1	12.3	6.1	6.0	3.7	5.0	7.1	5.8
Transmission grease, lb.	5.6	52.1	—	—	—	26.0	3.2	—	4.0	8.8	—	—	11.3	15.9*	8.4
Hard oil, lb.	—	13.0	—	—	13.7	—	12.0	—	—	4.0	5.9	1.1	—	8.3*	6.8

*Average of farms reporting.

Table 2

Cost per Hour of Operating Three-Plow Tractors, 1933 and 1934

Tractor Number:	1934								Average	
	2033	2123	1153	2023	1133	1073	2183	2133	1934	1933
Operating Cost:										
Fuel	$.321	$.206	$.207	$.215	$.339	$.375	$.179	$.209	$.256	$.160
Lubricants	.041	.040	.050	.051	.139	.030	.061	.044	.057	.036
Labor	.020	.015	.016	.008	.034	.007	.042	.031	.022	.015
Cash repairs	-	.142	-	.002	.069	.023	.073	.051	.045	.033
Total	.382	.403	.273	.276	.581	.435	.355	.335	.380	.244
Fixed Charges:										
Depreciation	.562	.379	.372	.167	.311	.289	.201	.183	.308	.227
Interest at 8% on average value	.337	.153	.239	.072	.112	.116	.082	.066	.147	.100
Total	.899	.532	.611	.239	.423	.405	.283	.249	.455	.327
Total cost per hour	1.281	.935	.884	.515	1.004	.840	.638	.584	.835	.571
Hours of work per year	178	221½	335¼	371¾	402¼	415	505¾	820¾	406¼	664
Labor and Materials per 100 Hours:										
Servicing, hrs.	8.2	4.9	6.4	3.2	2.4	2.7	8.9	6.3	5.4	4.5
Repairing, hrs.	-	1.1	-	-	11.3	-	7.0	6.1	3.2	1.5
Fuel: Gasoline, gal.	14.6	13.7	49.8	38.6	270.7	235.9	6.0	35.6	83.0	17.0
Kerosene, gal.	285.4	-	11.9	32.6	10.7	-	-	178.6	65.0	-
Distillate, gal.	-	245.8	242.8	225.7	-	28.9	222.0	21.0	123.0	201.0
Total	300.0	259.5	304.1	296.9	281.4	264.8	228.0	235.2	271.0	218.0
Oil, gal.	8.2	6.8	9.8	9.7	14.3	8.8	11.5	8.5	9.7	7.5
Transmission grease, lb.	-	-	-	-	39.8	3.4	-	1.0	14.7*	6.5
Hard oil, lb.	-	-	-	-	17.4	2.4	-	4.0	7.9*	11.6

*Average of farms reporting.

Table 3

Size of Implement and Acres Covered per Hour for Drawbar Operations, 1933 and 1934

Operation: Tractor Number	Tractor Size	Plowing Size	Plowing Acres	Disking Size	Disking Acres	Springtooth harrowing Size	Springtooth harrowing Acres	Field Cultivating Size	Field Cultivating Acres	Harrowing Size	Harrowing Acres	Seeding grain Size	Seeding grain Acres
3122	2-plow	2-14"	.78	-	-	8'	3.20	-	-	-	-	-	-
1132	2-plow	-	-	-	-	-	-	9'	3.20	-	-	11'	2.87
1032	2-plow	2-14"	.98	10'	3.43	-	-	-	-	-	-	-	-
1152	2-plow	2-14"	.56	8'	1.92	-	-	9'	3.51	18'	5.38	-	-
1012	2-plow	2-14"	.89	8'	3.52	-	-	9'	2.49	14'	8.00	-	-
1182	2-plow	2-16"	.90	8'	3.48	-	-	-	-	23'	9.07	-	-
1112	2-plow	2-14"	.85	8'	2.00	8'	2.80	-	-	20'	10.47	-	-
2022	2-plow	2-16"	.92	9'	3.03	9'	2.91	-	-	9'	3.57	10'	2.09
2192	2-plow	2-14"	.83	8'	2.76	-	-	12'	1.67	22'	6.40	14'	4.57
1192	2-plow	2-14"	.94	-	-	-	-	9'	2.62	-	-	-	-
2132	2-plow	2-14"	.72	6'	2.17	-	-	7'6"	1.88	22'	10.25	-	-
1232	2-plow	2-14"	.98	14'	5.10	-	-	-	-	17'	5.75	-	-
1062	2-plow	2-16"	.87	15'	4.72	-	-	9'	3.25	22'	8.32	-	-
1082	2-plow	2-14"	.80	-	-	-	-	9'	2.03	22'	7.27	10'	3.78
1022	2-plow	2-14"	.65	-	-	-	-	-	-	-	-	-	-
Avg. 2-plow tractors, 1934			.83		3.21		2.97		2.58		7.45		3.33
Avg. 2-plow tractors, 1933			.85		3.30		-		2.60		8.02		3.32
2033	3-plow	3-14"	.89	10'	3.46	-	-	-	-	-	-	-	-
2233	3-plow	3-16"	1.25	-	-	-	-	10'	3.31	29'	7.94	-	-
2123	3-plow	3-14"	1.07	-	-	-	-	-	-	-	-	-	-
1123	3-plow	3-16"	1.35	-	-	10'	3.93	9'6"	3.00	-	-	-	-
1153	3-plow	3-16"	1.23	8'	2.38	-	-	-	-	-	-	-	-
2023	3-plow	3-14"	1.13	9'	2.53	-	-	-	-	-	-	-	-
1133	3-plow	3-16"	1.36	-	2.24	-	-	-	-	-	-	-	-
1073	3-plow	4-14"	1.56	-	-	-	-	-	-	-	-	-	-
2183	3-plow	3-14"	1.05	17'	5.57	22'	3.49	-	-	-	-	-	-
2133	3-plow	3-16"	1.28	10'	3.79	-	-	9'	3.45	22'	9.29	14'	4.00
Avg. 3-plow tractors, 1934			1.22		3.33		3.71		3.25		8.62		4.00
Avg. 3-plow tractors, 1933			1.36		3.16		-		3.11		-		3.52

(Table 3 continued)

Tractor Number	Tractor Size	Cutting grain Size	Cutting grain Acres	Planting corn Size	Planting corn Acres	Cultivating corn Size	Cultivating corn Acres	Cutting corn Size	Cutting corn Acres	Picking corn Size	Picking corn Acres	Mowing hay Size	Mowing hay Acres
3122	2-plow	-	-	-	-	-	-	-	-	-	-	-	-
1132	2-plow	10'	2.95	4-row	3.00	-	-	-	-	-	-	7'	2.22
1032	2-plow	8'	1.20	-	-	-	-	-	-	-	-	-	-
1152	2-plow	8'	2.00	-	-	2-row	1.80	-	1.91	-	-	-	-
1012	2-plow	6'	1.87	-	-	-	-	-	-	-	-	-	-
1182	2-plow	-	2.22	4-row	1.94	2-row	1.90	-	-	-	-	-	-
1112	2-plow	8'	2.48	-	-	-	-	1-row	1.00	1-row	.85	-	-
2022	2-plow	10'	1.81	-	-	2-row	2.24	1-row	1.11	-	-	-	-
2192	2-plow	10'	1.79	-	-	-	-	1-row	1.23	-	-	-	-
1192	2-plow	8'	-	-	-	-	-	-	-	-	-	-	-
2132	2-plow	-	.97	4-row	2.54	2-row	1.71	-	-	1-row	.94	7'	3.19
1232	2-plow	6'	2.55	-	-	2-row	1.57	-	-	-	-	7'	2.33
1062	2-plow	8'	2.14	-	-	2-row	2.79	1-row	1.65	2-row	1.31	-	-
1082	2-plow	8'	1.66	3-row	2.16	3-row	3.81	1-row	1.06	1-row	1.01	-	-
1022	2-plow	8'	-	-	-	2-row	1.72	-	-	-	-	-	-
Avg. 2-plow tractors, 1934			1.97		2.41		2.19		1.33		1.03		2.58
Avg. 2-plow tractors, 1933			1.45		2.73		2.29		.82		.80		-
2033	3-plow	-	-	-	-	-	-	-	-	-	-	-	-
2233	3-plow	8'	2.00	-	-	-	-	-	-	-	-	-	-
2123	3-plow	10'	2.16	-	-	-	-	-	-	1-row	1.14	-	-
1123	3-plow	-	-	-	-	-	-	-	-	-	-	-	-
1153	3-plow	-	-	-	-	-	-	-	-	-	-	-	-
2023	3-plow	-	-	-	-	-	-	-	-	-	-	-	-
1133	3-plow	-	-	-	-	-	-	-	-	-	-	-	-
1073	3-plow	-	-	-	-	-	-	-	-	-	-	-	-
2183	3-plow	8'	2.19	-	-	2-row	1.69	-	-	-	-	-	-
2133	3-plow	-	-	-	-	-	-	-	-	-	-	-	-
Avg. 3-plow tractors, 1934			2.12		-		1.69		-		1.14		-
Avg. 3-plow tractors, 1933			1.70		-		2.17		-		.99		-

Table 4

Size of Implement and Rate of Performance per Hour for Belt Operations, 1933 and 1934

Operation: Tractor		Grinding feed		Shelling corn		Filling silo		Threshing	
Number	Size	Mill	Pounds per hour	Type	Bushels per hour	Size	Tons per hour	Size	Bushels per hour
3122	2-plow	--	--	--	--	16"	7.9	--	--
1132	2-plow	--	--	Cylinder sheller	46.0	--	--	--	--
1032	2-plow	10"	1898	--	--	--	--	--	--
1152	2-plow	--	--	--	--	--	--	--	--
1012	2-plow	10"	1120	--	--	--	--	--	--
1182	2-plow	--	--	--	--	--	--	--	--
1112	2-plow	Letz 109X	1116	Cylinder	54.6	--	--	--	--
2022	2-plow	10"	863	--	--	--	--	--	--
2192	2-plow	Feed mill	857	--	--	14"	6.9	22"	44.4
1192	2-plow	Hammer	2688	--	--	Papec cutter	10.7	22"	156.7
2132	2-plow	Hammer	1573	--	--	--	--	--	--
1232	2-plow	--	--	--	--	--	--	--	--
1062	2-plow	10"	2012	2-hole	45.6	16"	5.0	22"	82.4
1082	2-plow	10"	1770	--	--	14"	10.0	26"	56.5
1022	2-plow	--	--	Cylinder	55.4	--	--	28"	43.1
Avg. 2-plow tractors, 1934			1544		50.4		8.1		76.6
Avg. 2-plow tractors, 1933			2254		93.0		8.7		128.0
2033	3-plow	10"	1670	--	--	--	--	--	--
2233	3-plow	--	--	--	--	16"	14.06	28-46	50.0
2123	3-plow	8"	1718	--	--	--	5.76	28"	71.5
1123	3-plow	--	--	--	--	--	7.4	--	--
1153	3-plow	Hammer	2391	--	--	16"	19.05	28"	108.0
2023	3-plow	10"	510	--	--	--	--	30"	52.7
1133	3-plow	17"	1967	--	--	16"	10.0	28-46	34.1
1073	3-plow	10" Letz	1190	--	--	16"	9.78	--	--
2183	3-plow	--	1956	--	--	--	5.07	--	123.5
2133	3-plow	Hammer	1928	Cylinder No. 2	104.9	--	--	--	--
Avg. 3-plow tractors, 1933			1666		104.9		10.16		73.3
Avg. 3-plow tractors, 1934			1889		160.0		12.40		138.0