THE COST OF OPERATING FARM MACHINERY ON CENTRAL-WESTERN WHEAT FARMS.

By
P. C. DRUCE, *Economics Research Officer.*

One of the principal objectives of the survey of a group of wheat farms in the central-west of New South Wales, conducted by the Division of Marketing & Agricultural Economics in February and March, 1951, was to ascertain the cost of operating machinery in use in the wheat industry.

An account of the survey, which was carried out on 94 farms in the Shires of Goobang and Jemalong and in the Municipalities of Parkes and Forbes, was published in the previous issue of this journal[1].

In this article consideration will be given to conclusions drawn from this survey as to the cost of operating tractors and selected implements. The implements selected for consideration—the twin-disc plough ("sundercut"), scarifier, combine and header—include all but two of those implements which were in general use on wheat farms in the district in which the survey was carried out.

Binders and tyne harrows (both the stump-jump and diamond type) were also widely used on most farms, but only for relatively short periods of the year. The data supplied by farmers participating in the survey was inadequate to allow of any analysis being undertaken of the costs of operating implements other than the four mentioned.

1. THE BASIS OF THE COST DETERMINATION.

The cost figures included in this study are based primarily on farmers' estimates. They include estimates of the remaining useful life of the machinery, estimates of the number of hours worked by the various machines during 1950, estimates of repair costs and fuel consumption in 1950, and estimates of the life of tractor tyres.

[1] See P. C. Druce "Machinery Usage on Wheat Farms in the Central-West", *Review of Marketing and Agricultural Economics,* Vol. 19, No. 2, (June, 1951), pp. 59-81.

In any costing work of the type attempted here it is inevitable that some of the magnitudes must be estimated. Particularly does this apply to the useful life of the machinery. On the other hand actual figures of repair costs for a number of tractors and implements, and of the use made of such machines during a particular period, can be obtained, provided farmers keep accurate records of their machinery operations. It is hoped that some records of this type will be available in twelve months which will enable costs to be determined with greater precision than is at present possible.

The cost figures which follow are average operating costs determined on an hourly basis. They may be readily adapted to an acreage basis, if required. Hourly costs vary appreciably under differing circumstances. The time taken to work land varies to an even greater extent, depending upon the type and condition of the soil worked, the size and shape of the paddock, the gearing and condition of the tractor, the size of the implement and, in the case of harvesting, the state and yield of the crop. Average costs per acre are therefore of little value. However, average costs per hour, ascertained on farms of a similar type, can be used to determine average costs per acre in particular circumstances.

The costs quoted herein do not include any allowance for the value of the farmer's own labour or for the labour of his employees. This is an additional cost which must be added to the costs quoted if the total cost of operating tractors and machinery is to be determined. Farmers' and farm employees' labour involved in the repairing and servicing of farm tractors and implements represents another significant addition to the cost involved in actually working the plant.

Costs are based on the price of fuel and the replacement cost of machinery ruling at Parkes on March 1st, 1951. There was, as might be expected, some slight variation in prices within the area surveyed, due to freight differentials. This also results from the fact that in parts of the district some machinery is normally consigned from Sydney while, in other parts it is consigned from the place of manufacture in Victoria. Prices used are an approximate average of prices ruling in the district at the time, including freight charges.

2. AVERAGE HOURLY COST OF OPERATING TRACTORS.

Tractors have been classified by size according to their rated drawbar horse-power as "small", "medium" and "large." The classification is as follows:—

Small Tractors—Under 20 horse-power.

Medium Tractors—20 to 28 horse-power.

Large Tractors—Over 28 horse-power.

Relatively few "small" tractors were found on the sample farms. They are not suitable for use in wheat production and their operating costs will not be considered here. The average hourly cost of operating both "large" and "medium" kerosene tractors, assuming specific annual rates of usage, is shown in Tables I and II.

The information gathered in the course of the survey was insufficient to allow of the determination of diesel tractor operating costs. All figures quoted herein are therefore applicable only to kerosene tractors, unless the contrary is specifically stated.

TABLE I.

Average Hourly Operating Cost.

"Large" Kerosene Tractor.

Cost Item.	Annual Use.		
	400 hours.	600 hours.	800 hours.
	s. d.	s. d.	s. d.
Depreciation	4 2	2 9	2 1
Interest	1 10	1 2	0 11
	6 0	3 11	3 0
Tyres	0 10	0 10	0 10
Repairs	2 0	2 0	2 0
Kerosene	5 11	5 11	5 11
Petrol	0 5	0 5	0 5
Oil	0 8	0 8	0 8
Grease*a*	0 1	0 1	0 1
Total	15 11	13 10	12 11

a Including average hourly cost of grease used on implement.

TABLE II.

Average Hourly Operating Cost.

"Medium" Kerosene Tractor.

Cost Item.	Annual Use.		
	400 hours.	600 hours.	800 hours.
	s. d.	s. d.	s. d.
Depreciation	2 10	1 11	1 5
Interest	1 4	0 10	0 8
	4 2	2 9	2 1
Tyres	0 8	0 8	0 8
Repairs	1 6	1 6	1 6
Kerosene	4 9	4 9	4 9
Petrol	0 4	0 4	0 4
Oil	0 7	0 7	0 7
Grease*a*	0 1	0 1	0 1
Total	12 1	10 8	10 0

a Including average hourly cost of grease used on implement.

Hourly costs show appreciable variation depending upon annual usage. Hourly costs increase as annual usage falls. The figures included in Tables I and II have therefore been calculated so as to show hourly costs assuming 400, 600 and 800 hours' annual usage. In 1950 the annual usage of all types of tractors on the 94 survey farms averaged 573 hours, but there was appreciable variation in usage on individual farms. In many cases tractors were worked 800 hours or more while in other instances less than 400 hours' work was performed. However, in a normal season, it is unlikely that many wheat farmers would use their tractor for less than 400 hours. A small proportion of farmers may do more than 800 hours' work with their tractor, but the method here used to calculate depreciation results in a steady hourly rate of depreciation after an annual usage of 800 hours is reached. The only other cost factor which fluctuates according to annual usage is the interest charge. Variations in this figure, when annual usage exceeds 800 hours, are relatively small. Hourly costs will therefore decline fairly rapidly as annual usage increases, until an annual usage of 800 hours is reached, after which the decline in hourly costs will be relatively insignificant.

The relative importance of the various cost factors is illustrated in Tables III and IV.

TABLE III.

Relative Importance of Individual Operating Costs—"Large" Kerosene Tractor.

Cost Item.	Annual Use.		
	400 hours.	600 hours.	800 hours.
	per cent.	per cent.	per cent.
Depreciation	26.2	19.9	16.1
Interest	11.5	8.4	7.1
	37.7	28.3	23.2
Tyres	5.2	6.0	6.5
Repairs	12.6	14.5	15.5
Kerosene	37.2	42.8	45.8
Petrol	2.6	3.0	3.2
Oil	4.2	4.8	5.1
Grease *a*	0.5	0.6	0.7
Total	100.0	100.0	100.0

a Including average cost of grease used on implement.

TABLE IV.

Relative Importance of Individual Operating Costs—"Medium" Kerosene Tractor.

Cost Item.	Annual Use.		
	400 hours.	600 hours.	800 hours.
	per cent.	per cent.	per cent.
Depreciation	23.5	18.0	14.2
Interest	11.0	7.8	6.7
	34.5	25.8	20.9
Tyres	5.5	6.2	6.7
Repairs	12.4	14.1	15.0
Kerosene	39.3	44.5	47.5
Petrol	2.8	3.1	3.3
Oil	4.8	5.5	5.8
Grease *a*	0.7	0.8	0.8
Total	100.0	100.0	100.0

a Including average cost of grease used on implement.

It may be noted that overhead costs—depreciation and interest—accounted from 21 per cent. to 38 per cent. of total costs when usage ranged from 400 to 800 hours annually. As the actual range is somewhat greater than these figures would indicate it may be fairly assumed that overhead costs ranged from approximately 20 per cent. to 40 per cent. of total costs at the time in question.

What may be termed prime costs fall into two distinct categories: firstly, tyre and repair costs, and secondly, fuel costs. Tyre and repair costs are somewhat different in nature from fuel costs in that they are spasmodic and can often, but not invariably, be postponed, whereas fuel costs are true prime costs, being incurred inevitably every time the tractor is used.

Fuel costs are the major costs incurred in operating farm tractors. Reference to Tables III and IV indicates that, where tractors were used extensively, fuel costs accounted for over 56 per cent. of the total operating cost. Even when tractors were used for only 400 hours annually, fuel costs represented over 44 per cent. of the total cost. Tyre and repair costs together, represented from 17 per cent. to 22 per cent. of total costs. This group of costs was, then, substantially lower than either overhead costs or fuel costs.

The Individual Cost Items.

(a) Depreciation.

The calculation of depreciation under present circumstances, presents peculiar difficulties. At any time the charge made for depreciation is inevitably of an arbitrary nature. It is nevertheless an important item of cost. In calculating depreciation the objective should be to write down the machinery in question, so that, at the end of its useful life, but not sooner, its book value has been reduced to whatever "junk" or residual value it may then have. In other words it becomes a matter of forecasting

the useful life of the machine either in years or in hours. The useful life of a machine will vary appreciably as the result of a number of factors, including the care with which it is handled, the type of country on which it is worked and the quality of the original material and workmanship in the machine. Technological advances which may be made in the type of machinery in question may also affect the useful life of existing machinery. In other words a machine may be superseded, long before it is worn out, by a new machine which is not merely technologically superior, but so vastly superior that it will pay the farmer to sell or scrap the old machine. Thus the question of obsolescence enters into the calculation.

A further factor which must be taken into account is the recognised fact that as a machine ages spare parts tend to become increasingly difficult to obtain. Consequently, after a number of years, a machine may cease to be an economic proposition due to this difficulty.

Some of these factors, which in practice determine the working life of a particular machine, cannot be predetermined with any great degree of accuracy at the time the machine is originally put into use. The calculations upon which depreciation costs are based must then, of necessity, rest upon forecasts which are not only arbitrary in a high degree but are based on the experience of a number of operators working under somewhat similar, but not identical, circumstances.

In the long term and in a period of stable prices, depreciation is quite as important a cost as the cost of fuel or the cost of repairs and servicing but it cannot be pre-determined with the same degree of accuracy. Under present circumstances the problem of calculating depreciation is greatly increased by virtue of two facts. Firstly, the price of farm machinery, in common with most other commodities, has shown, and continues to show, a steady increase. Since the end of World War II the purchase price of many well-known makes of tractors has more than doubled. Secondly, due to the shortage of many farm implements and some types of tractors, much farm machinery tends to appreciate in market or re-sale value, rather than to depreciate for a period after it leaves the dealer's showroom. Numerous cases of machinery purchased in recent years being sold for a price substantially higher than the original purchase price could be quoted. While these circumstances exist, it is possible for the astute farmer to avoid any significant depreciation cost. He may do this by constantly ordering machinery in advance of his requirements and by disposing of his old machine as soon as a new machine of the same type comes to hand. There was, however, no evidence obtained during the survey to indicate that farmers do pursue such a policy. They generally appear content to obtain a new machine and use it until either it is superseded by an improved type of machine or until such time as it will no longer give satisfactory service. Even under present exceptional circumstances, where a machine may *temporarily* increase in value, depreciation remains a cost and must be taken into account in assessing the total cost of operating farm machinery.

In this study depreciation has been based on the approximate replacement cost of the machinery as at 1st March, 1951. The estimated life of the machinery, used in determining the hourly depreciation charge, is based upon farmers' estimates of the remaining life of machinery in use. In the case of tractors this estimate has been modified slightly.

Farmers were asked to supply the age of their existing tractor or tractors, and at the same time to give an estimate of the remaining useful life of the machine. The information so supplied indicated an estimated total life of 17 years. Independently of this question farmers were also asked to give their estimate of the "economic life" of a tractor used under conditions similar to those existing on their farm. The estimate was given in years and, in some cases, also in hours. Farmers' estimates of the economic life of a tractor averaged 13 years or 12,000 hours.

Taking the age of existing tractors into consideration it appears that under farm conditions an average useful life of 15 years may be expected, unless the annual usage is unusually high. Where annual usage is in excess of 800 hours per annum, an average working life of 12,000 hours is indicated. These two estimates, that is 15 years' work, or 12,000 working hours, whichever is reached first, have been used as a basis for the determination of depreciation charges.

After the period indicated the tractor will normally still be in working order and have some tangible value. But in most cases it will be disposed of at that stage because of obsolescence, because repair costs have become excessive, or because spare parts are difficult or impossible to obtain. As the tractor is still likely to have some value on the market after 15 years or 12,000 hours' work a purely arbitrary residual value of 10 per cent. of the original cost has been assumed in calculating depreciation. A variation of 5 per cent. either way in this residual value would result in quite an insignificant variation in hourly costs, as here determined. As indicated elsewhere, the cost of the original rubber tyres has been deducted from the initial cost of the tractor, prior to determining the hourly depreciation rate.

Undoubtedly, the life of individual tractors, calculated either in years or working hours, will vary very greatly as the result of a number of different factors. Many tractors will become uneconomic to operate well before they reach the age of 15 years or before they have been worked for 12,000 hours; many others will be serviceable for up to 20 years and in rare cases even longer, while 20,000 hours' work is not unusual. Nevertheless, the estimates and assumptions made herein appear reasonable on the evidence available, despite wide individual variations.

The average purchase price, including freight, of the various types of tractors dealt with herein, at 1st March, 1951, was:—

"Large"—Kerosene	.. ..	£1,600
Diesel—4-cylinder	.. ..	£2,400
Diesel—Single-cylinder	.. ..	£1,650
"Medium"—Kerosene	.. .. ..	£1,150
Diesel—4-cylinder	.. ..	£1,500
Diesel—Single-cylinder	..	£1,350

These prices are the unweighted average of comparable makes in each class which were in use in the district. However, in calculating the average purchase price, certain makes were intentionally omitted.

Two British makes, one particularly well-known and widely used in the district, were not taken into account when calculating the average price of the "medium" kerosene tractor. Both these tractors, although falling into the "medium" size group, were appreciably lower-powered

than any of the other makes in this group, all but one of which were of North American manufacture. They were also appreciably cheaper. The depreciation charge for "medium" tractors as used here, is therefore applicable to tractors of from 25 to 28 horse-power. Other costs, such as fuel, are also applicable to that group of tractors rather than to those of from 21 to 22 horse-power.

A new, but popular, six-cylinder British diesel was not taken into account when the average price of "large" diesels was being calculated. The estimated rated drawbar horse-power of this particular machine is 29 and it is therefore less powerful than most of those diesels classified as "large." At the same time its purchase price was very low by comparison with other "large" diesels. It was cheaper than some "medium" diesels. This machine was in no way typical of "large" diesels in common use in the district, being lower-powered and over £1,000 cheaper than the next cheapest "large" orthodox diesel.

Tyre costs are dealt with subsequently. After making allowance for the residual value already referred to and deducting the cost of the original type equipment, depreciation rates for the various types of tractors, according to annual usage, have been determined and are set out in Table V.

TABLE V.

Hourly Depreciation Rates for Tractors.

Size and Type of Tractor.	Annual Use.		
	400 hours.	600 hours.	800 hours.
	s. d.	s. d.	s. d.
"Large" Tractors—			
Kerosene	4 2	2 9	2 1
Diesel—4-cylinder ...	6 6	4 4	3 3
Single-cylinder ...	4 4	2 11	2 2
"Medium" Tractors—			
Kerosene	2 10	1 11	1 5
Diesel—4-cylinder ...	3 11	2 7	2 0
Diesel—Single-cylinder ...	3 6	2 4	1 9

(b) Interest.

The annual interest charge has been calculated at the current bank rate of 4½ per cent. on half the purchase price of the machine as at 1st March, 1951. The hourly interest charge therefore varies according to annual usage, irrespective of the number of hours worked. It is the only hourly cost which continues to fall when annual usage exceeds 800 hours.

(c) Tyres.

In normal circumstances it becomes necessary to replace tyres at least once, usually twice, and sometimes more frequently, during the life of a tractor. As the cost of tractor tyres is particularly heavy, hourly tyre costs, including the cost of the tyres with which the tractor was originally equipped, have been calculated independently of depreciation charges and of repair costs.

Farmers were asked to give an estimate of the life of tractor tyres in working hours, based on their past experience. Front tyres were treated separately from rear tyres, although many farmers apparently did not consider there was any significant difference in the life of front tyres as compared with rear tyres.

Naturally there was great variation in farmers' estimates. Such a variation is to be expected owing to the range of soil types found in the district and, of course, as a result both of the manner in which the tractor is operated and the care given the tyres. In some instances farmers reported over 10,000 hours' use from rear tyres, while in a few cases normal use was set at less than 2,000 hours. Both these figures were exceptional. There is, of course, variation in the rate of wear on the rear tyres, the furrow-tyre wearing at a more rapid rate. It is common practice to rotate wheels with a view to obtaining relatively even wear. Farmers were also asked whether they had their tractor tyres retreaded. Less than five per cent. of those interviewed replied in the affirmative; the remainder considered that retreading was uneconomic. Tyre costs have therefore been determined on the assumption that retreading was not practised.

Hourly costs are based on the average cost of the size of tyre most commonly fitted to the two sizes of tractor dealt with. The price of tyres upon which costs are based was that ruling on 1st March, 1951. There have been substantial increases in tyre prices since that date.

The farmers' estimate of the life of tractor tyres, in hours, the cost of tyres and the total average hourly cost, as on 1st March, 1951, are shown in Table VI.

TABLE VI.

Estimated Average Life of Tractor Tyres—Prices of Tyres and Average Hourly Cost—1st March, 1951.

Size of Tractor.	Estimated Average Life.		Average Price—1st March, 1951.		Average Hourly Cost—Full Set.
	Front.	Rear.	Front.	Rear.	
	hours	hours	£	£	s. d.
"Large"	5,000	4,500	32	165	0 10
"Medium"	5,500	5,000	30	145	0 8

There is no evidence to suggest that there is any variation in the life of tyres due to a difference in the motive power of the tractor. The rate of tyre wear on kerosene and diesel tractors is presumably the same.

(d) Repairs.

Hourly repair costs are based on the farmers' reported costs during 1950. Naturally there is very considerable individual variation as not only do figures relate to tractors ranging in age from a few months to over 15 years but, as might be expected, major overhauls were undertaken on some tractors during the year while other tractors required virtually no attention, apart from normal servicing. Unfortunately, insufficient information was available to enable any assessment of repair costs on diesel tractors.

Included in the figure of hourly repair costs is the cost of all replacement parts and the cost of work done on the tractor by garages and servicing agencies. The figure does not include any allowance for time spent by the farmer or his employees in servicing or repairing the tractor. This is, of course, quite a considerable cost as the majority of farmers, or their employees, carry out all routine servicing on their machinery. They also undertake nearly all minor repairs and quite frequently undertake most major repair jobs.

Farmers were asked to estimate the total time spent by themselves or their employees in working on their machinery, exclusive of the time spent in routine servicing whilst actually operating the machinery. Here again there was great variation in the answers given. They ranged from 50 hours to 450 hours and averaged 130 hours per annum. It is believed that the estimates were generally conservative. Farmers were also asked to express an opinion, based on their past experience, as to the number of hours of work obtained from a set of engine sleeves. Again, and as might be expected, estimates varied greatly. In some instances farmers stated that they had re-sleeved their tractors three times in less than 7,000 working hours, while others claimed over 10,000 working hours without a re-sleeve. Some makes are not fitted with sleeved engines. In so far as these machines were concerned farmers were asked to indicate the number of hours' work obtained prior to a rebore or the fitting of a new block. The information supplied did not suggest that there was any significant variation in the engine life of "large" and "medium" tractors.

The average estimated working life of a set of sleeves in a kerosene tractor was 5,500 hours. It was not possible to assess a similar figure for diesel tractors.

(e) Fuel.

Fuel costs are based on prices ruling in the district at the time the survey was undertaken. There was a slight variation in price in different parts of the district but it was not more than one-halfpenny per gallon. Fuel prices used in the determination of costs are shown in Table VII.

TABLE VII.

Fuel Prices.

Fuel.	Unit.	Price.
		s. d.
Kerosene	gallon ...	2 4½
Petrol	gallon ...	3 6
Distillate *a*	gallon ...	2 1½
Diesel Fuel *b*	gallon ...	1 9½
Lubricating Oil	gallon ...	9 1
Grease	lb.	0 11½

a Marketed under various trade names such as "Dieseline" and "Diesoleum."
b The grade of fuel varies appreciably. Usually sold on a tonnage basis, but converted to an approximate gallonage basis here.

The hourly rate of consumption is based on information supplied in the survey. Many farmers were unable to supply accurate information but it was possible to assess reliable average figures for kerosene tractors. However, the information supplied was not sufficiently complete to allow of any estimates being made of average fuel consumption by diesel tractors, with the exception of the "medium" single-cylinder diesel. Average hourly fuel consumption figures are shown in Table VIII.

TABLE VIII.

Average Hourly Fuel Consumption.

Type and Size of Tractor.	Fuel.			
	Kerosene.	Petrol.	Diesel Fuel.	Oil.
	gallons.	pints.	gallons.	pints.
"Large"—Kerosene	2.25–2.50	1.00	...	0.6
"Medium"—Kerosene	1.75–2.00	0.75	...	0.5
"Medium"—Diesel—Single-cylinder only *a*	...	...	0.75–1.00	0.5

a Starting cartridges, costing 1s. each, are used for starting purposes.

In the cost figures shown earlier, in Tables I and II, the higher consumption figure was used, where a range is quoted. This course was followed because the lower figure usually applied to tractors significantly smaller than the majority of tractors in the size-range. The fuel costs quoted may therefore be taken as applying to tractors of over 30 horse-power in the "large" group and of 25 horse-power or over in the "medium" group. The hourly rate of fuel consumption of tractors of 29 to 30 horse-power and of about 21 horse-power (a size in widespread use) would normally be slightly lower than that quoted here for "large" and "medium" tractors, respectively.

The consumption of diesel fuel by "medium" single-cylinder diesel tractors was based almost entirely on the fuel consumption of one make of tractor, rated at 28 horse-power.

Grease costs were very small. The figure quoted for tractors also included the cost of grease used on the implement drawn. The cost of grease used on both the tractor and implement together was usually less than one penny per hour. Obviously there would be considerable variation in the quantity of grease used, depending upon the implement being operated. It has not been possible to treat implements individually, nor to separate them from the tractor, insofar as the use of grease is concerned.

(f) Other Costs.

Certain costs not included in the foregoing tables must also be recognised. The first is the cost of labour; whether the farmer's own labour or the labour of his employees. This is a most significant cost and while no attempt is made here to evaluate it, it is probably the greatest single cost incurred in operating a tractor.

Another cost not dealt with is the cost of housing the tractor, and implements. This cost is relatively insignificant. It is doubtful if it would under any circumstances, exceed 4d. per hour for a tractor, if full allowance were made for depreciation on the building and interest on the investment. In view of its relative insignificance and the fact that accurate information relating to housing costs was not available, it has been ignored in this study.

One further cost is at times incurred. That is the cost of registering and insuring the tractor. This cost has not been included in the figures quoted herein because in the course of the survey it was found that only in rare circumstances did wheat-farmers either register or insure their tractors. Tractors were rarely registered unless extensive contract work was engaged in; they were seldom insured unless purchased on terms. Of the 125 tractors on the 94 survey farms only nine were registered and twelve insured at the time the survey was carried out.

3. THE COST OF OPERATING KEROSENE AND DIESEL TRACTORS COMPARED.

Unfortunately insufficient information was obtained in the course of the survey to allow of any conclusions being reached as to the relative costs of operating kerosene and diesel tractors of equivalent power output.

However, as this is a matter of very real interest to the majority of purchasers of agricultural tractors it is worth discussing, briefly, the various factors involved.

Factors which must be taken into consideration include the initial cost of the respective machines, their useful working life, together with fuel and repair costs. In respect of some of these factors a clear-cut comparison can be made but in respect of others the position is as yet far from clear.

Insofar as the initial cost is concerned the position is plain. The orthodox four-cylinder diesel is clearly more expensive than the kerosene tractor of similar power-output. However, the single-cylinder diesel is not appreciably dearer than the kerosene-operated tractor, and in some individual cases may be even cheaper. For this reason, and because single-cylinder diesels are usually particularly economical in so far as fuel consumption is concerned, it is desirable in discussing the relative costs of operating diesel and kerosene tractors, to distinguish between the orthodox diesel, usually of four cylinders, and the single-cylinder diesel.

The fact that the orthodox diesel is more expensive than the kerosene tractor does not necessarily mean that depreciation must be charged at a higher rate. It may be that the diesel tractor has a longer life than the kerosene tractor. It is generally considered in the trade that this is the case. Here again, the question of obsolescence and the difficulty of obtaining spare parts must be taken into consideration. Whether the diesel tractor will have a longer life *in years*, by comparison with the kerosene tractor may be doubted, although if used extensively at a rate of usage in excess of 800 hours per year, the diesel may very well have a longer life in *working hours*.

No definite conclusion can be drawn at this stage but it appears almost certain that a higher hourly depreciation rate must be charged on orthodox diesel tractors than on kerosene tractors, unless annual usage is well in excess of 800 hours.

Hourly depreciation rates, assuming an equivalent life in years, are shown for the three types of tractors in Table IX.

TABLE IX.

Average Hourly Depreciation—Kerosene and Two Types of Diesel Tractor.

Size and Type of Tractor.	Annual Use.		
	400 hours.	600 hours.	800 hours
	s. d.	s. d.	s. d.
"Large" Tractors—			
Kerosene	4 2	2 9	2 1
Diesel—4-cylinder ...	6 6	4 4	3 3
Single-cylinder ...	4 4	2 10	2 2
"Medium" Tractors—			
Kerosene	2 10	1 11	1 5
Diesel—4-cylinder ...	3 11	2 7	1 11
Single-cylinder ...	3 6	2 4	1 9

The interest charge would also be somewhat higher on orthodox diesels than on kerosene tractors, but the difference would not be great where fairly extensive use was made of the tractors. The difference in the interest charge between single-cylinder and kerosene tractors would be almost negligible.

Fuel costs on the other hand, are clearly lower in the case of diesels. This applies particularly to those machines which use low grade diesel fuel. This fuel is used in most diesels of European manufacture and in all single-cylinder diesels. Not only is fuel consumption per hour lower but the cost of the fuel used is also less per unit.

There is no evidence to suggest that the rate of wear on tyres differs on diesel tractors by comparison with kerosene tractors. The only other cost to be taken into account, then, is the cost of servicing and repairs. Here, unfortunately, no conclusive evidence is available.

4. AVERAGE HOURLY COSTS OF OPERATING SELECTED IMPLEMENTS.

The hourly cost of operating the four types of implements most commonly and widely used in wheat production in the district in which the survey was conducted is shown in Table X. In the determination of these cost figures it has been necessary to assume a certain annual rate of usage for each machine. The cost figures are based on the following annual rates of usage:—

Twin-Disc Plough	200 hours.
Scarifier	150 hours.
Combine	125 hours.
Header	150 hours.

These figures are not identical with the average usage of 1950 on the sample farms. Some minor adjustments have been made in view of the fact that (i) rather exceptional seasonal conditions were experienced in 1950, and (ii) the area sown to wheat in that season was below normal. The assumed annual usage is believed to be typical of the use made of such machinery on wheat farms in the district.

Since overhead costs account for up to 78 per cent. of total costs at the rate of usage here used, it is apparent that the annual rate of usage has a very significant effect on the hourly cost of operating farm implements. It is of far greater significance with implements than with tractors.

TABLE X.

Average Hourly Cost of Operating Selected Farm Implements.
(Figures calculated to nearest halfpenny.)

Implement.	Size.	Cost Item.				Total Cost.
		Depreciation.	Interest.	Total Overhead Costs.	Repairs.	
		s. d.	s. d.	s. d.	s. d.	s. d.
Twin-Disc Plough ...	10-disc	0 8½	0 5	1 1½	1 5	2 6½
	12-disc	0 9½	0 5½	1 3	1 6	2 9
	14-disc	0 10½	0 6	1 4½	1 7	2 11½
Scarifier	10-tyne	0 7½	0 4	0 11½	0 7	1 6½
	14-tyne	0 8½	0 4½	1 1	0 9	1 10
	18-tyne	0 9	0 5	1 2	0 11	2 1
	20-tyne	0 10½	0 6	1 4½	1 0	2 4½
Combine	14-row	1 4	0 8½	2 0½	0 8	2 8½
	16-row	1 5	0 9	2 2	0 9	2 11
	20-row	1 8	0 11	2 7	0 10	3 5
	24-row	2 0½	1 1	3 1½	1 0	4 1½
Header	8-ft.	4 11	1 8	6 7	2 6	9 1
	10-ft.	7 4½	2 6	9 10½	2 10	12 8½
	12-ft.	7 9½	2 7½	10 5	3 0	13 5
	14-ft.	8 8	2 11	11 7	3 2	14 9

The Individual Cost Items.

(a) Depreciation.

Depreciation has been calculated using replacement costs as at 1st March, 1951, as a basis. The average useful life of the implements in years, is based on farmers' estimates, with minor adjustments. The estimated useful life of the machines is shown in Table XI.

TABLE XI.

Estimated Life of Implements.

Implement.	Estimated Life.	Implement.	Estimated Life
	Years.		Years.
Twin-Disc Plough ...	25	Combine	24
Scarifier	24	Header	15

Where possible the price of machinery used in determining hourly operating costs is the average price (including the estimated freight) of the product of two or more manufacturers. In some instances, however, a particular machine is supplied by only one manufacturer.

In other instances it is virtually impossible to compare the product of one manufacturer with the product of another. In these cases the price used for costing is that of the cheapest machine of the particular type available from the leading suppliers. The only exception is that the price of the 8-ft header is the price of a machine without hydraulic lift whereas the prices of the 10-ft., 12-ft. and 14-ft. headers are the prices of the cheapest machines fitted with hydraulic lift.

The prices of the various machines upon which interest and depreciation costs are based are shown in Table XII.

TABLE XII.

Approximate Price of Implements—1st March, 1951.a

Implement.	Size.	Price (incl. freight).
		£
Twin-Disc Plough *b*	10-disc	180
	12-disc	200
	14-disc	220
Scarifier *c*	10-tyne	110
	14-tyne	130
	18-tyne	145
	20-tyne	155
Combine *c*	14-row	200
	16-row	215
	20-row	250
	24-row	305
Header	8-ft.*d*	555
	10-ft.*e*	830
	12-ft.*e*	875
	14-ft.*e*	975

a Price to nearest £5.
b Average price of four makes.
c Cheapest available at time.
d Not fitted with hydraulic lift.
e Fitted with hydraulic lift.

(b) Interest.

The interest charge has been calculated in precisely the same manner as used in determining the interest charge included in the hourly cost of operating tractors.

(c) Repairs.

The hourly cost of repairs, including disc and point replacements, etc., is based on farmers' estimates of their costs and usage in 1950. As with tractors the farm-time spent in servicing and repairing implements, although appreciable, is not taken into account.

(d) Other Costs.

The only other costs which could be incurred in operating any of the implements dealt with here would be housing costs and grease costs. The question of determining the cost of housing tractors has already been discussed. Similar problems apply to implements. However, the majority of farmers do not provide housing for ploughs or scarifiers. Nor do some provide cover for combines. With few exceptions, housing is provided for headers. All grease costs have been included in hourly tractor operating costs, for reasons already given.