





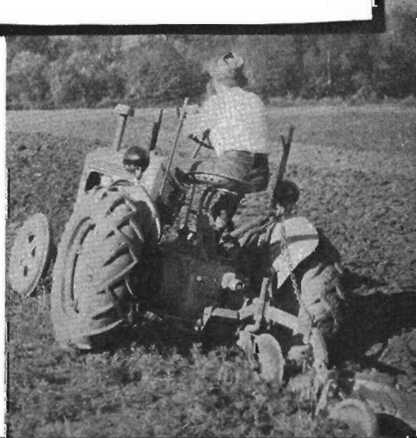

STATION BULLETIN 409 JUNE 1942

Cost of Operating Power Equipment on Oregon Farms

Agricultural Experiment Station
Oregon State College, Corvallis

Cost of Operating Power Equipment on Oregon Farms

By

D. Curtis Mumford, Virgil D. Kennedy,

and

George B. Davis

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FOREWORD

Agriculture in Oregon is becoming increasingly mechanized. According to the 1940 census, there were 17,077 tractors, 16,825 farm trucks, and 58,797 farm automobiles in Oregon. This represents 74 per cent more tractors, 73 per cent more trucks, and 24 per cent more farm automobiles than were reported on farms by the census of 1930.

With such an increase in power equipment, its cost of operation naturally becomes a larger part of the total farm expense. To keep such costs at a minimum the operator needs more specific information on costs.

It is the purpose of this bulletin to present the costs of operating units of power equipment according to various size, age, and season's use groups. An attempt has also been made to show the effect of different factors on the cost of operating this equipment.

Cost figures presented in this bulletin were obtained from more than 25,000 hours of tractor use, about 70,000 acres of grain and small seeds harvested with combines, more than 500,000 truck miles, and about 2,500,000 miles of travel by farm automobiles.

WM. A. SCHOENFELD
Director

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SUMMARY

The information presented in this bulletin represents the cost of operating a total of 358 tractors, 155 combines, 159 farm trucks, 49 pickups, and 321 farm automobiles in the Willamette Valley and Columbia Basin.

TRACTORS

The largest tractors were the most expensive to operate on the basis of cost per hour. They were the cheapest to operate, however, from the standpoint of the *cost per horsepower hour.* This does not necessarily mean that a large tractor should be purchased in preference to a small one. It does suggest, however, that it is economical to use a large tractor where there is sufficient work available. For the individual farm the tractor

COST OF OPERATING TRACTORS

Willamette Valley and Columbia Basin

Group	Average rated drawbar horsepower	Number	Average value	Season's use	Total cost per hour*	Cost per horsepower hour*
				Hours	*Cents*	*Cents*
Willamette Valley, 1940						
Wheel type:						
Under 14 ..	11.2	46	$ 564	561	44	3.9
14 to 17	15.8	49	679	749	46	2.9
18 to 21	19.7	31	741	1,010	48	2.4
22 to 25	23.5	30	639	902	48	2.0
26 and over ..	27.5	14	942	1,075	50	1.8
Track type:						
18 to 21	18.9	22	1,435	1,240	50	2.7
22 to 25	22.8	9	1,317	1,172	57	2.5
26 and over ..	31.9	10	1,954	1,547	51	1.6
Willamette Valley, 1938						
Wheel type:						
Under 14	10.7	31	$ 334	398	40	3.8
14 to 17	15.2	28	254	338	41	2.7
18 to 21	18.6	8	745	794	54	2.9
22 and over ..	24.8	9	586	499	51	2.0
Track type:						
14 to 17	14.0	6	679	520	65	4.6
18 to 21	18.6	12	1,027	695	57	3.1
22 and over ..	25.0	7	1,141	819	66	2.7
Columbia Basin, 1941						
Track type:						
Under 26	22.0	7	$ 997	558	80	3.6
26 to 39	32.7	27	1,768	746	94	2.9
40 and over ..	52.8	12	2,437	926	121	2.3

* Includes the cost of fuel, oil, grease, repairs, insurance, upkeep labor (not included in 1938 or 1941 costs), depreciation, and interest. A wage for the tractor operator *has not* been included.

that best fits the work demands on that farm is the one that should be used, regardless of the size of the tractor.

Season's use and age were both important in explaining differences in the cost per hour of operating tractors. In all cases an increase in the hours of use was associated with a decrease in the cost per hour. Generally speaking, the older tractors were used fewer hours per year and were more expensive to operate than the younger machines. The older machines had higher cash costs, but had lower noncash costs. This would indicate that with a very small season's use the older tractors would be the more economical, while with heavy use the newer tractors would be the cheaper to operate. Season's use, however, was much more important than age.

Combines

In studying the costs of combine operation, no attempt was made to measure the relative proportions of the grain or seed saved by individual machines.

In the Willamette Valley the "5 foot" power take-off combines were the cheapest per acre to operate, while the "8 foot" combines with engines were the most expensive. The cost of power take-off combines, however, does not include the extra fuel required by the tractor to pull these machines. In the Columbia Basin the "20 foot" machines cost the least per acre to operate while those with a "14 foot" cut cost the most.

The noncash cost items, depreciation and interest, represent about two-thirds of the total cost of operating combines, and therefore, increases in the acreage harvested effect substantial economies in the total cost per acre by spreading these relatively fixed cost items over a larger number of acres.

Cost of Operating Combines

Willamette Valley and Columbia Basin

Width of cut	Number	Average value	Age	Area harvested	Area harvested per day	Cost per acre*
			Years	*Acres*	*Acres*	
Willamette Valley, 1940						
5 feet†	12	$ 417	3.7	283	10	$0.69
5 feet	9	791	1.6	247	9	.96
6 feet	37	864	2.2	235	10	1.11
8 feet	18	1,180	3.0	297	12	1.20
10 feet	19	980	5.9	277	12	1.12
12 feet	23	1,320	5.7	401	16	1.03
15 feet	3	1,040	10.3	441	13	.77
Columbia Basin, 1941						
14 feet	7	1,546	.....	488	31	1.14
16 feet	17	1,508	.....	672	38	.86
20 feet	10	1,697	.....	1,101	53	.60

* Includes the cost of fuel, oil, grease, repairs, insurance, upkeep labor (not included in 1941 costs), depreciation, and interest. Wages for the combine operators *have not* been included.

† These are power take-off combines. All other machines are powered by a motor mounted on the combine.

Trucks and automobiles

The cost of operating trucks and automobiles was materially influenced by the number of miles driven and by the age of the machines. Generally the cheapest to operate were the older machines, driven the most miles. On the other hand, the trucks and automobiles having the highest cost per mile were the youngest machines, driven the fewest miles. This should not be interpreted as meaning that older trucks and automobiles provide the best and most economical transportation. Other factors than costs such as speed, efficiency, and dependability must also be considered.

Cost of Operating Farm Trucks, Pickups and Automobiles

Willamette Valley

Kind of machines	Year	Number	Average value	Age	Season's use	Miles per gallon	Cost per mile*
				Years	*Miles*	*Miles*	*Cents*
Trucks	1940	85	$313	7.8	3,466	11.6	5.8
Trucks	1938	74	217	....	3,151	12.5	4.8
Pickups	1940	22	372	5.9	4,576	16.3	4.3
Pickups	1938	27	329	....	7,656	15.7	3.2
Automobiles	1940	70	384	....	7,277	16.8	3.5
Automobiles	1938	251	279	....	6,496	16.9	3.1

* Includes the cost of fuel, oil, grease, repairs, insurance, upkeep labor (not included in 1938 costs), depreciation, and interest. A wage for the driver *has not* been included.

Cost of Operating Power Equipment on Oregon Farms*

by

D. CURTIS MUMFORD, VIRGIL D. KENNEDY,

and

GEORGE B. DAVIS†

INTRODUCTION

SEVERAL farm organization and cost studies conducted in this State since 1938 have supplied a substantial fund of data dealing with the cost of operating tractors, combines,‡ trucks, and automobiles on Oregon farms.

The most recent studies from which data are available are a Willamette Valley study made in 1938, another Willamette Valley study made in 1940, and a wheat farm operation study made in two Columbia Basin counties in 1941. In the course of these three studies, data were obtained on the operation of 358 tractors, 155 combines, 159 trucks, and 370 automobiles and pickups.

This bulletin summarizes information on power equipment costs procured in the above-mentioned and as yet unpublished studies.

OBJECTIVES

The objectives of this study are:

(1) To determine the cost of operating tractors, combines, farm trucks, and farm automobiles.

(2) To determine the relative importance of the different cost items making up the total cost of operation.

(3) To determine the effect of size, age, season's use, and other factors on the cost of operating different machines for the purpose of discovering methods of reducing costs.

METHOD

Obtaining the field information

The information in this report was obtained from farmers by the survey method. The farms in the 1938 study were selected at random in the Wil-

* *Acknowledgments:* The authors express their appreciation to approximately 650 farmers in Oregon whose cooperation has made this study possible. The authors are indebted to the Soil Conservation Service and the Farm Credit Administration, United States Department of Agriculture, for their cooperation with the Oregon Agricultural Experiment Station in obtaining the data for power equipment in the Columbia Basin, 1941, and in the Willamette Valley, 1938, respectively. Acknowledgments are especially made to G. W. Kuhlman, of the Department of Farm Management, Oregon State College, for his supervision in obtaining and summarizing the data collected in 1940; to H. L. Thomas of the Soil Conservation Service, United States Department of Agriculture for his leadership in planning and conducting the Columbia Basin study, 1941; to E. L. Potter, Head, Division of Agricultural Economics, Oregon State College; to the several persons who assisted in collecting the field data for the aforementioned studies; and to the county agricultural agents of the various counties in which field data were secured.

† D. Curtis Mumford, Head, Department of Farm Management; Virgil D. Kennedy, formerly Research Assistant; and George B. Davis, Research Assistant, Department of Farm Management, Oregon State College.

‡ The term "combine" as used in this publication refers to the "combine harvester."

lamette Valley.* The farms in the 1940 study were also selected at random but were chosen from those who were raising Austrian Winter field peas or vetches; these farms are considerably larger and provide more work for power equipment than those in the 1938 study.† For these reasons the two studies are treated separately. The wheat farms included in the 1941 study of farming operations in the Columbia Basin counties were selected as typical farms by the respective county agricultural agents.‡

Depreciation, present value, and interest on investment

The depreciation and present value for each machine were estimated by the individual farmers. Interest is figured at 5 per cent on the average inventory value.

Drawbar horsepower rating

Each tractor has been classified according to its drawbar horsepower rating. These ratings are based on the Nebraska tractor tests reported in Bulletin 330, Nebraska Experiment Station, 1941.

NUMBER AND SIZE OF TRACTORS

Table 1 shows the number of tractors studied, arranged by type and by the rated drawbar horsepower groups. The tractors with a higher rating than 22 horsepower made up 16 per cent of the total number of tractors in the 1938 study, and 30 per cent of the total number of tractors in the 1940 study. Wheel-

Table 1. NUMBER OF TRACTORS BY TYPE AND RATED DRAWBAR HORSEPOWER GROUPS

Rated drawbar horsepower groups	Number of tractors		
	Wheel-type	Track-type	Total
Willamette Valley, 1940:			
Under 14	46	....	46
14 to 17	49	....	49
18 to 21	31	22	53
22 to 25	30	9	39
26 and over	14	10	24
ALL TRACTORS	170	41	211
Willamette Valley, 1938:			
Under 14	31	....	31
14 to 17	28	6	34
18 to 21	8	12	20
22 and over	9	7	16
ALL TRACTORS	76	25	101
Columbia Basin, 1941:			
Under 26	....	7	7
26 to 39	....	27	27
40 and over	....	12	12
ALL TRACTORS	....	46	46

* The 1938 study, in which the Farm Credit Administration of Spokane, Washington, and Washington, D. C., cooperated, was a study of "farm organization and valuation" and represented a cross section of the Willamette Valley.

† The 1940 study was a "cost of production" study concerned chiefly with Austrian Winter field peas and several vetches.

‡ The 1941 study, in which the Division of Economic Research of the Soil Conservation Service cooperated, was chiefly concerned with the "comparative costs" of making trashy fallow as compared with black fallow.

type tractors made up 75 per cent of the total number for 1938 and 81 per cent of the total number for 1940.

The tractors in the "under 14" horsepower group are the small wheel-type tractors that are commonly referred to as one-plow tractors. The next group of tractors, "14 to 17" horsepower, are capable of pulling three plows. The "22 to 25" horsepower group is not usually thought of as representing tractors that can pull a specified number of plows, but tractor manufacturers estimate the capacity of the machines to be 3 or 4 plows. The tractors "26 horsepower and over" are also generally described in terms of plows, such as a range of 5 to 10 plows.

TYPE OF FUEL

About 52 per cent of the tractors in the 1940 study used gasoline, the remainder using some type of lower grade fuel. Generally speaking, most of the smaller tractors were gasoline operated and a majority of the larger tractors were operated on fuel oil. Diesel oil was the predominant fuel used by the large track-type tractors in the Columbia Basin.

DEPRECIATION

Results of this study indicate that farmers were depreciating their tractors and combines about 13 or 14 per cent of their *present value* (not new value) each year. Trucks and pickups were depreciated about 18 per cent and automobiles 20 per cent of their present values.

The depreciation for tractors as estimated by the farmers had the same general trend as the depreciation shown in the dealer's "blue book."* The farmers, however, placed values on their machines that averaged about 25 per cent higher than the trade-in values listed in the "blue book."

COST OF OPERATING TRACTORS

Wheel-type tractors, 1940

The total cost per hour is remarkably similar for the five different sizes of tractors presented in Table 2. The last group of tractors has more than twice the horsepower rating as that of the "under 14" horsepower group, yet the cost is only 6 cents or 14 per cent more per hour. Obviously the "horsepower hour" cost is lower for the larger tractors than for the smaller.†

These costs do not include the wages of the operator. It requires no more effort to drive a large tractor than a small one, and therefore, if we add the cost of wages of the driver to the cost of operating the tractor, the difference in cost between the large tractors and the small ones is even more marked. If we assume the tractor driver's wage is $3.00 per 10-hour day, then the total cost (including the wage of the driver as well as all the tractor costs) for the 5 different sizes of tractors presented in Table 2 would be 6.6, 4.8, 4.0, 3.3, and 2.9 cents per horsepower hour respectively. Of these costs, the wage of the

* Official Tractor and Combine Trade-in Manual, 1941. National Retail Farm Equipment Association, St. Louis, Missouri.

† The term "horsepower hours" as used in this study represents the rated drawbar horsepower of the tractor multiplied by the number of hours the tractor was used during the year of the study. The cost per horsepower hour is the total cost of operating the tractors for the year divided by the number of "horsepower hours" of use. It is assumed that all the tractors, regardless of size, are used to the same percentage of their rated drawbar horsepower capacity.

tractor operator represents 2.7, 1.9, 1.6, 1.3, and 1.1 cents, respectively. This points out the economy of using larger tractors *when there is enough work to keep the tractor busy at its rated horsepower capacity.*

The cost of fuel is the most important single cost item. Its importance ranges from 39 per cent of the total cost per tractor on the smallest tractors to 54 per cent on the largest group. The largest tractors use about a gallon more fuel per hour than the smallest horsepower tractors. On the basis of horsepower hours, however, the largest tractors use only .098 gallon per horsepower hour. The corresponding figure for the smallest tractors is .148 gallon.

Table 2. COST OF OPERATING WHEEL-TYPE TRACTORS BY RATED DRAWBAR HORSEPOWER GROUPS*

Willamette Valley, 1940

Item	Rated drawbar horsepower				
	Under 14	14 to 17	18 to 21	22 to 25	26 and over
Number of tractors	46	49	31	30	14
Average horsepower	11.2	15.8	19.7	23.5	27.5
Age of tractors—*Years*	6.2	5.4	4.9	7.7	4.1
Average value	$564	$679	$741	$639	$942
Depreciation in 1940	$ 76	$101	$121	$100	$129
Gallons oil per 100 hours	3.7	4.5	4.7	6.7	5.4
Season's use—*Hours*	561	749	1,010	902	1,075
Horsepower hours	6,284	11,837	19,897	21,204	29,562
Gallons fuel per hour	1.66	1.94	2.31	2.58	2.70
	Cost per hour				
Cost items:	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Fuel	17	20	23	23	27
Oil and grease	3	3	3	4	4
Repairs	3	2	4	4	1
Tires	....	1	....	....	....
Insurance	....	....	....	....	....
Upkeep labor	2	2	2	2	2
Total cash cost	25	28	32	33	34
Interest on average value	5	5	4	4	4
Depreciation	14	13	12	11	12
Total noncash cost	19	18	16	15	16
TOTAL COST	44	46	48	48	50
Total cost per horsepower hour	3.9	2.9	2.4	2.0	1.8

* See Table 23 (Appendix) for instructions and blank form to be used in estimating the cost of operating your own tractor.

As might be expected, the larger tractors used the most lubricating oil per 100 hours. The reason why the "26 and over" horsepower group used less oil than the "22 to 25" horsepower tractors is probably due to the fact that the tractors in the latter group were about 3½ years older and probably were in need of major repairs.

We might expect these tractors, because of their larger capacity, to accomplish their work in a shorter period of time, thereby decreasing the season's use. Generally speaking, however, the larger tractors were used more hours per year. This in itself tends to lower the cost per horsepower hour on the larger machines. Some farms are so small that even the capacity of the smaller types of tractors is too large to be fully utilized. The operators of large farms,

on the other hand, can and do buy tractors that more nearly fit the needs of their farms.

Track-type tractors, 1940

Track-type tractors were considerably larger, were newer, had a higher valuation, and were used more hours than the wheel-type tractors (Table 3). The "26 and over" horsepower tractors had costs averaging only 1 cent per hour more than the "18 to 21" horsepower group. This can be attributed to the economies resulting from a larger season's use, about the same fuel consumption per hour, and the use of fuel costing about 2.5 cents less per gallon. The group of tractors having an average horsepower of 22.8 had higher costs per hour than either of the other tractor sizes. This is the result of a higher fuel consumption per hour and a cost of fuel averaging more than 11 cents per gallon.

Table 3. COST OF OPERATING TRACK-TYPE TRACTORS BY RATED DRAWBAR HORSEPOWER GROUPS

Willamette Valley, 1940

Item	Rated drawbar horsepower		
	18 to 21	22 to 25	26 and over
Number of tractors	22	9	10
Average horsepower	18.9	22.8	31.9
Age of tractors—*Years*	3.2	4.2	3.7
Average value	$1,435	$1,317	$1,954
Depreciation in 1940	$ 203	$ 189	$ 267
Gallons oil per 100 hours	3.7	4.1	5.1
Season's use—*Hours*	1,240	1,172	1,547
Horsepower hours	23,445	26,726	49,352
Gallons fuel per hour	2.01	2.23	2.02
	Cost per hour		
Cost items:	*Cents*	*Cents*	*Cents*
Fuel	19	25	14
Oil and grease	4	4	5
Repairs	2	3	5
Insurance	....	....	....
Upkeep labor	3	3	3
Total cash cost	28	35	27
Interest	6	6	6
Depreciation	16	16	18
Total noncash cost	22	22	24
TOTAL COST	50	57	51
Total cost per horsepower hour	2.7	2.5	1.6

The "26 and over" horsepower track-type tractors have a valuation of $61 per horsepower, while the corresponding group of wheel tractors have an average value of only $34 per horsepower. In spite of this fact, however, the larger number of hours of use and the greater fuel economy of the large track-type tractors give them a lower cost per horsepower hour than for the large wheel-type tractors.

Wheel-type tractors, 1938

The cost per hour of operating wheel-type tractors in the Willamette Valley for 1938 is presented in Table 4. The information for these tractors

differs from that for the 1940 study in that age of machine and upkeep labor were not obtained from the farmers interviewed. Because of the lack of information on upkeep labor, the cost of operation is not strictly comparable to the cost of operating the tractors in the 1940 study. The tractors in the 1938 study were used fewer hours per year and with the exception of the "18 to 21" horsepower group had a lower average value per machine than the same sized tractors in the 1940 study.

There is a range of 14 cents per hour in the operating cost of the low and high cost groups of tractors. The "under 14" horsepower group is used less than 400 hours, but has low interest and depreciation charges. The "18 and 21" horsepower group is the high cost group because of a relatively high depreciation charge. The season's use is larger on this group of tractors, but is not large enough to offset the high depreciation charge.

On the basis of cost per horsepower hour the largest tractors, as in the 1940 study, were the cheapest to operate. Because of the high depreciation charge, the cost per horsepower hour is higher for the "18 to 21" horsepower group than the smaller "14 to 17" horsepower tractors.

Table 4. COST OF OPERATING WHEEL-TYPE TRACTORS BY DRAWBAR HORSEPOWER GROUPS
Willamette Valley, 1938

Item	Rated drawbar horsepower			
	Under 14	14 to 17	18 to 21	22 and over
Number of tractors	31	28	8	9
Average horsepower	10.7	15.2	18.6	24.8
Average value	$334	$254	$745	$586
Depreciation in 1938	$ 44	$ 29	$160	$ 73
Season's use—*Hours*	398	338	794	499
Horsepower hours	4,260	5,130	14,765	12,373
Gallons fuel per hour	1.61	1.77	1.83	2.74
	Cost per hour			
Cost items:	*Cents*	*Cents*	*Cents*	*Cents*
Fuel	18	19	21	22
Oil and grease	3	5	3	5
Repairs	4	5	5	3
Insurance	....	....	....	....
Tires	....	....	....	....
Total cash cost	25	29	29	30
Interest	4	4	5	6
Depreciation	11	8	20	15
Total noncash cost	15	12	25	21
TOTAL COST	40	41	54	51
Total cost per horsepower hour	3.8	2.7	2.9	2.0

Track-type tractors, 1938

The cost of operating track-type tractors in the Willamette Valley in 1938 is presented in Table 5. It is significant to note that the "14 to 17" horsepower group has a very high repair cost per hour when compared with the other two groups. This was partly compensated for by a lower depreciation cost per hour. In other words, the repairs reduced the depreciation charge, but not in proportion to the large repair bill.

The "22 and over" horsepower tractors have the highest cost per hour because of more depreciation, and a higher cost for oil and grease. On a horsepower hour basis, however, the cost is about 2 cents lower than for the "14 to 17" horsepower tractors.

Table 5. COST OF OPERATING TRACK-TYPE TRACTORS BY DRAWBAR HORSEPOWER GROUPS
Willamette Valley, 1938

Item	Rated drawbar horsepower		
	14 to 17	18 to 21	22 and over
Number of tractors	6	12	7
Average horsepower	14	18.6	25
Average value	$679	$1,027	$1,141
Depreciation in 1938	$ 58	$ 142	$ 196
Season's use—*Hours*	520	695	819
Horsepower hours	7,280	12,934	20,465
Gallons fuel per hour	1.98	1.99	1.85
	Cost per hour		
Cost items:	*Cents*	*Cents*	*Cents*
Fuel	25	23	19
Oil and grease	5	4	7
Repairs	17	2	9
Total cash cost	47	29	35
Interest	7	8	7
Depreciation	11	20	24
Total noncash cost	18	28	31
TOTAL COST	65	57	66
Total cost per horsepower hour	4.6	3.1	2.7

Track-type tractors, 1941

These tractors are considerably larger and are of a different type from those discussed previously (Table 6). About 75 per cent use diesel fuel while the remainder use gasoline.

The reader should bear in mind that though the specific cost items are quite comparable between these tractors and the previously discussed tractors, the costs themselves represent the cost of different sized tractors working under far different conditions from those experienced in the Willamette Valley. The Columbia Basin farms are quite large and wheat is the major crop. The tractors are used almost entirely for work connected with large scale production of wheat. In wheat production in this area, as compared to the diversified farming in the Willamette Valley, the farms are larger, the equipment is larger, fields are larger and fewer per farm, and the tractor work tends to be more seasonal. All these factors will undoubtedly affect the comparability of the power equipment costs in the two areas.

Because of a higher rate of fuel and oil consumption, a greater value and a higher depreciation, the larger tractors cost more per hour to operate. On the basis of horsepower hours, however, the largest tractors are the cheapest to operate. The "40 and over" horsepower group uses about .07 gallon per horsepower hour while the "under 26" horsepower uses .11 gallon.

It is interesting to note that the farmers who owned the largest tractors used them 368 hours more per year than the owners of the "under 26" horse-

Table 6. COST OF OPERATING TRACK-TYPE TRACTORS BY DRAWBAR HORSEPOWER GROUPS
Columbia Basin, 1941

Item	Rated drawbar horsepower		
	Under 26	26 to 39	40 and over
Number of tractors	7	27	12
Average horsepower	22.0	32.7	52.8
Average value	$997	$1,768	$2,437
Depreciation in 1941	$172	$ 263	$ 373
Years of use*	8.4	10.2	11.1
Gallons of oil per 100 hours	8.6	7.9	13.0
Season's use—*Hours*	558	746	926
Drawbar horsepower hours	12,276	24,401	48,872
Gallons fuel per hour	2.45	2.72	3.56
	Cost per hour		
Cost items:	*Cents*	*Cents*	*Cents*
Fuel	18	20	26
Oil	4	4	6
Grease	4	5	8
Repairs	14	18	28
Total cash cost	40	47	68
Interest	9	12	13
Depreciation	31	35	40
Total noncash costs	40	47	53
TOTAL COST	80	94	121
Total cost per horsepower hour	3.6	2.9	2.3

* Represents the farmers' estimate of the number of years the tractors will be used by the present owners from the time of purchase until they are traded in.

power group. The former estimated, however, that they would also receive about 2½ years more service from their tractors before trading them in. It is not known whether this difference is due to the smaller tractors being traded more often or whether their actual years of service will be less.

FACTORS AFFECTING TRACTOR COSTS

Wheel-type tractors, Willamette Valley

Of the various factors affecting the cost of operating tractors, season's use (hours used annually), and age of tractor are probably the most important (Figure 1). These factors not only affect cost per hour, but also bear a relationship to each other. In other words, generally speaking, the older tractors were used the fewest number of hours and conversely, the tractors used the most hours were the youngest. With such an interrelation between the factors affecting cost, it becomes necessary to study one of the factors with the influence of the other factor removed. This has been done for the three tractor sizes presented in Table 7. (See also tables 19 and 20, Appendix.)

With the exception of the middle aged and oldest tractors in the "18 to 21" horsepower group, there is a marked decrease in cost per hour accompanying an increased season's use. This relationship is to be expected because a heavier season's use spreads the noncash (relatively fixed) costs over a large number of hours. The cash costs per hour tend to remain about the same.

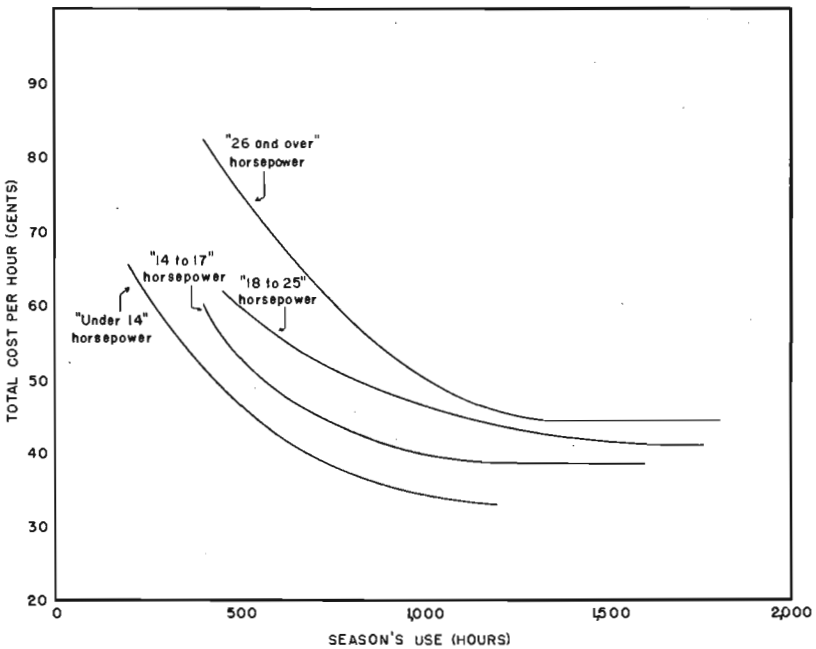

Figure 1. Relationship between season's use (hours) and total cost per hour for different sized wheel tractors, Willamette Valley, 1940.

Table 7. EFFECT OF SEASON'S USE AND AGE OF TRACTOR ON COST PER HOUR OF WHEEL TRACTORS

Willamette Valley, 1940

Season's use	Age of tractor			All tractors
	Under 3 years	3 to 5 years	6 years and over	
	Cents	*Cents*	*Cents*	*Cents*
Under 14 Horsepower:				
Under 400 hours	57.5	64.6	54.5	53.9
400 to 599 hours	48.1	44.7	51.4	48.4
600 hours and over	31.9	36.9	47.0	38.8
All tractors	39.3	39.8	49.8	44.0
14 to 17 Horsepower:				
Under 600 hours	65.9	54.8	51.5	56.2
600 to 1,199 hours	45.7	46.3	40.8	44.0
1,200 hours and over	39.0	43.1	.....	42.3
All tractors	48.3	46.2	43.9	46.0
*18 to 21 Horsepower**				
Under 800 hours	52.5	58.8	81.3	64.3
800 to 1,199 hours	42.4	49.0	47.4	46.3
1,200 hours and over	38.4	49.2	53.0	43.6
All tractors	40.6	51.5	55.8	48.0

* The age groups for these tractors are: Under 4, 4 to 5, and 6 and over.

The influence of age on cost per hour is not so pronounced as that of season's use. There is a general tendency in the case of the "under 14" horsepower and "18 to 21" horsepower groups for cost to increase with age. Further investigation of the data indicates that in most cases the older tractors have the highest cash costs while the tractors "1 to 2" years old have the least cash costs. This situation is due to the higher fuel and oil consumption and larger repair bills for the older machines. Season's use (holding age constant) had little or no effect on *cash costs.*

Obviously there is a rather high degree of correlation between season's use and *noncash costs.* As explained previously, these costs are relatively fixed and consequently a higher season's use will lower these costs on a per hour basis. Noncash costs (interest and depreciation) are also affected by age. There is a tendency for the older tractors to have lower noncash costs. This is due to the fact that the interest and depreciation charges are lower per tractor because of the lower values of these older machines. This would indicate that for a very small usage the older tractor, even though having high cash costs per hour, would be the most economical to operate because of low noncash (interest and depreciation) charges. In the case of heavy usage the newer tractor would probably be cheaper because of low cash costs and through the reduction of the noncash costs by more hours of tractor use.

Season's use, as previously stated, is probably the most important single factor affecting the cost of operating tractors. The data indicate that every increase of 100 hours per year is accompanied by a decrease of about 3.5 cents per hour in the cost of operating "under 14" horsepower tractors. The same figures for the "14 to 17" horsepower and "18 to 21" horsepower group are 2.1 and 1.7 cents. This of course is after the influence of age has been removed; in other words, all tractors are placed on a comparable basis insofar as age is concerned. Using these figures as a basis for estimating the savings resulting from a greater season's use, a tractor of 15 horsepower, 4 years old, when used 400 hours would cost about 55 cents per hour to operate. The same machine, if used 1,000 hours, would cost approximately 43 cents per hour.

A more detailed study of age reveals that age is relatively unimportant in explaining differences in cost of operating the tractors in the "under 14" horsepower and "14 to 17" horsepower group. In the case of the "18 to 21" horsepower group, however, each increase in age of 1 year is associated with an increase in the cost per hour of about 2.5 cents. Thus, if a 19 horsepower tractor, 2 years old, and operated 700 hours costs 50 cents per hour, an 8-year-old machine of the same horsepower and operated the same number of hours would cost about 65 cents per hour to operate. The figures in the preceding examples are purely hypothetical.

Track-type tractors, Columbia Basin

Tractors used under 500 hours cost almost twice as much to operate as the machines of the same size used more than 900 hours (Table 8). The greatest savings were made in the noncash costs (interest and depreciation). The cash costs per hour, however, were also smaller on the tractors with the heaviest season's use. Smaller cash costs were due to a lower fuel consumption and a lower repair charge per hour for these machines. In regard to repairs the tractors that were used more than 900 hours per year had 3 times as many hours of use per year, but had only a third more repairs than the machines used less than 500 hours. This is probably due to the fact that every 2 or 3 years these large tractors are given a complete overhaul. At this time the

machine may have been operated 5,000 hours or it may have been used only 2,000 hours since the last major overhaul. To a certain extent, therefore, repairs become a relatively fixed charge.

Table 8. EFFECT OF SEASON'S USE ON THE COST OF OPERATING "26 TO 39" HORSEPOWER TRACK-TYPE TRACTORS

Columbia Basin, 1941

Group	Average season's use	Number of tractors	Average value	Fuel per hour	Cost per hour			Cost per horsepower hour
					Cash	Noncash	Total	
	Hours			*Gallons*				*Cents*
Under 500 hours	420	8	$1,736	3.40	$0.61	$0.74	$1.35	4.3
500 to 899 hours	641	11	1,907	2.64	.49	.61	1.10	3.1
900 hours and over	1,217	8	1,608	2.55	.40	.32	.72	2.3

COST OF OPERATING COMBINES

Willamette Valley, 1940

The combines having a cut of 15 feet were the cheapest to operate, while the ones having a cut of 8 feet cost the most (Table 9). It should be kept in mind that the threshing efficiency of combines has not been considered in this study. The machines having cuts of more than 8 feet are considerably older than the smaller combines. This of course is due to the recent popularity of smaller and lower priced machines. The 5-foot and 6-foot cut machines are typical of these smaller units.

In comparing the costs of these various sizes of combines, it must be kept in mind that these machines were undoubtedly used on several kinds of crops and that the cost per hour will depend somewhat on the percentage of the total time spent on these various jobs. For instance, most of these combines harvested peas or vetch. In most cases attachments were used to pick up these particular crops from windrows. In comparison to cutting standing grain, harvesting peas and vetch lowers the acreage cut per day for the season, or, in other words, costs more per acre.

It should be noted that the number of acres cut per day does not increase in proportion to the size of cut. That is, the 6-foot cut machine harvests 10 acres per 10-hour day while the 12-foot cut, though twice as large, cuts only 6 acres more per day. The study does not show the causes of this, but it may be due to the greater efficiency of the newer and smaller machines, or it may be that the smaller machines were used more on standing grain crops than the older and larger combines.

Depreciation is the largest single expense item and interest on the average value of the machine is the second largest item on all combines except the 15-foot group. Fuel and repairs are the largest cash expenses. The fuel consumption per acre is about the same for all groups.

The noncash costs for combines represent a large proportion, approximately 65 per cent, of the total cost. Such a large fixed charge offers a good

Table 9. COST OF OPERATING DIFFERENT SIZED COMBINES WITH ENGINES*
Willamette Valley, 1940

	Width of cut					
	5 feet	6 feet	8 feet	10 feet	12 feet	15 feet
Number of combines..	9	37	18	19	23	3
Age—*Years*	1.6	2.2	3.0	5.9	5.7	10.3
Average value	$791	$864	$1,180	$980	$1,320	$1,040
Depreciation in 1940..	$134	$142	$ 176	$133	$ 197	$ 123
Season's use—*Acres*....	247	235	297	277	401	441
Acres per 10-hour day	9	10	12	12	16	13
Fuel per acre—*Gallons*	1.06	1.16	1.20	1.12	1.13	1.10
	Cost per acre					
Cost items:						
Fuel	$0.15	$0.13	$0.15	$0.13	$0.14	$0.14
Oil	.03	.03	.04	.05	.03	.04
Repairs	.02	.08	.13	.19	.13	.14
Insurance	....	.02	.02	.01	....	....
Upkeep labor	.06	.06	.07	.08	.07	.05
Total cash cost....	.26	.32	.41	.46	.37	.37
Interest	.16	.19	.20	.18	.16	.12
Depreciation	.54	.60	.59	.48	.50	.28
Total noncash cost	.70	.79	.79	.66	.66	.40
TOTAL COST	$0.96	$1.11	$1.20	$1.12	$1.03	$0.77

* See Table 23 (Appendix) for instructions and blank form to be used in estimating the cost of operating your own combine.

opportunity to lower the cost per acre by increasing the season's use. This phase of the study of combines will be discussed later.

Information was obtained in this study for 12 5-foot power take-off combines. These combines are not powered by a motor on the combine but rely on the power transmitted by a driveshaft from the tractor. Their costs, which are lower than any of the other groups of combines, are presented in Table 10. The cost should be lower because the item for fuel and oil for the combine motor is not incurred, nor was the extra fuel required by the tractor to pull these machines included. These combines also had a relatively low value per machine with consequent low interest charges.

Because these machines are relatively inexpensive to operate it should not be concluded that they will be the best machine to buy. They may have certain disadvantages, when compared with combines with engines, which may or may not offset the advantage of a lower cost per acre.

Columbia Basin, 1941

Information was obtained on 44 combines with engines in the Columbia Basin wheat area. The machines represent nine different sizes or cuts. The cost of operating thirty-four combines including the three most common sizes is presented in Table 11. The larger combines were operated at almost one-half the cost per acre of operating the smallest or 14-foot machines. The difference, of course, is not altogether due to size, since the smaller machines harvested less than half the acreage of wheat that the larger machines har-

vested. Season's use is very important due to the fact that interest and depreciation account for such a large share of the total cost of operating combines. Spreading these costs over more acres will therefore materially reduce the total cost per acre.

It should be noted that for each cost item the cost per acre is less for the larger combines. The cost of repairs is especially significant. For all sized combines repairs average about 70 per cent of the cash cost per acre. It is in

Table 10. COST OF OPERATING 5-FOOT POWER TAKE-OFF COMBINES
Willamette Valley, 1940

Item	Power take-off combines
Number of combines	12
Age—*Years*	3.7
Average value	$417
Depreciation in 1940	$103
Season's use—*Acres*	283
Acres per 10-hour day	9.7
	Cost per acre
Cost items:	
Oil and grease	$0.02
Repairs	.17
Upkeep labor	.06
Total cash cost	$0.25
Interest	$0.07
Depreciation	.37
Total noncash cost	$0.44
TOTAL COST	$0.69

Table 11. COST OF OPERATING DIFFERENT SIZED COMBINES
Columbia Basin, 1941

Item	Width of cut		
	14 feet	16 feet	20 feet
Number of combines	7	17	10
Average value	$1,546	$1,508	$1,697
Depreciation in 1941	$ 217	$ 211	$ 238
Gallons fuel per acre	.68	.64	.47
Gallons oil per 100 hours	5.1	7.5	6.7
Season's use—*Acres*	488	672	1,101
Acres per 10-hour day	31.1	38.5	52.7
	Cost per acre		
Cost items:			
Fuel	$0.09	$0.08	$0.06
Oil	.01	.01	.01
Grease	.03	.03	.02
Repairs	.41	.31	.22
Total cash cost	$0.54	$0.43	$0.31
Interest	$0.16	$0.12	$0.08
Depreciation	.44	.31	.21
Total noncash cost	$0.60	$0.43	$0.29
TOTAL COST	$1.14	$0.86	$0.60

fact the largest cost item on the 16- and 20-foot machines. Depreciation, however, is 3 cents per acre larger than repairs on the 14-foot combines.

With most farm machinery, repairs usually tend to vary with the season's use. For these combines, however, the repair bill is very little more per combine for the "20-foot" than it is for the "14-foot" machine, even though the larger machines were used twice as much. For the three sizes, the repairs per machine averaged $200, $207, and $242 respectively. It would appear that repairs per machine, similar to depreciation and interest, do not vary materially with season's use. This being the case, an increase in the number of acres cut would greatly reduce the per acre cost from the standpoint of repairs. The probable reason for this relatively fixed repair bill is that the operators usually make a complete overhaul job on their machines every year or two. At this time all worn parts are replaced, the motor is overhauled, and new canvases are put on the machine.

Effect of season's use on cost of operating combines

As previously stated, almost two-thirds of the expense of operating combines consists of noncash costs in the form of interest and depreciation. The effect of an increased season's use on these relatively fixed costs is well illustrated by the data presented in Table 12.

Table 12. EFFECT OF SEASON'S USE ON THE COST OF OPERATING COMBINES

Group	Average season's use	Number	Acres per day	Fuel per acre	Cost per acre		
					Cash	Noncash	Total
Six-foot combines							
Willamette Valley, 1940:	*Acres*		*Acres*	*Gallons*			
Under 180 acres	131	11	8	1.52	$0.41	$1.33	$1.74
180 to 259 acres	217	16	10	.95	.27	.90	1.17
260 acres and over	379	10	11	1.21	.34	.49	.83
All combines							
Columbia Basin, 1941:							
Under 500 acres	380	17	30	.67	$0.50	$0.66	$1.16
500 to 999 acres	752	16	40	.62	.43	.40	.83
1,000 acres and over	1,333	11	49	.58	.32	.25	.57

In the case of the small Willamette Valley combines the noncash costs for the machines cutting 379 acres were 84 cents per acre less than for the combines harvesting 131 acres. The data indicate that the total cost per acre of operating the machines decreases much more rapidly with an increase from 131 acres to 217 acres per machine than from 217 acres to 379. In the former case every increase of 10 acres in season's use was accompanied by an average decrease in cost of 6.6 cents per acre. In the latter case (changing from 217 to 379 acres) the economy had dropped to 2.1 cents per acre for each increase of 10 acres.

Figure 2 indicates how rapidly the per acre cost of combining decreases up to about 320 acres per season. Beyond that point, according to the data in this study, the increased savings in cost per acre are not so apparent.

The larger combines of the Columbia Basin indicate a similar situation to that existing in the Willamette Valley. Not only do the noncash costs per acre

decrease with more acres cut, but also the cash items, especially the repair charges, decrease. On the average, every increase of 100 acres in season's use results in about 6 cents decrease in the total cost per acre.

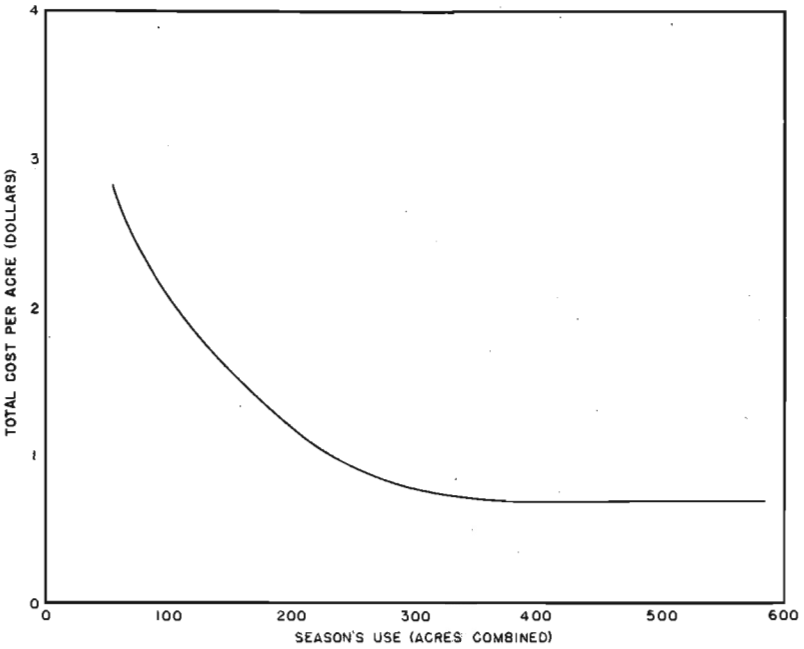

Figure 2. Relationship between season's use (acres combined) and total cost per acre for 6 foot combines 1 year old, Willamette Valley, 1940.

COST OF OPERATING TRUCKS

The trucks in the Willamette Valley included in this study range from 1 to 2 tons capacity, but the majority are 1½ tons. Table 13 presents the 1940 and 1938 cost information for trucks. The 2 years have been kept separate in order to use the age and upkeep labor items that were enumerated in the 1940 study but not in the 1938.

The season's use and gasoline consumption are about the same for the two groups. The trucks in the 1938 group have a lower average value and are probably older than the average of 7.8 years for the 1940 trucks. The higher noncash cost is accounted for by the higher interest and depreciation charges on the 85 trucks in 1940. The increased cash cost is explained by the additional cost items of upkeep labor in 1940, and the slightly higher cost per mile for repairs, tires, and license fees.

Effect of season's use and age on cost per mile*

Season's use and age are both very important in explaining the differences in cost of operating individual trucks. When all trucks are considered, regard-

* See Table 21, Appendix, for distribution of trucks by season's use and age.

Table 13. COST OF OPERATING TRUCKS ON WILLAMETTE VALLEY FARMS*

Willamette Valley

Item	1940	1938
Number of trucks†	85	74
Age—*Years*	7.8	....
Average value	$313	$217
Depreciation	$ 59	$ 43
Season's use—*Miles*	3,466	3,151
Miles per gallon	11.6	12.5
	Cost per mile	
Cost items:	*Cents*	*Cents*
Fuel	1.5	1.5
Oil and grease	.2	.2
Repairs	.5	.4
Tires	.5	.4
License	.5	.4
Insurance	.2	.2
Upkeep labor	.2	....
Total cash cost	3.6	3.1
Interest	.5	.3
Depreciation	1.7	1.4
Total noncash cost	2.2	1.7
TOTAL COST	5.8	4.8‡

* See Table 23 (Appendix) for instructions and blank form to be used in estimating the cost of operating your own truck.

† The sizes of these trucks range from 1 to 2 tons, but the majority are of 1½ ton capacity.

‡ Does not include cost for upkeep labor.

less of age, season's use stands out as materially affecting cost per mile, and age appears to be relatively unimportant. When each season's use group is studied separately, however, the importance of age becomes apparent (Table 14). This table indicates that the cheapest trucks to operate were those 9 years old and older, and operated more than 5,000 miles. The highest cost trucks were under 6 years old and had been driven less than 2,500 miles. (Figure 3.)

Table 14. EFFECT OF SEASON'S USE AND AGE OF TRUCKS ON COST PER MILE

Willamette Valley, 1940

Season's use	Age			All trucks
	Under 6 years	6 to 8 years	9 years and over	
	Cents	*Cents*	*Cents*	*Cents*
Under 2,500 miles	8.8	7.6	7.2	7.7
2,500 to 4,999 miles	6.9	6.5	4.2	6.2
5,000 miles and over	5.0	4.7	3.4	4.8
ALL TRUCKS	5.9	5.6	5.7	5.8

In actual practice, not many farmers will buy a new truck and operate it only a few miles, because of the high interest and depreciation charges per mile. On the other hand, most operators with a large amount of trucking to do will not use a 10-year-old truck even though it might be cheaper insofar as actual cost per mile is concerned. In this regard, it should be remembered that the operating cost as presented in this table is not the sole cost of using a truck. The wage of the driver and the length of time necessary to do a par-

ticular job must also be considered. No information was obtained in respect to these items. It is entirely conceivable that these older trucks, the ones having the lowest operating costs, were as expensive or more expensive to operate when all costs are considered than the newer trucks that could perform the same job in less time, thereby decreasing the wage of the driver per mile operated.

The relationships shown in Table 14 are due to the fact that though the older machines have higher cash costs per mile, their noncash costs are considerably lower, especially when they are driven a large number of miles. The opposite is true for the newer trucks. These machines have lower cash costs per mile, but on the other hand, have a large depreciation and interest charge.

Figure 3 illustrates the effect of season's use (miles driven) on the cost of operating the different aged trucks. Generally speaking the total cost per mile decreases about $\frac{2}{3}$ of a cent for each increase of 1,000 miles in season's use. Thus if a truck 4 years old, driven 3,000 miles, costs 7 cents per mile to operate, then a truck of the same age driven 5,000 miles would cost only 5.7 cents per mile.

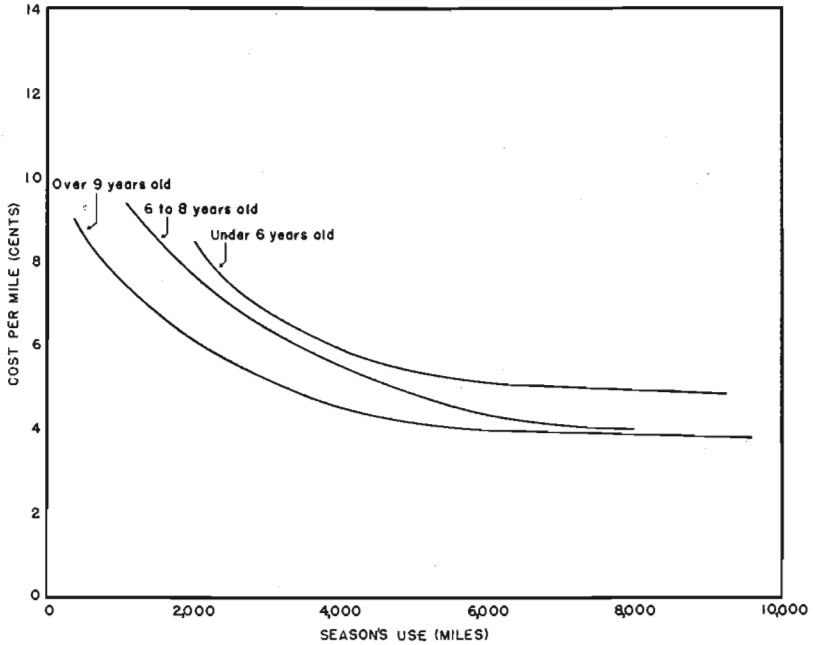

Figure 3. Relationship between season's use and cost per mile for different aged trucks, Willamette Valley, 1940.

The data indicate that on the average an increase of one year in age is associated with a decrease of about $\frac{1}{4}$ of a cent in the total cost per mile. This, of course, assumes that the trucks are driven the same number of miles. For example, if a truck 4 years old driven 3,000 miles costs 7 cents per mile, then a truck 8 years old also driven 3,000 miles would cost about 6 cents per mile.

COST OF OPERATING PICKUPS

Table 15 shows the total cost per mile of operating pickups in 1940 to have been 4.3 cents per mile, whereas the cost per mile for operating those in 1938 was 3.2 cents per mile. The larger mileage for the pickups in 1938 is the main cause for the lower cost per mile. The cash cost per mile for both studies was 2.2 cents. The noncash cost in 1940 was 48 per cent of the total cost as compared with a noncash cost of 32 per cent of the total cost in 1938. This is due to the fact that the 1938 pickups had depreciation and interest charges averaging less than half the same items for the 1940 study. In both cases,

Table 15. COST OF OPERATING PICKUPS ON WILLAMETTE VALLEY FARMS*

Willamette Valley

Item	1940	1938
Number of pickups	22	27
Age—*Years*	5.9	....
Average value	$372	$329
Depreciation	$ 75	$ 67
Season's use—*Miles*	4,576	7,656
Miles per gallon	16.3	15.7
	Cost per mile	
Cost items:	*Cents*	*Cents*
Fuel	1.1	1.2
Oil and grease	.2	.2
Repairs	.3	.3
Tires	.2	.2
License	.1	.1
Insurance	.2	.2
Upkeep labor	.1	....
Total cash cost	2.2	2.2
Interest	.4	.2
Depreciation	1.7	.8
Total noncash cost	2.1	1.0
TOTAL COST	4.3	3.2†

* See Table 23 (Appendix) for instructions and blank form to be used in estimating the cost of operating your own pickup.

† Does not include cost of upkeep labor.

the owners depreciated their pickups about 20 per cent of their present (not new) values.

Effect of season's use on cost per mile

Undoubtedly age as well as season's use affects the cost of operating pickups, but since age was not obtained in the 1938 study and since the 1940 study contains so few pickups, the effect of age cannot be studied.

The effect of season's use on cost per mile is well illustrated in Table 16. In both studies, the total costs as well as the cash and noncash costs per mile decreased with an increase in season's use. The decrease in cash costs is due largely to spreading the license and insurance fees, which are fixed, over a greater season's use. The noncash costs (interest and depreciation) are also divided among a greater number of miles, thereby decreasing the cost per mile.

In the case of the 1938 study, the costs are undoubtedly influenced by age. The pickups driven the most miles had the highest value per machine, while the machines driven the fewest miles had the lowest value. This would suggest that the machines driven the most miles were the newest. In the 1940 study, however, the effect of age has been minimized by using only the machines less than 5 years old. For the latter study, the data indicate that each increase of 1,000 miles in season's use is accompanied by a decrease of ½ cent per mile in operating costs. On the basis of this, if a pickup under 5 years old driven 4,000 miles costs 5.8 cents per mile to operate, then a pickup of the same age driven 8,000 miles would cost about 3.8 cents per mile.

Table 16. EFFECT OF SEASON'S USE ON COST OF OPERATING PICKUPS

Willamette Valley

Group	Average season's use	Number of pickups	Value per pickup	Cost per mile		
				Cash	Noncash	Total cost
1940 study (pickups under 5 years of age)	*Miles*			*Cents*	*Cents*	*Cents*
Under 5,000 miles	3,833	3	$549	2.1	3.7	5.8
5,000 to 7,999 miles	6,125	4	522	2.0	2.2	4.4
8,000 miles and over	8,500	4	657	1.8	1.7	3.5
1938 study (all pickups)						
Under 4,000 miles	1,338	8	206	4.6	3.0	7.6
4,000 to 9,999 miles	5,444	9	336	2.2	1.9	4.1
10,000 miles and over	14,700	10	422	2.0	0.6	2.6

COST OF OPERATING FARM AUTOMOBILES

The 70 automobiles in the 1940 study cost about 4/10 of a cent more per mile to operate than those in 1938 (Table 17). The difference in costs is due to the higher depreciation and interest charges on the 1940 machines. It is interesting to note that the cash costs in the two studies, with the exception of upkeep labor, are identical item for item. The upkeep labor was not obtained in the 1938 study.

Effect of age and season's use on cost per mile

It has been indicated in previous discussions dealing with tractors and trucks that age is often associated with the cost per hour of operating different farm machinery. The actual influence of age, however, is frequently obscured because age is also associated with season's use. In other words, season's use has an important effect on cost, yet the degree of effect will depend on the age of the machine or vice versa.

This combined effect of age and season's use is also true for automobiles (Table 18). The table indicates that the oldest automobiles operated the most miles cost the least per mile. The wage of the driver, however, has not been included. The automobiles 9 years and older driven 10,000 miles or more were the cheapest while those "5 to 8" years old, driven under 5,000 miles, were the most expensive to operate. Further analysis indicates that, after accounting

Table 17. COST OF OPERATING AUTOMOBILES ON FARMS IN THE WILLAMETTE VALLEY*

Willamette Valley

Item	1940	1938
Number of automobiles	70	251
Age—*Years*	6.6	.....
Average value	$384	$279
Depreciation	$ 83	$ 58
Season's use—*Miles*	7,277	6,496
Miles per gallon	16.8	16.9
	Cost per mile	
Cost items:	*Cents*	*Cents*
Fuel	1.1	1.1
Oil and grease	.2	.2
Repairs	.2	.2
Tires	.2	.2
License	.1	.1
Insurance	.2	.2
Upkeep labor	.1	....
Total cash cost	2.1	2.0
Interest	.3	.2
Depreciation	1.1	.9
Total noncash cost	1.4	1.1
TOTAL COST	3.5	3.1†

* See Table 23 (Appendix) for instructions and blank form to be used in estimating the cost of operating your own automobile.

† Does not include cost of upkeep labor.

for the variations in cost associated with age, each increase of 1,000 miles in season's use is accompanied by a decrease in total cost of about ½ of a cent per mile. For example, if it is assumed that an automobile 7 years old driven 5,000 miles costs 5 cents per mile, then an automobile of the same age driven 9,000 miles would cost 4 cents per mile.

For automobiles driven about the same number of miles, each increase of 1 year in age is paralleled by 1/10 of a cent decrease in cost per mile. Thus, if the cost of operating an automobile 5 years old driven 5,000 miles is 5.5 cents per mile, then the cost of a 10-year-old car driven the same number of miles would be about 5 cents per mile.

The reasons for such relationships are readily apparent. The older automobiles are less valuable and consequently have smaller depreciation and interest charges per machine. Although repairs and fuel costs are higher per mile for the older machines, these costs are more than offset by the small noncash costs.

Table 18. EFFECT OF SEASON'S USE AND AGE OF AUTOMOBILE ON COST PER MILE

Willamette Valley, 1940

Season's use	Age			All automobiles
	Under 5 years	5 to 8 years	9 years and over	
	Cents	*Cents*	*Cents*	*Cents*
Under 5,000 miles	5.1	5.6	4.3	5.0
5,000 to 9,999 miles	3.9	3.6	2.9	4.0
10,000 miles and over	3.2	3.1	2.2	3.0
ALL AUTOMOBILES	3.5	3.6	3.1	3.5

In regard to season's use, depreciation and interest charges are relatively fixed and are divided among the number of miles traveled. When a car is driven a large number of miles, therefore, there is a definite saving insofar as these costs are concerned. (See Figure 4.) The cash costs per mile in the form of fuel, oil, repairs, and tires, tend to remain about the same, or in other words, vary in proportion to the mileage of the automobile.

It would be a mistake to conclude that farmers should operate older automobiles merely because they cost less per mile to operate. One should keep in mind that this discussion has not included the important items of quality, dependability, and speed. The type of transportation one should have is usually an individual problem. Undoubtedly most farmers have the type of transportation that is best adapted to their needs, yet consistent with what they can afford.

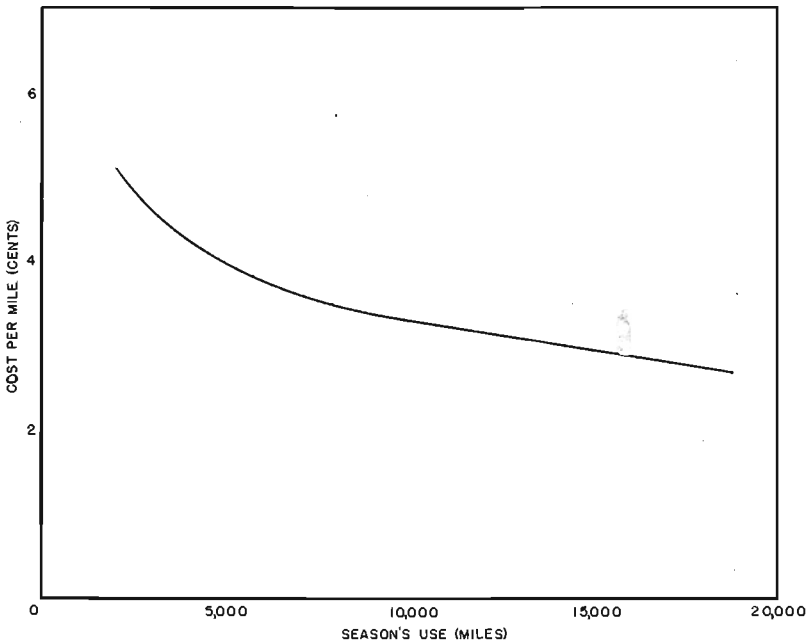

Figure 4. Relationship between season's use (miles) and total cost per mile for farm autos, Willamette Valley, 1940.

APPENDIX

Table 19. EFFECT OF SEASON'S USE AND AGE OF TRACTOR ON CASH COST PER HOUR OF WHEEL TRACTORS

Willamette Valley, 1940

Season's use	Age of tractor: Under 3 years	3 to 5 years	6 years and over	All tractors
	Cents	*Cents*	*Cents*	*Cents*
Under 14 Horsepower:				
Under 400 hours	25.5	26.2	30.5	24.7
400 to 599 hours	20.2	21.5	29.7	24.6
600 hours and over	15.7	23.7	34.3	25.0
All tractors	18.0	22.2	32.1	25.0
14 to 17 Horsepower:				
Under 600 hours	34.1	24.9	30.9	29.0
600 to 1,199 hours	25.8	25.6	29.2	27.0
1,200 hours and over	28.6	28.8	.....	29.0
All tractors	29.0	27.0	30.0	28.0
*18 to 21 Horsepower**				
Under 800 hours	26.3	31.6	64.7	40.8
800 to 1,199 hours	24.4	31.3	33.6	30.2
1,200 hours and over	25.0	37.9	39.2	30.7
All tractors	25.1	34.5	41.4	32.0

* The age groups for these tractors are: under 4, 4 to 5, and 6 and over.

Table 20. EFFECT OF SEASON'S USE AND AGE OF TRACTOR ON NONCASH COST PER HOUR OF WHEEL TRACTORS

Willamette Valley, 1940

Season's use	Age of tractor: Under 3 years	3 to 5 years	6 years and over	All tractors
	Cents	*Cents*	*Cents*	*Cents*
Under 14 Horsepower:				
Under 400 hours	32.0	38.5	24.0	29.2
400 to 599 hours	27.9	23.2	21.7	23.8
600 hours and over	16.2	13.2	12.7	13.8
All tractors	21.3	17.6	17.7	19.0
14 to 17 Horsepower:				
Under 600 hours	31.8	29.9	20.6	27.2
600 to 1,199 hours	19.9	20.7	11.6	17.0
1,200 hours and over	10.4	14.3	.....	13.3
All tractors	19.3	19.2	13.9	18.0
*18 to 21 Horsepower**				
Under 800 hours	26.2	27.2	16.6	23.5
800 to 1,199 hours	18.0	17.7	13.8	16.1
1,200 hours and over	13.4	11.3	13.8	12.9
All tractors	15.5	17.0	14.4	16.0

* The age groups for these tractors are: under 4, 4 to 5, and 6 and over.

Table 21. DISTRIBUTION OF TRUCKS BY SEASON'S USE AND AGE
Willamette Valley, 1940

Season's use	Age			All trucks
	Under 6 years	6 to 8 years	9 years and over	
	Per cent	*Per cent*	*Per cent*	*Per cent*
Under 2,500 miles	31	19	79	46
2,500 to 4,999 miles	31	50	15	31
5,000 miles and over	38	31	6	23
ALL TRUCKS	100	100	100	100

Table 22. DISTRIBUTION OF AUTOMOBILES ACCORDING TO SEASON'S USE AND AGE
Willamette Valley, 1940

Season's use	Age			All automobiles
	Under 5 years	5 to 8 years	9 years and over	
	Per cent	*Per cent*	*Per cent*	*Per cent*
Under 5,000 miles	9	31	55	30
5,000 to 9,999 miles	35	42	35	38
10,000 miles and over	56	27	10	32
ALL AUTOMOBILES	100	100	100	100

Table 23. Form for Determining Cost of Operating Power Equipment

Note: This form has been designed to help the farm operator who wishes to compute the estimated total cost per mile, per hour, or per acre for operating his power equipment. In using this table the upper part should be filled out before the actual cost figures are placed in the bottom half of the form.

Item	Automobile	Truck	Tractor	Combine
Value year ago	$	$	$	$
Present value	$	$	$	$
Average value[1]	$	$	$	$
Season's use for the past year	miles	miles	hours	acres hours
Miles per gallon or gallons per hour..				
Total gallons of fuel used[2]				
Cost of fuel per gallon (cents)[3] ..				
Gallons of oil used				
Cost of oil per gallon (cents) ..				
Hours of upkeep labor[4]				
	Total cost per machine			
Cash costs: Fuel[5]	$	$	$	$
Oil[5]				
Repairs				
Tires				
License				
Insurance				
Upkeep labor[6]				
Total cash costs	$	$	$	$
Noncash costs: Depreciation[7]	$	$	$	$
Interest at .....%[8]				
Total noncash costs ..	$	$	$	$
Total cost (cash plus noncash costs)	$	$	$	$
Total cost per mile, hour, or acre[9]	$	$	$	$

[1]Add the "value year ago" to the "present value" and divide by two.

[2]In the case of automobiles or trucks divide the estimated number of miles driven during the year by the estimated number of miles traveled per gallon of fuel consumed. This will give the total gallons of fuel used. For tractors and combines, multiply the estimated number of hours used during the year by the gallons of fuel used per hour.

[3]Take off any tax *refunds* from the price per gallon.

[4]Estimate the number of hours you and your hired help spent in greasing, repairing, and in general upkeep work on the specific piece of equipment.

[5]Multiply the cost of fuel (or oil) per gallon times the total gallons used in the particular machine.

[6]In order to compute this figure multiply the number of hours of "upkeep labor" listed in the upper part of the table times a reasonable wage rate per hour.

[7]Depreciation is the difference between the values listed as the "value year ago" and the "present value."

[8]The interest rate should be a nominal figure. Five per cent is often used.

[9]Divide the total cost of the machine by its season's use for the year.