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Tractors  
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THE WEST OF SCOTLAND AGRICULTURAL COLLEGE

ECONOMICS DEPARTMENT

DIESEL TRACTOR OPERATING COSTS  
1953-54

A Summary For 15 Tractors

By  
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REPORT No. 19  
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GLASGOW, C.2.

## INTRODUCTION

At the request of the Engineering Department of the College, a small survey into the costs of operating Diesel tractors was begun on 1st March, 1953.

For the whole year sixteen records were completed. One of these, that of a Diesel conversion from an older petrol driven tractor has been excluded from the averages.

This report relates to a sample of fifteen tractors.

## THE SAMPLE

The fifteen tractors have been classified according to engine cubic capacity into three groups, the grouping being as follows:-

Light	(under 2500 c.c.)	6 tractors
Medium Light	(2500 c.c. to 3000 c.c.)	6 tractors
Medium Heavy	(3000 c.c. and over)	3 tractors
	Total	15 tractors

The tractors were all fairly new. The newest was one month old and none was older than two years at the start of the costing year. The average age for the whole sample at the start was twelve months.

## METHOD OF RECORDING

The work done was divided into four groups:-

- A - Ploughing.
- B - Stationary Belt Work (including all stationary work whether from belt or power take-off).
- C - Road Work and Haulage.
- D - All Other Work.

For measuring the fuel in the tank the Engineering Department provided dip sticks graduated for each make of tractor. Daily job record sheets showing the class of job done, the number of hours worked and the fuel used during the day were kept by the tractor driver. This information was summarised on weekly sheets together with notes on changing of lubricating oils, any repairs and time spent on maintenance etc. by farm staff.

In the case of "Road Work and Haulage" normal stops were included in the time shown, so that the fuel consumption figures are not necessarily of the actual engine running time but rather of the time spent at any job of this type.

Except where otherwise stated, all the averages are unweighted averages giving equal weight to each tractor.

<u>SUMMARY</u>	All Types	Light	Medium Light	Medium Heavy
No. of tractors costed	15	6	6	3
Average age at start of cost year	12mths.	10mths.	18mths.	4mths.
Average cost when new	£633	£548	£683	£703
Average hours worked per year	1146hrs.	1306hrs.	1012hrs.	1092hrs.
Average fuel consumed per year	463gals.	485gals.	443gals.	458gals.
Average fuel consumption per hour	.40gals.	.38gals.	.42gals.	.41gals.
Average lubricating oil used per hr.	.10pts.	.09pts.	.11pts.	.08pts.
Average price per gallon of fuel	1/2 <sup>3</sup> / <sub>4</sub> d.	1/2d.	1/2 <sup>3</sup> / <sub>4</sub> d.	1/4d.
Average cost per year - Depreciation	£133	£121	£121	£180
- Other Costs	59	65	55	56
	£192	£186	£176	£236
Average cost per hour - Depreciation	2/7 <sup>1</sup> / <sub>2</sub> d.	2/1 <sup>1</sup> / <sub>4</sub> d.	2/7 <sup>1</sup> / <sub>2</sub> d.	3/7 <sup>1</sup> / <sub>2</sub> d.
- Other Costs	1/0 <sup>3</sup> / <sub>4</sub> d.	11 <sup>3</sup> / <sub>4</sub> d.	1/0 <sup>3</sup> / <sub>4</sub> d.	11 <sup>1</sup> / <sub>2</sub> d.
	<u>3/7<sup>1</sup>/<sub>2</sub>d.</u>	<u>3/1d.</u>	<u>3/8<sup>1</sup>/<sub>4</sub>d.</u>	<u>4/6<sup>3</sup>/<sub>4</sub>d.</u>



SEASONAL DISTRIBUTION OF WORK

For the whole sample the average number of hours worked during the year was 1146, the range being from 630 to 1895.

The seasonal distribution of work by thirteen periods each of four weeks is shown in the following tables. Table I shows the average number of hours worked in each period. Table II expresses these as a percentage of the yearly total.

TABLE I

The distribution of working hours by 4-week periods expressed as the average number of hours worked in each period.

<u>Period ended</u>	<u>All Types</u>	<u>Light</u>	<u>Medium Light</u>	<u>Medium Heavy</u>
28th March, 1953	125	146	106	124
25th April, "	97	107	88	96
23rd May, "	105	128	92	88
20th June, "	73	90	63	59
18th July, "	82	82	75	95
15th August, "	85	83	74	112
12th September, 1953	118	124	104	131
10th October, "	82	98	73	66
7th November, "	75	109	59	38
5th December, "	66	79	61	50
2nd January, 1954	80	90	71	76
30th January, "	78	85	73	72
27th February, "	80	85	73	85
Total Hours	<u>1146</u>	<u>1306</u>	<u>1012</u>	<u>1092</u>

It will be seen that the peak periods are during the Spring and at harvest time.

TABLE II

The distribution of working hours by 4-week periods expressed as a percentage of the yearly total.

<u>Period ended</u>	<u>All Types</u>	<u>Light</u>	<u>Medium Light</u>	<u>Medium Heavy</u>
28th March, 1953	11	11	11	11
25th April, "	9	8	9	9
23rd May, "	9	10	9	8
20th June, "	6	7	6	5
18th July, "	7	6	8	9
15th August, "	7	6	7	10
12th September, 1953	10	9	10	12
10th October, "	7	8	7	6
7th November, "	7	8	6	3
5th December, "	6	6	6	5
2nd January, 1954	7	7	7	7
30th January, "	7	7	7	7
27th February, "	7	7	7	8
	<u>100%</u>	<u>100%</u>	<u>100%</u>	<u>100%</u>

TYPE OF WORK DONE

The time spent on each of the four groups of work is shown in Tables III and IV.

TABLE III

The average number of hours worked during the year

	<u>All Types</u>	<u>Light</u>	<u>Medium Light</u>	<u>Medium Heavy</u>
Ploughing	178	214	182	100
Stationary Belt Work, etc.	35	33	21	65
Road Work and Haulage	383	425	342	379
All Other Work	550	634	467	548
Total Work	<u>1146</u>	<u>1306</u>	<u>1012</u>	<u>1092</u>

The average tractor in the sample and in each group spent about a third of its time on road work and haulage.

TABLE IV

The time spent on each of the four groups of work expressed as a percentage of the yearly total.

	<u>All Types</u>	<u>Light</u>	<u>Medium Light</u>	<u>Medium Heavy</u>
Ploughing	16	16	18	9
Stationary Belt Work, etc.	3	3	2	6
Road Work and Haulage	33	33	34	35
All Other Work	48	48	46	50
	<u>100%</u>	<u>100%</u>	<u>100%</u>	<u>100%</u>

FUEL CONSUMPTION

For the whole sample the average fuel consumption rate was .40 gallons per hour. The lowest rate of fuel consumption was .28 gallons per hour for a tractor which spent almost half of its time on road work and haulage, with very little ploughing, and where in addition the land was very easily worked. The highest rate was .56 gallons per hour for a tractor which spent about one third of its time ploughing. The land on this farm was heavier and the tractor was one of the oldest in the sample.

The average amount of fuel consumed per tractor per year was 463 gallons for the whole sample, and 485 gallons, 443 gallons and 458 gallons for the Light, Medium Light and Medium Heavy groups respectively.

Table V shows the average fuel consumption in gallons per hour for the different types of work. These averages are obtained from the number of tractors which actually did the work shown in the side groupings.

TABLE V

The figures in brackets show the number of tractors which actually worked on these job groups, and from which these average fuel consumption figures are obtained.

	<u>Average Fuel Consumption by Job Groups</u>			
	<u>Gallons per Hour</u>			
	<u>All Types</u>	<u>Light</u>	<u>Medium Light</u>	<u>Medium Heavy</u>
Ploughing	.48 (15)	.44 (6)	.55 (6)	.42 (3)
Stationary Belt Work, etc.	.51 (10)	.61 (4)	.42 (4)	.48 (2)
Road Work and Haulage	.33 (14)	.30 (6)	.35 (5)	.35 (3)
All Other Work	.42 (15)	.41 (6)	.41 (6)	.48 (3)
Total Work	.40 (15)	.38 (6)	.42 (6)	.41 (3)

COST STRUCTURE

The various items of expense are briefly outlined below.

Fuel Oil

This was charged at purchase price to the farmer. During the costing year there were slight fluctuations in price and also small price variations depending on the distance of the farm from the distributing depots. There was also a difference in price according to the amount bought in at one time. The lowest price during the costing year was  $1/18^d$ . per gallon for a bulk delivery of 500 gallons. The highest price was  $1/6^d$ . per gallon where the fuel oil was bought by the drum.

The weighted average price per gallon during the costing year was  $1/2^d$ .

### Lubricating Oils and Grease

These oils - engine oil, air cleaner oil and transmission oil - were charged at purchase price to the farmer. The prices varied slightly according to the make and grades used. The weighted average price for all types used during the costing year was  $8\frac{1}{4}$ d per gallon. The weighted average price for grease was  $1\frac{3}{4}$ d. per lb.

The average amount of lubricating oil used per tractor per hour was .10 pints for the whole sample, and .09 pints, .11 pints and .08 pints for the Light, Medium Light and Medium Heavy groups respectively.

### Repairs and Spares

Details of repairs, spares and renewals were recorded on the weekly summary sheets. The commonest expenses in this section were for the periodical changes of oil and fuel filters and occasionally injectors. Renewal of tyres and batteries where this occurred was charged to this section at the net cost to the farmer (any allowance on the return of the used article to the agent being taken into account). In only one case were new batteries fitted during the costing year. The tractor in question was fifteen months old at the start and recorded 1700 working hours during the year.

Four of the tractors were decarbonised during the costing year.

### Share of Major Overhauls

Where a repair was considered big enough to be classed as a "Major Overhaul", the cost was not included with "Repairs and Spares" but was divided by the estimated life of the overhaul and the resulting figure put to "Share of Major Overhauls" in the cost statement. Repairs to four tractors during the costing year were classed as major overhauls, where in most cases the tractor had to be left with the agent. These overhauls included the fitting of a new type cylinder head, the relining of brakes and the fitting of new fuel pumps, clutch plates, valves and piston rings. In one case where the overhaul was done under warranty, only the actual cost to the farmer was taken into account.

As there were no major overhauls to any of the tractors before the start of the costing year and as none of the farmers foresaw any major overhauls, this item "Share of Major Overhauls" deals only with those incurred during the costing year.

The most expensive of these overhauls cost £45.

### Tax and Insurance

All the tractors in the sample were licensed for road work. This cost £2 per annum. The insurance premiums varied with the type of policy.

### Maintenance and Service Time

The time spent by the farm staff on the routine maintenance and servicing of the tractor - on refuelling, greasing, changing oil and cleaning etc. - was noted and charged at an hourly rate based on the tractorman's weekly wage. Where the farmer himself worked with the tractor, a flat rate of  $3\frac{1}{4}$ d. per hour was charged.

The weighted average rate per hour for the whole sample was  $2\frac{1}{4}$ d.

The average time spent on maintenance during the whole year was 65 hours for the whole sample, and 83 hours, 46 hours and 66 hours for the Light, Medium Light and Medium Heavy groups respectively.

### Depreciation

Depreciation was calculated at  $28\frac{1}{8}\%$  ( $22\frac{1}{2}\%$  + the additional allowance of one-quarter) per annum from the date of original purchase. (Any capital additions were also included.) Thus  $28\frac{1}{8}\%$  of the written-down value at the start of the costing year was charged against the year's costing.

Since all the tractors in the sample were fairly new the depreciation charge is high, as will be seen in the following cost statements. The cost per hour, however, may be quite low provided that this depreciation charge can be spread over a sufficient number of working hours, and as the tractor becomes older the charge made for depreciation by this method will decrease, although this may to some extent be offset by increased costs for repairs.

COSTS - TOTAL AND PER HOUR

The following tables show the average annual and hourly costs per tractor for the whole sample, and for each of the three groups.

TABLE VI

The average annual and hourly costs per tractor for the whole sample.

<u>Cost Structure</u>	<u>£'s per Year</u>	<u>Pence per Hour</u>
Fuel	28. 9. 7.	5.90
Lubricating Oil	6. 0. 8.	1.21
Grease	-.17. 0.	.15
Repairs and Spares	8. 2. 7.	1.44
Tax and Insurance	4.15. 7.	1.11
Maintenance and Service Time	9.10. 0.	2.04
	<u>57.15. 5.</u>	<u>11.85</u>
Depreciation	132.17. 7.	31.33
	190.13. 0.	43.18
Share of Major Overhauls	1. 8. 2.	.32
	<u>£192. 1. 2.</u>	<u>43.50d. 3/7<sup>1</sup>/<sub>2</sub>d.</u>

If depreciation and tax and insurance (which are fixed costs) are excluded, the running cost per hour amounted to just over 11d. for the average tractor in the whole sample.

TABLE VII

The average annual cost per tractor for each of the three groups.

Average Annual Cost (£'s per Year)

<u>Cost Structure</u>	<u>Light</u>	<u>Medium Light</u>	<u>Medium Heavy</u>
Fuel	28. 6. 1.	27. 7.11.	30.19.11.
Lubricating Oil	6.11. 0.	6. 5. 0.	4.11. 4.
Grease	-. 8. 7.	1. 5. 9.	-.16. 5.
Repairs and Spares	12.10. 7.	5. 9. 7.	4.12. 6.
Tax and Insurance	5.12. 9.	4. 2. 7.	4. 7. 3.
Maintenance and Service Time	11.13.10.	7. 2. 4.	9.17. 6.
	<u>65. 2.10.</u>	<u>51.13. 2.</u>	<u>55. 4.11.</u>
Depreciation	120.19. 8.	121. 4. 3.	180. 0. 3.
	186. 2. 6.	172.17. 5.	235. 5. 2.
Share of Major Overhauls	-	3. 4. 8.	-.11. 5.
	<u>£186. 2. 6.</u>	<u>£176. 2. 1.</u>	<u>£235.16. 7.</u>

If depreciation and tax and insurance (which are fixed costs) are excluded, Table VIII shows that there was very little difference in running costs between the different groups of the tractors recorded, the running costs per hour being 10<sup>1</sup>/<sub>2</sub>d, 11<sup>3</sup>/<sub>4</sub>d and 10<sup>1</sup>/<sub>4</sub>d for Light, Medium Light and Medium Heavy groups respectively.

TABLE VIII

The average cost per working hour for each of the three groups.

Average Hourly Cost (Pence per Hour)

<u>Cost Structure</u>	<u>Light</u>	<u>Medium Light</u>	<u>Medium Heavy</u>
Fuel	5.32	6.12	6.59
Lubricating Oil	1.20	1.40	.83
Grease	.04	.29	.08
Repairs and Spares	1.84	1.39	.83
Tax and Insurance	1.20	1.04	1.09
Maintenance and Service Time	2.28	1.84	1.91
	<u>11.88</u>	<u>12.08</u>	<u>11.33</u>
Depreciation	<u>25.24</u>	<u>31.42</u>	<u>43.33</u>
	37.12	43.50	54.66
Share of Major Overhauls	-	.75	.08
	<u>37.12</u>	<u>44.25</u>	<u>54.74</u>
	3/1d.	3/8 <sup>1</sup> / <sub>2</sub> d.	4/6 <sup>3</sup> / <sub>4</sub> d.

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