UNIVERSITY OF MINNESOTA
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TRACTOR COSTS AND RATES OF PERFORMANCE

A preliminary report of data secured in 1933 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 fourteen farm tractors submitted records covering the cost of operating their tractors and the amount of work done by them during the year 1933 to the Minnesota Agricultural Experiment Station. These records are from eleven farms. On three of these farms, two tractors were used. Since some of these records were started during the year, only seven of the fourteen records cover the full calendar year of 1933. The distribution of tractors by makes is as follows: Farmall 20, 5; John Deere 10-20, 3; Farmall 30, 2; McCormick-Deering 10-20, 2; John Deere 15-27, 1; and Case Model L, 1. The date of purchase of these tractors was as follows: 1926, 1; 1928, 2; 1929, 2; 1930, 2; 1931, 5; and 1932, 2. 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 of the average value of the tractor in 1933. Costs for each individual tractor are shown and also averages for each size group. A wide variation in several items of operating cost is apparent, especially in fuel. Farms using a large proportion of distillate had a relatively low fuel cost. Variations in both cash and labor cost for repairs reflects the fact that the amount of repairs for any particular year varies widely. There is a slight omission in the cost for tractors 62 and 63 in that no cylinder oil is reported. Fixed charges vary with the amount of work done annually and also with the age of the tractor. There is also undoubtedly some difference due to variations in the farmer's estimate as to the probable life of his tractor.

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 fields, 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. Both springtooth harrows and field cultivators were used for the operation listed as "field cultivating". In some cases, one or two-section harrows were used behind the plows, disks, field cultivators, and drills, but this did not seem to affect the rate materially. 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. In one case silage was reported in terms of loads. These loads were estimated at one ton per load. 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.

Table 1

Cost per Hour of Operating Two-Plow Tractors - 1933

Tractor Number:	42	92	102	62	22	Average
Operating Cost:						
Fuel	$.172	$.105	$.174	$.102	$.154	$.141
Lubricants	.026	.046	.067	.011	.036	.037
Labor	.011	.021	.012	.031	.021	.019
Cash repairs	-	.006	-	.037	.079	.025
Total	.209	.178	.253	.181	.290	.222
Fixed Charges:						
Depreciation	.469	.212	.131	.194	.159	.233
Interest at 8% on average value	.293	.093	.071	.067	.028	.110
Total	.762	.305	.202	.261	.187	.343
Total cost per hour	$.971	$.483	$.455	$.442	$.477	$.565
Hours of work per year	177	556¼	565	643	994½	587
Labor and Materials per 100 Hours:						
Servicing, hrs.	4.2	4.0	4.9	4.7	7.9	5.1
Repairing, hrs.	-	4.3	-	7.5	0.7	3.1
Fuel: Gasoline, gal.	31	8	77	27	128	54
Kerosene, gal.	76	-	11	-	22	22
Distillate, gal.	111	130	118	103	-	92
Total	217	138	206	130	150	168
Oil, gal.	3.4	5.1	10.0	-	4.8	-
Transmission grease, lb.	-	7.2	-	9.6	-	-
Hard oil, lb.	2.8	13.1	1.8	3.1	12.1	6.8

Table 2

Cost per Hour of Operating Three-Plow Tractors - 1933

Tractor Number:	93	63	Average
Operating Cost:			
Fuel	$.164	$.155	$.160
Lubricants	.068	.005	.036
Labor	.012	.018	.015
Cash repairs	.046	.019	.033
Total	.290	.197	.244
Fixed Charges:			
Depreciation	.245	.210	.227
Interest at 8% on average value	.108	.092	.100
Total	.353	.302	.327
Total cost per hour	$.643	$.499	$.571
Hours of work per year	612¾	714½	664
Labor and Materials per 100 Hours:			
Servicing, hrs.	3.1	6.0	4.5
Repairing, hrs.	1.6	1.3	1.5
Fuel: Gasoline, gal.	9	24	17
Kerosene, gal.	-	-	-
Distillate, gal.	209	193	201
Total	218	217	218
Oil, gal.	7.5	-	-
Transmission grease, lb.	11.3	1.7	6.5
Hard oil, lb.	20.7	2.5	11.6

Table 3

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

Operation:		Plowing		Disking		Field Cultivating		Harrowing		Seeding Grain	
Tractor number	Size tractor	Size	Acres	Size	Acres	Size	Acres	Size	Acres	Size	Acres
62	2-plow	2-14"	.68	-	-	9'	3.09	22'	9.57	14'	3.87
112	2-plow	2-14"	.78	14' single	4.47	8'6"	3.07	22'	7.68	-	-
22	2-plow	2-14"	.74	-	-	9'	2.43	-	-	10'	2.76
92	2-plow	2-16"	.87	8' tandem	3.50	-	-	23'	6.30	-	-
32	2-plow	3-14"	.98	7' single	2.21	8'	1.86	20'	8.56	-	-
102	2-plow	2-14"	.99	8' tandem	2.48	10'	2.42	-	-	-	-
12	2-plow	2-14"	.84	8' tandem	4.00	9'	2.69	14'	8.00	-	-
82	2-plow	2-14"	.71	8' tandem	3.11	10'	3.00	-	-	-	-
42	2-plow	2-14"	.92	-	-	8'	2.25	-	-	-	-
72	2-plow	2-14"	.99	-	-	-	-	-	-	-	-
63	3-plow	3-16"	1.05	10' tandem	3.51	-	-	-	-	14'	3.52
-	-	-	-	8' tandem	2.91	-	-	-	-	-	-
53	3-plow	3-14"	.98	15' single	3.52	8'6"	2.42	-	-	-	-
-	-	-	-	8' single	1.66	-	-	-	-	-	-
93	3-plow	3-14"	1.03	8' tandem	2.71	9'	2.62	-	-	-	-
73	3-plow	3-16"	1.47	10' tandem	4.67	10'	4.30	-	-	-	-

Table 3 (continued)

Operation:		Cutting Grain		Planting Corn		Cultivating		Cutting Corn		Picking Corn	
Tractor number	Size tractor	Size	Acres	Size	Acres	Size	Acres	Size	Acres	Size	Acres
62	2-plow	-	-	4-row	2.12	2-row	1.82	-	-	1-row	.80
112	2-plow	6'	1.93	3-row	3.07	3-row	3.46	1-row	.81	-	-
22	2-plow	8'	1.78	-	-	2-row	1.98	-	-	-	-
92	2-plow	6'	1.57	4-row	3.01	2-row	1.89	1-row	.81	-	-
32	2-plow	7'	1.46	-	-	-	-	1-row	.80	-	-
102	2-plow	8'	2.53	-	-	-	-	-	-	-	-
12	2-plow	-	-	-	-	-	-	-	-	-	-
82	2-plow	-	-	-	-	-	-	-	-	-	-
42	2-plow	-	-	-	-	-	-	-	-	-	-
72	2-plow	-	-	-	-	-	-	1-row	.90	-	-
63	3-plow	-	-	-	-	2-row	1.69	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
53	3-plow	10'	1.70	-	-	-	-	-	-	2-row	1.08
-	-	-	-	-	-	-	-	-	-	-	-
93	3-plow	-	-	-	-	4-row	2.65	-	-	-	-
73	3-plow	-	-	-	-	-	-	-	-	1-row	.90

Table 4

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

Operation:		Grinding Feed		Shelling Corn	Filling Silo		Threshing		Shredding	
Tractor number	Size tractor	Mill	Lbs. per hr.	Bu. per hr.	Size	Tons per hr.	Size	Bu. per hr.	Size	Bu. per hr.
62	2-plow	Hammer	1511	103	-	-	-	-	-	-
112	2-plow	8" burr	2976	-	16"	7.3	-	-	-	-
22	2-plow	10" burr	850	57	-	-	28"	109	2-roll	15.2
32	2-plow	10" burr	1456	72	-	-	-	-	-	-
102	2-plow	Hammer	2701	139	-	10.7	22"	146	-	-
82	2-plow	8" burr	1840	-	-	-	-	-	-	-
42	2-plow	8" burr	2680	-	12"	8.0	-	-	-	-
	-	10" burr	4016	-	-	-	-	-	-	-
63	3-plow	Hammer	1761	-	-	-	-	-	-	-
53	3-plow	8" burr	2023	160	-	-	28"	138	-	-
93	3-plow	-	-	-	15'	12.4	-	-	4-roll	23.1
73	3-plow	Hammer	1884	-	-	-	-	-	-	-

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.