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Cost of Operating Tractors in Nebraska, 1961

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COST OF



Operating Tractors

IN NEBRASKA

1961

Nebraska Agricultural Experiment Station
Cooperating with
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The Agricultural Experiment Station

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COST OF OPERATING TRACTORS IN NEBRASKA, 1961

T. S. Thorfinnson¹ and A. W. Epp²

INTRODUCTION

The last study on tractor power and cost of operation on Nebraska farms was published in 1939. Since then so many changes have been made in size of farms, farm machinery, and tractor design and efficiency that current information is needed to bring cost estimates up to date for farmers, county agents, research workers, and many agencies indirectly interested in agriculture.

This study was to obtain information on cost and performance of the kinds and sizes of tractors in most general use in Nebraska. Of importance also were the number of hours of use per tractor and the kinds of work performed in the field and elsewhere.

PROCEDURE

Information on tractors was gathered from a study of tillage machinery on 374 farms in 1959, providing data on the number, size, kind, and age of tractors on farms in eastern, southcentral, and south-western Nebraska. Based on this information, a sample was selected which included one group of tractors rated at 20-29 drawbar horsepower,³ a second group having 30-39 horsepower, and a third group with 40-49 horsepower. This sample was drawn from farmers previously interviewed to obtain costs for tillage machines. Preference was given tractors having meters but many of the tractors studied did not have meters. The sample included 49 small tractors, 45 of medium size, but only 21 large tractors. The information was obtained for 1961 through personal interview with farmers.

The information supplied by farmers for each tractor for the 1961 season included purchase price, cost of shelter, repairs, grease, oil, and fuel as well as time required in daily servicing. Total hours of use and acreage covered in 1961 were obtained. Use included odd jobs performed by the tractor such as feed grinding, hauling, trips to town, etc. Depreciation was computed by subtracting the trade-in value from the purchase price and dividing the remainder by the number of years the farmer expected to use the tractor from the year of pur-

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³ Rated at 75 percent of pull at maximum power—Nebraska Tractor Tests, Nebraska Agricultural Experiment Station.

Table 1. Distribution of farms by number of tractors per farm in eastern, south-central, and southwestern Nebraska, 1959.

Number of tractors per farm	Farms reporting	
	Number	Percent
1	73	20
2	188	50
3	86	23
4	20	5
5	5	1
6+	2	1
Total	374	100

chase until it would be traded. Interest on the investment was calculated at 5 percent, taxes at current rates for personal property in Nebraska, and insurance at average rates, all based on the average value of the tractor during its estimated life. The operator's labor was assumed to be worth \$1.25 per hour. Average state prices were used for grease at 20 cents per pound, propane fuel at 12 cents, tractor fuel and diesel fuel at 16 cents per gallon, gasoline at 19 cents per gallon, and oil at 24 cents per quart. The purchase price of each machine was based on the price paid by the farmer, adjusted to 1961 value by use of the general index of cost of motor vehicles as indicated by information provided by the United States Department of Agriculture.

TRACTOR POWER ON FARMS, 1959

Among the 374 farmers included in the 1959 machinery study, half of the farmers had two tractors; one-fifth had one tractor, and nearly one-fourth had three (Table 1). Horsepower ratings varied among farms and sub-areas (Table 2). In eastern Nebraska nearly half of the tractors had 20 horsepower or less. Slightly over one-third rated 20-29 horsepower. In southcentral Nebraska 40 percent rated 20-29 horsepower, with nearly one-fourth rated at 30-39 horsepower and slightly over one-fourth, 20 horsepower or less. Larger tractors predominate in

Table 2. Distribution of tractors by drawbar horsepower in three areas in Nebraska, 1959.

Drawbar ^a horsepower	Eastern ^b		Southcentral ^c		Southwestern ^d		Total three areas	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
0-20	161	48	41	28	17	7	219	30
21-30	121	36	59	40	63	25	243	33
31-40	45	13	34	23	96	39	175	24
41-50	8	3	10	7	53	22	71	10
50+	...	...	3	2	17	7	20	3
Total	335	100	147	100	246	100	728	100

^a Rated at 75 percent of pull at maximum power—Nebraska Tractor Tests.

^b Includes Wayne, Dodge, Johnson, Pawnee, and Lancaster Counties.

^c Includes York, Thayer, and Adams Counties.

^d Includes Kimball, Cheyenne, and Perkins Counties.

Table 3. Distribution of farms by average age of tractors per farm, in eastern, south-central, and southwestern Nebraska, 1959.

Average age of tractors	Farms reporting	
	Number	Percent
(years)		
0-5	51	15
6-10	151	44
11-15	92	27
16-20	37	11
21 or more	10	3
Total	341	100

southwestern Nebraska. Thirty-nine percent had 30-39 horsepower, about one-fourth 20-29 horsepower, and more than one-fifth had 40-49 horsepower.

On 59 percent of the farms the tractors averaged 10 years old or less. Very few were more than 15 years old (Table 3). This indicated it would be desirable to study the cost of owning and operating tractors of fairly recent make and model to best represent those on Nebraska farms.

The relation of tractors to size of farm indicates that the number of tractors, average age, and drawbar horsepower are adjusted, at least to some extent, to the crop acres per farm (Table 4). Horsepower per farm tends to rise with an increase in crop acres as does also the number of tractors per farm. Newer models appear to be associated with larger acreages. Comparison of the three sub-areas indicates that in eastern Nebraska tractors are older and horsepower per farm is lower than in southcentral and southwestern Nebraska. This is consistent with the average acreage in crops in these areas.

COST OF OPERATING TRACTORS, 1961

The drawbar horsepower (at 75 percent of maximum pull) varied from 20-29 for the small tractors, to 30-39 for the medium tractors, and 40-49 for the large tractors. Average drawbar horsepower for these groups was 24, 34, and 43, respectively. The average purchase price per tractor, in the same order, was \$2,163, \$3,204, and \$4,492 and the average estimated life was 16 years for the small tractors and 13 years for the other two sizes. Life estimates represent the period from purchase to trade-in. Most farmers planned to trade in their tractors before they were worn out.

The tractors studied were used for the usual plowing, planting, tillage, and harvesting. Most tractors were also used for grinding and hauling feed as well as a number of other chores (Table 5). For the small tractors chore time averaged 19 percent of the total hours of use, but only 15 percent for the medium and large tractors.

The average annual fixed cost per tractor increases as horsepower

Table 4. Relation of crops per farm to numbers, age, and horsepower of tractors per farm, Nebraska, 1959.^a

Acres in crops		Farms reporting	Tractors per farm	Average age of tractors	Drawbar ^b horsepower	Crop acres per horsepower
Range	Average					
		No.	No.	Years		
<i>Eastern Nebraska</i>						
0-100	81	13	1.7	14	32	2.5
101-200	158	78	2.0	11	45	3.5
201-300	264	37	2.1	10	55	4.8
301-400	363	17	2.8	10	69	5.3
401-1250	602	8	3.4	11	87	6.9
Avg. 0-1250	223	153	2.18	11	52	4.3
<i>Southwestern Nebraska</i>						
0-500	379	20	1.8	10	54	7.0
501-750	639	27	2.1	10	68	9.4
751-1000	886	22	2.0	8	73	12.1
1001-1250	1142	16	2.1	10	77	14.8
1251-8900	2243	28	2.8	9	103	21.8
Avg. 0-8900	1092	113	2.18	10	77	14
<i>Southcentral Nebraska</i>						
101-200	161	23	1.8	12	42	3.8
201-300	254	18	1.8	9	47	5.4
301-400	346	14	2.4	8	65	5.3
401-500	457	6	2.2	8	56	8.2
501-1120	722	7	4.0	9	131	5.5
Avg. 101-1120	308	68	2.18	10	59	5.2

^a Based on information from Wayne, Dodge, Johnson, Pawnee, Lancaster, York, Thayer, Adams, Kimball, Cheyenne, and Perkins Counties.

^b Seventy-five percent of maximum drawbar horsepower as reported in Nebraska Tractor Tests.

increases (Table 6). The same is true of the average number of hours that the tractors are used. The average hourly cost of operation is no higher for the large tractors than for the medium size. This apparent discrepancy is explained by the fact that most of the tractors in the small and medium groups burn gasoline, while most of the large

Table 5. Annual use by kinds of work for small, medium and large tractors in eastern and southcentral Nebraska, 1961.^a

Kind of work	20-29 DB H.P.		30-39 DB H.P.		40-49 DB H.P.	
	Acres (once over)	Hours	Acres (once over)	Hours	Acres (once over)	Hours
Plowing	79	73	127	81	151	71
Planting	89	30	113	33	158	42
Tillage operations ^b	613	174	1,021	201	1,335	251
Harvesting	192	115	184	106	220	116
Miscellaneous ^c	40	15	117	35	156	47
Other work ^d	...	97	...	81	...	88
Total	1,013	504	1,562	537	2,020	615

^a Averages for 49 tractors in the 20-29 H.P. group, 45 in the 30-39 H.P. group and 21 in the 40-49 H.P. group.

^b Disking, harrowing, cultivating, rotary hoeing.

^c Includes field chopping, sweeping, threshing, filling silo, stacking.

^d Mostly grinding and hauling feed.

Table 6. Annual cost of operating small, medium and large tractors in eastern and southcentral Nebraska, 1961.

Item	20-29 DB H.P.		30-39 DB H.P.		40-49 DB H.P.	
	Total	Per hour	Total	Per hour	Total	Per hour
Number of tractors	49	...	45	...	21	...
Average investment*	\$2,163	...	\$3,204	...	\$4,492	...
Annual use—hours	504	...	537	...	615	...
Fuel used—gallons	1,029	2.04	1,253	2.32	1,404	2.28
<i>Annual Cost of Operation in Dollars</i>						
Fixed cost						
Depreciation	117	0.23	206	0.38	286	0.46
Interest	63	.12	99	.18	146	.24
Taxes, shelter, and insurance	30	.06	43	.08	57	.09
Total	210	.41	348	.64	489	.79
Variable cost						
Repairs	79	.16	96	.18	57	.09
Grease, oil, servicing	49	.10	47	.09	45	.07
Fuel	188	.37	228	.42	231 ^b	.38 ^b
Total	316	.63	371	.69	333	.54
Total operating cost	526	1.04	719	1.34	822	1.34

* Price paid by farmers for tractors, adjusted to 1961 price level.

^b Mostly diesel fuel.

tractors burn diesel fuel (Table 7). Diesel fuel costs 3 cents less per gallon than gasoline and is consumed at a lower rate by one-fourth gallon per hour for similar sized tractors. If gasoline were substituted for diesel fuel for the group of large tractors the average cost would probably rise to over \$1.50 per hour. Hourly fuel consumption seems low, but farmers' estimates of hours of annual use included some idling time and considerable use on light loads.

Among individual tractors, depreciation, repair bills and rate of fuel consumption varied considerably. The same is true of a number of smaller expense items such as shelter, servicing, and lubricating oil. However, the factor which probably had most influence on average cost per hour was amount of use. The hours each tractor was used during the year varied from 200 to 1,000; costs per hour varied accordingly.

It cost approximately \$1.83 per hour to operate small tractors used only 200 hours per year (Table 8). Operating the same tractors 1,000 hours annually would reduce the cost to 78 cents per hour. The same tendency prevails for medium and large tractors. The figures in Table

Table 7. Fuel required per hour for small, medium and large tractors, eastern and southcentral Nebraska, 1961.

Kind of fuel	20-29 DB H.P.		30-39 DB H.P.		40-49 DB H.P.	
	Farms reporting	Gallons per hour	Farms reporting	Gallons per hour	Farms reporting	Gallons per hour
Gasoline	38	1.99	33	2.46	4	2.85
Tractor fuel	9	2.24	...	...	...	...
Diesel	...	...	9	1.79	16	2.10

Table 8. Cost of operating tractors related to number of hours of annual use, eastern and southcentral Nebraska, 1961.^a

Hours of use	Operating cost per hours in dollars		
	20-29 DB H.P.	30-39 DB H.P.	40-49 DB H.P.
	49 Tractors	45 Tractors	21 Tractors
200	1.83	...	...
300	1.39	1.88	2.25
400	1.17	1.57	1.80
500	1.04	1.38	1.54
600	0.95	1.26	1.36
700	.89	1.17	1.24
800	.85	1.11	1.14
900	.81	1.05	1.06
1,000	.78	1.01	1.00

^a Costs are calculated on data furnished by the cooperating farmers. Costs include depreciation, interest on investment, taxes, insurance, shelter, repairs, fuel and oil but no labor costs.

8 were calculated from the cost data and amount of use reported by the 115 farmers. Spreading the fixed costs over more hours of use materially decreases the cost per hour.

EFFECT OF INCREASED POWER ON COST PER ACRE

Large tractors usually cost more per hour to operate than small tractors, but they also pull machinery that covers more acres per hour. Power and labor costs per acre are usually lower for large tractors (Table 9). Comparative costs per acre are given for only four machines but the principle in varying degrees applies to all machines, provided the load is adjusted to the horsepower. Little difference is noted in the cost of the machine per acre but power cost per acre is appreciably less for larger machines. The difference in labor cost is even greater. For example, the combined cost of power and labor per acre for four-

Table 9. Cost per acre of selected field operations with various sizes of machines, Nebraska, 1961.^a

Kind of machine	Acres per hour	Cost per acre in dollars			
		Machine	Power	Labor	Total
Plow					
2 b-14"	1.04	0.65	1.00	1.20	2.85
3 b-14"	1.61	.34	0.83	0.78	1.95
5 b-16"	3.48	.32	.39	.36	1.07
Cornplanter surface					
2-row	2.89	.32	.36	.43	1.11
4-row	5.26	.34	.25	.24	0.83
Corn cultivator					
2-row	2.27	.15	.46	.55	1.16
4-row	4.88	.16	.27	.26	0.69
Grain drill					
14 ft.	4.93	.28	.26	.25	.79
28 ft.	9.90	.34	.13	.13	.60

^a Based on tractor costs in Table 6, machine costs in Nebraska Bulletin SB 475 "Cost of Operating Tillage and Harvesting Machinery in Nebraska." Labor was valued at \$1.25 per hour.

row corn equipment is about half as much as for two-row equipment.

The use of large equipment results in a saving in labor and power which gives the farm family increased opportunity to farm more acres, keep more livestock, seek other part-time employment, or enjoy more leisure time, depending on circumstances and preferences. Not to be overlooked is the effect of large equipment on timeliness of farming operations, especially at planting or harvest time. When weather is unfavorable, this may materially affect crop yields and, consequently, profits. Some machines and equipment operate effectively only with a large tractor. The opportunity cost of labor must also be considered. The returns to labor from alternative work (such as cattle feeding) may be substantially higher than the \$1.25 per hour wage assumed for this study.

APPENDIX

Table 10. Miscellaneous information on farms surveyed in eastern and southcentral Nebraska, 1961.

	Tractors		
	20-29 DB H.P.	30-39 DB H.P.	40-49 DB H.P.
Estimated life of tires in years			
Drivers	9	7	6
Front	6	6	6
Percentage tread wear on tires when traded	80%	76%	75%
Cost of tires per set			
Drivers	\$198	\$225	\$255
Front	35	39	42
Reason for choosing this tractor	No. rptg.	No. rptg.	No. rptg.
Fits machinery	21	11	5
Liked this make	18	11	8
Best buy	12	12	4
Needed bigger tractor	...	11	2
Good service	...	9	2
Miscellaneous	9	10	5
Total	60	64	26
Distance to parts dealer:			
Average (miles)	10	10	11
Range (miles)	1 to 30	1 to 28	3 to 33
Average tractor horsepower per farm (all tractors)	49.15	60.89	94.49
Average tractor hours per farm	989	977	1,507
Average number of crop acres per farm	199	259	462
Average number of tractor hours per crop acre	5.0	3.8	3.3
Crop acres per horsepower	4.0	4.2	4.9
Tractor hours per horsepower	20	16	16

Table 11. Miscellaneous information on small, medium and large tractors, eastern and southcentral Nebraska, 1961.

Average per tractor	20-29 DB H.P.	30-39 DB H.P.	40-49 DB H.P.
Purchase price, dollars ^a	2,163	3,204	4,492
Estimated life, years	16	13	13
Annual charge for shelter, dollars	8.88	9.63	9.16
Daily servicing time, minutes	19	18	15
Number of quarts of oil, 1961	60	60	68
Number of filter elements, 1961	6	6	6
Fuel as percentage of total operating cost	36	32	27

^a Price paid by farmers adjusted to the 1961 price level.