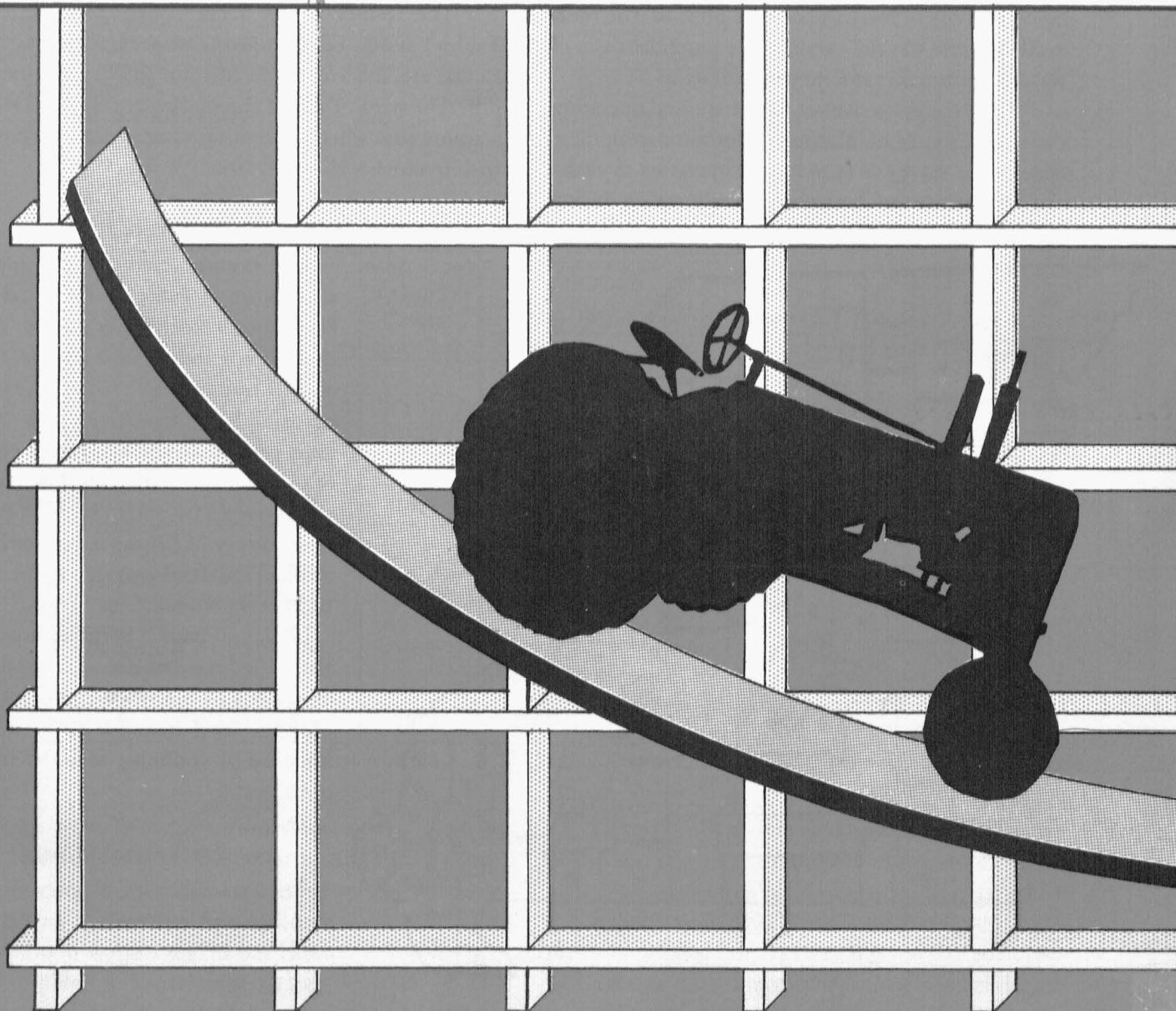


farm

# TRACTOR COSTS

COST DOLLARS PER HOUR



HOURS USED ANNUALLY

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE  
AGRICULTURAL EXPERIMENT STATION

J. H. LONGWELL, *Director*

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# FARM TRACTOR COSTS

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With the continued mechanization of various farming operations, the selection of the most suitable type of tractor for a particular enterprise is of increasing importance. Some factors which will affect the choice of a tractor are (1) the size of the farming operation, (2) the power requirements of the machines to be operated, (3) the comparative price of the fuels available, and (4) the comparative purchase costs of the different makes and models of tractors.

Tractor costs consist of fixed costs and operating costs. One source of information for estimating these costs was a survey of farm tractor operators made by the Department of Agricultural Engineering during

the winter of 1952-53. More than 1000 operators returned a post card questionnaire with information regarding the make, model, age, annual use, repair costs, and fuel and oil consumption and cost for their tractors. Figure 1 indicates the number and location of the tractors.

The results of the survey are summarized in Tables 1 and 2. Table 1 shows the average age, average annual use, and average oil costs for gasoline tractors of different sizes. Table 2 shows the average gasoline consumption when performing some typical operation with tractors of different sizes.

## Average Fuel Prices

The average cost for gasoline, also shown in Table 2, was found to be about 19.5 cents per gallon. Although not shown in the table, the cost of tractor fuel (distillate) as reported by 51 operators was 14.6 cents per gallon, and an average price of 13.5 cents per gallon for diesel fuel was reported by 5 operators. A previous survey of LP gas tractor operators had indicated an average price of 10.5 cents per gallon for LP gas.

LP gas (liquefied petroleum gas), also called bottled gas, is a mixture of gaseous hydrocarbons, principally propane and butane. It is kept liquefied by confining it under high pressures.

## Average Tractor Costs

The estimated average costs of owning and operating gasoline, diesel and LP gas tractors of different sizes are summarized in Table 3. The basis for determining these costs is explained below. It must be emphasized that the costs in the table are

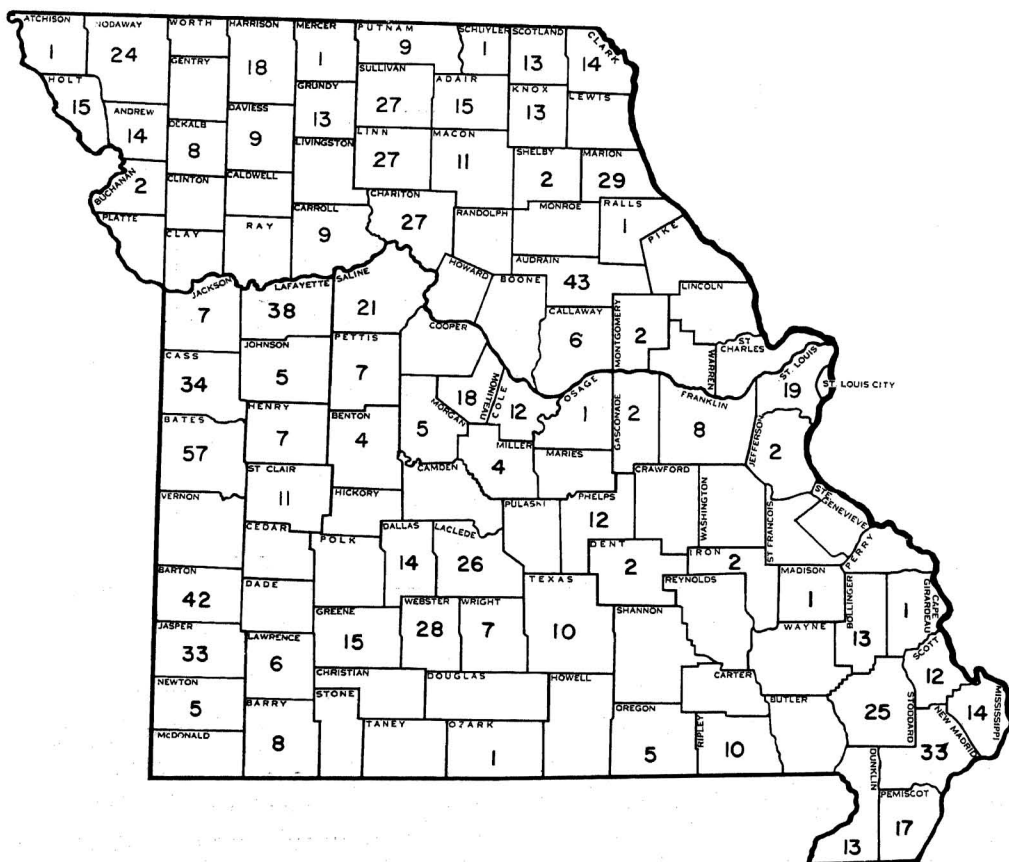


Fig. 1—As an aid in determining farm tractor costs, a survey of tractor operators was made during the winter of 1952-53. The number and location of the tractors included in the survey are indicated on this map.

TABLE 1 -- AGE, ANNUAL USE, AND OIL COSTS FOR GASOLINE-BURNING WHEEL TRACTORS

Size of Tractor	No. of Tractors	Avg. Age, Years	Avg. Ann. Use, Hours	Avg. Hours Between Oil Changes	Avg. Cost of Oil - Dollars per Gallon
Light 1-plow Less than 10 Rated DBHP	39	9.3	565	181	\$1.11
Reg. 1-plow 12-15 Rated DBHP	96	7.4	885	128	1.06
Light 2-plow 16-18 Rated DBHP	369	5.1	958	142	1.03
Reg. 2-plow 19-21 Rated DBHP	234	6.6	1251	117	0.98
3-plow 22-28 Rated DBHP	226	4.5	1257	106	0.96

TABLE 2 -- FUEL CONSUMPTION AND FUEL COSTS FOR GASOLINE-BURNING WHEEL TRACTORS

Size of Tractor	No. of Tractors	Avg. Cost of Gaso.- Cents per Gal.	Avg. Fuel Consumption, Gal./10-hour Day			
			Plowing	Disking	Planting	Cultivating
Light 1-plow Less than 10 Rated DBHP	39	19.3	11.1	9.9	6.2	7.3
Reg. 1-plow 12-15 Rated DBHP	96	19.7	12.4	11.3	8.9	8.8
Light 2-plow 16-18 Rated DBHP	369	19.6	14.8	13.5	9.4	10.4
Reg. 2-plow 19-21 Rated DBHP	234	19.5	17.7	16.5	11.8	12.5
3-plow 22-28 Rated DBHP	226	19.3	23.7	22.0	15.4	16.3

average costs. Where the annual use, average load, or the fuel prices on individual farms differ from those assumed in the table, the actual costs will be different.

#### Fixed Costs

Fixed costs of a tractor include depreciation, repairs, interest, housing, insurance, taxes, and cost of fuel storage facilities and fuel transfer equipment. The charges for these items were estimated as follows:

*Depreciation* was computed by dividing 90 percent of the first cost by the estimated years of life. (Junk value was assumed to be 10 percent of the first cost.) Purchase costs given in Table 3 are averages of 1953 prices for several tractors of each given size and type. The average life of tractors of 2-plow size and larger was estimated to be 10 years when used 1000 hours per year. This estimate is based on the results of the survey and other available information. Missouri farm-

TABLE 3 -- ESTIMATED COSTS OF OWNING AND OPERATING WHEEL TRACTORS BURNING  
GASOLINE, PROPANE, OR DIESEL FUEL  
(Based on an annual use of 1000 hours and an assumed life of 10 years)

Tractor Size	New Cost* (1953) (\$)	Annual Fixed Cost (\$)	Fixed Cost Per Hour (\$)	Avg. Fuel** Consumption Per Hour (Gallons)	Avg. Fuel*** Cost Per Hour (\$)	Oil, Grease, and Servicing Cost per Hour (\$)	Total Operating Cost Per Hr. (\$)	Total Operating and Fixed Cost Per Hour (\$)
GASOLINE TRACTORS								
Two 14-inch plows (16-21 rated DBHP)	1800	324	.32	1.7	.35	.08	.43	.75
Three 14-inch plows (22-28 rated DBHP)	2500	433	.43	2.2	.45	.09	.54	.97
Four 14-inch plows (29-35 rated DBHP)	3150	534	.53	2.7	.55	.11	.66	1.19
Five 14-inch plows (36-45 rated DBHP)	3800	634	.63	3.4	.70	.13	.83	1.46
DIESEL TRACTORS								
Two 14-inch plows (16-21 rated DBHP)	2400	417	.42	1.2	.16	.09	.25	.67
Three 14-inch plows (22-28 rated DBHP)	3200	541	.54	1.6	.22	.10	.32	.86
Four 14-inch plows (29-35 rated DBHP)	3850	641	.64	1.9	.26	.12	.38	1.02
Five 14-inch plows (36-45 rated DBHP)	4500	743	.74	2.4	.33	.14	.47	1.21
LP GAS TRACTORS								
Three 14-inch plows (22-28 rated DBHP)	2750	497	.50	2.8	.30	.08	.38	.88
Four 14-inch plows (29-35 rated DBHP)	3350	590	.59	3.5	.37	.10	.47	1.06
Five 14-inch plows (36-45 rated DBHP)	4000	690	.69	4.2	.45	.12	.57	1.26

\* Includes lights, hydraulic equipment and fluid in tires.

\*\* Based on average fuel consumption in Test E of Nebraska Tractor Tests for a representative group of tractors.

\*\*\* Includes an allowance for losses by evaporation and waste.

ers' estimates of average annual use ranged from 958 hours for small 2-plow tractors to 1257 hours for 3-plow tractors.

In a report by Brodell and Kendall<sup>1</sup> the average life of a tractor is estimated at 19 to 20 years. They also report that the average annual use for all wheel tractors throughout the United States is about 676 hours for tractors 10 years old or less, and about 570 hours for tractors 11 to 20 years old. Fenton and Fairbanks<sup>2</sup> report average annual uses ranging from 57 to 89 days for 2-plow, 3-plow, and 4-plow tractors. They estimate the life of these tractors at from 11.0 to 12.6 years. Assuming 10-hour days, this would indicate a useful life of from 7200 to 9000 hours. The Allis-Chalmers Manufacturing Company<sup>3</sup> estimates that 10,000 hours is a reasonable average length of life for tractors used with earth moving equipment.

*Annual repair costs* for farm tractors are quite variable, and will depend upon the care exercised by the operator in servicing and using the tractor as well as the size, type, age and hours of annual use.

Data supplied by the survey were incomplete, but did indicate that annual repair costs for gasoline tractors increase each year until about the sixth or seventh year at which time they tend to level off. As would be expected, repair costs for 3-plow tractors were found to be higher than for 2-plow tractors. Repair costs were also found to be related to the hours of annual use. Estimates of annual repair costs used in Tables 3, 5, 6, and 7 were based on the first cost of the tractor as well as the number of hours used annually. For gasoline and diesel tractors the average annual repair costs were estimated at 2 percent of the first cost plus 4 cents per hour of annual use. Annual repairs for LP gas tractors were estimated at 2 percent of the first cost plus 3 cents per hour of annual use.

*Interest on investment* was charged at the rate of 6 percent on the average investment (55 percent of first cost) and the total of the charges for *housing, insurance and taxes* was 4 percent on the average investment.

Though not included in the survey, these are important items and are often overlooked by farmers in determining costs for machinery.

*Fuel storage costs* depend upon the kind of fuel used. For tractors using gasoline or diesel fuel, the average investment in storage tanks and fueling equipment was estimated at about \$50. The life of the equipment was assumed to be about 15 years. Interest was computed at the rate of 6 percent on the average investment, and the cost of annual upkeep was estimated at about 1 percent of the purchase cost. For tractors using LP gas, the average investment in fuel storage tanks and fuel transfer equipment was estimated at \$500, and the life of the tank at 25 years. Interest and upkeep were computed on the same basis as for gasoline tanks.

### Operating Costs

Operating costs include the costs for fuel, oil, grease, and the labor for servicing the tractor (but not the labor for operating it).

*The cost for fuel* makes up the greatest part of the operating costs. The amount of fuel used will depend upon the size, type, and condition of the tractor and the extent to which it is loaded. All fuel consumption rates used herein are based on the averages of Test E of the official Nebraska Tractor Tests for a representative group of tractors of each size. It must be emphasized that tractors operating at maximum loads would consume 30 to 40 percent more fuel than has been assumed, and that tractors operating at lighter loads would consume less fuel than has been assumed. The costs for gasoline tractors were increased by 5 percent to allow for vaporization losses and waste. Losses by vaporization and waste for LP gas and diesel tractors were assumed to be negligible. Total fuel costs on gasoline are based at 19.5 cents per gallon, LP gas at 10.5 cents per gallon, and diesel fuel at 13.5 cents per gallon. In localities where fuel prices differ from these, the fuel costs will, of course, be different.

<sup>1</sup>Brodell, A. P. Kendall, A. R., Life of Farm Tractors, Bulletin F. M. 80, Bureau of Agricultural Economics, U. S. Department of Agriculture, June 1950

<sup>2</sup>Fenton, F. C. and Fairbanks, G. E., The Cost of Using Farm Machinery, Bulletin 74, Kansas State College Engineering Experiment Station, September 1954

<sup>3</sup>Allis-Chalmers Mfg. Company, Tractor Division, Earth Moving Construction Data, Third Edition, January 1953.

The costs for oil, grease, and servicing were based on oil at \$1 per gallon, grease at 10 cents per pound, and labor at \$1 per hour. Table 4 shows the estimated costs for these items for different sizes and types of tractors.

TABLE 4 -- ESTIMATED OIL, GREASE, AND SERVICING COSTS FOR TRACTORS OF DIFFERENT SIZES AND TYPES

	COSTS - CENTS PER HOUR			
	Oil	Grease	Servicing	Total
<u>GASOLINE TRACTORS</u>				
2-plow	2.0¢	2.5¢	3.5¢	8¢
3-plow	2.5	2.5	4.0	9
4-plow	3.5	2.5	5.0	11
5-plow	4.5	2.5	6.0	13
<u>DIESEL TRACTORS</u>				
2-plow	2.5	2.5	4.0	9
3-plow	3.0	2.5	4.5	10
4-plow	4.0	2.5	5.5	12
5-plow	5.0	2.5	6.5	14
<u>LP GAS TRACTORS</u>				
3-plow	1.5	2.5	4.0	8
4-plow	2.5	2.5	5.0	10
5-plow	3.5	2.5	6.0	12

#### Effect of Annual Use on Tractor Costs

The fixed cost of a tractor is affected somewhat by the amount of annual use, but not nearly so much as the operating cost. Of the three types compared in this study, diesel tractors have the highest fixed costs, followed by LP gas tractors and gasoline tractors. In the case of operating costs, the reverse is true. Operating costs for diesel tractors are lowest while those for gasoline tractors are highest.

Figure 2 shows the relationship between hours of annual use and cost per hour for 3-plow tractors using different fuels. Fixed and operating costs were computed as previously discussed. Tables 5, 6, and 7 show the various components which go to make up the costs shown in Figure 2.

TABLE 5 -- ESTIMATED COSTS FOR 3-PLOW GASOLINE TRACTORS  
FOR ANNUAL USES OF FROM 400 TO 1800 HOURS

Hours per year	400	500	650	800	1,000	1,300	1,800
Estimated life - years	16	16	14	12	10	8	6
Estimated life - hours	6400	8000	9100	9600	10,000	10,400	10,800
Depreciation	\$ 141	\$ 141	\$ 161	\$ 188	\$ 225	\$ 282	\$ 375
Repairs	66	70	76	82	90	102	122
Interest, Housing, Insurance and Taxes	112	112	112	112	112	112	112
Fuel Storage Costs	5	5	5	5	5	5	5
Ann. Fixed Costs	324	328	354	387	432	501	614
Fixed Cost per hour	.81	.66	.55	.48	.43	.39	.34
Fuel Cost per hour	.45	.45	.45	.45	.45	.45	.45
Oil, Grease & Serv. per hour	.09	.09	.09	.09	.09	.09	.09
Total Cost per hour	\$ 1.35	\$ 1.20	\$ 1.09	\$ 1.02	\$ .97	\$ .93	\$ .88

TABLE 6 -- ESTIMATED COSTS FOR 3-PLOW DIESEL TRACTORS  
FOR ANNUAL USES OF FROM 400 TO 1800 HOURS

Hours per year	400	500	650	800	1,000	1,300	1,800
Estimated life - years	16	16	14	12	10	8	6
Estimated life - hours	6400	8000	9100	9600	10,000	10,400	10,800
Depreciation	\$ 180	\$ 180	\$ 206	\$ 240	\$ 288	\$ 360	\$ 480
Repairs	80	84	90	96	104	116	136
Interest, Housing, Insurance and Taxes	144	144	144	144	144	144	144
Fuel Storage Costs	5	5	5	5	5	5	5
Ann. Fixed Costs	409	413	445	485	541	625	765
Fixed Cost per hour	1.02	.83	.69	.61	.54	.48	.43
Fuel Cost per hour	.22	.22	.22	.22	.22	.22	.22
Oil, Grease & Serv. per hour	.10	.10	.10	.10	.10	.10	.10
Total Cost per hour	\$ 1.34	\$ 1.15	\$ 1.01	\$ .93	\$ .86	\$ .80	\$ .75

TABLE 7 -- ESTIMATED COSTS FOR 3-PLOW LP GAS TRACTORS  
FOR ANNUAL USES OF FROM 400 TO 1800 HOURS

Hours per year	400	500	650	800	1,000	1,300	1,800
Estimated life - years	16	16	14	12	10	8	6
Estimated life - hours	6400	8000	9100	9600	10,000	10,400	10,800
Depreciation	\$ 155	\$ 155	\$ 177	\$ 206	\$ 248	\$ 310	\$ 413
Repairs	67	70	75	79	85	94	109
Interest, Housing, Insurance and Taxes	124	124	124	124	124	124	124
Fuel Storage Costs	40	40	40	40	40	40	40
Ann. Fixed Costs	386	389	416	449	497	568	686
Fixed Cost per hour	.97	.78	.64	.56	.50	.44	.38
Fuel Cost per hour	.30	.30	.30	.30	.30	.30	.30
Oil, Grease & Serv. per hour	.08	.08	.08	.08	.08	.08	.08
Total Cost per hour	\$ 1.35	\$ 1.16	\$ 1.02	\$ .94	\$ .88	\$ .82	\$ .76

Figure 2 indicates that diesel and LP gas tractors can be used at a lower cost per hour than comparable gasoline models when the annual use is more than 400 hours. It must again be emphasized that the information in Figure 2 applies only when fuel prices and fuel rates are comparable to those used in this study. The savings which might result from the use of a diesel tractor instead of a gasoline tractor would be much

more pronounced in cases where farmers use their tractors a large number of hours each year. For example, according to the data in Figure 2, for tractors used 500 hours per year there is a difference of only \$25 in the cost of using a gasoline tractor or a diesel tractor. If the tractors were used 1000 hours per year, however, there would be an annual difference in cost of \$110 in favor of the diesel tractor.

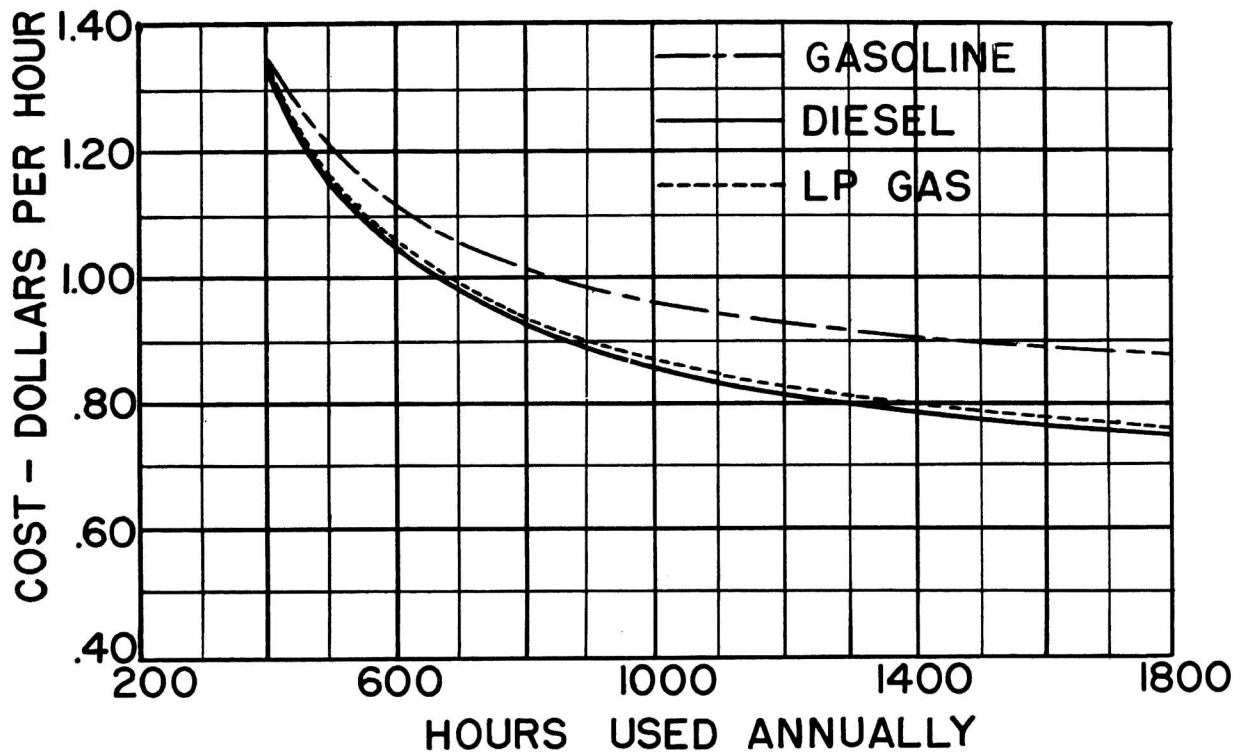


Fig. 2—Relationship between tractor costs and hours used annually for 3-plow tractors using different fuels. Costs include depreciation, repairs, interest, housing, insurance, taxes, fuel, oil, and grease, but not labor for operating. The fuel prices used were—gasoline at 19.5 cents per gallon, diesel fuel at 13.5 cents per gallon, and LP gas at 10.5 cents per gallon.