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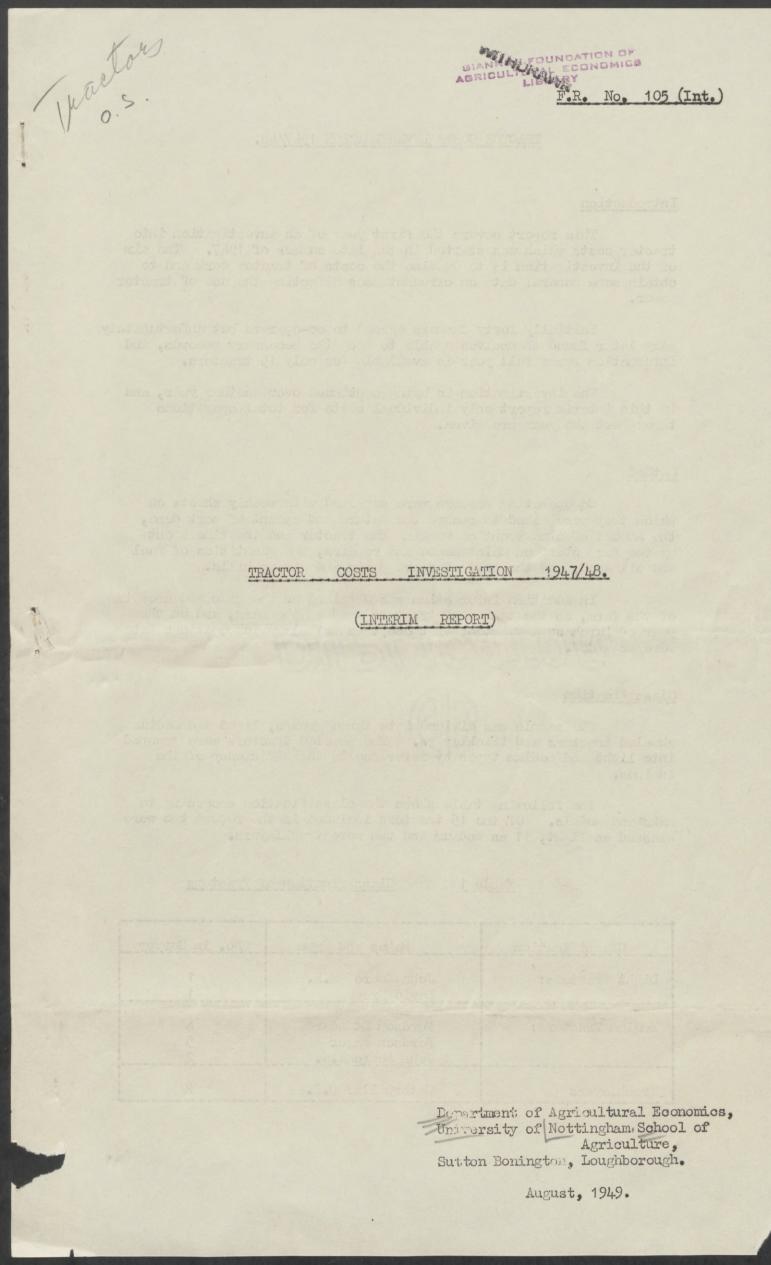
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TRACTOR COSTS INVESTIGATION 1947/48.

Introduction

This report covers the first year of an investigation into tractor costs which was started in the late summer of 1947. The aim of the investigation is to examine the costs of tractor work and to obtain some general data on circumstances affecting the use of tractor power.

Initially forty farmers agreed to co-operate but unfortunately many later found themselves unable to keep the necessary records, and information for a full year is available for only 15 tractors.

The investigation is being continued over another year, and in this interim report only individual costs for total operations throughout the year are given.

Method

Co-operating farmers were supplied with weekly sheets on which they were asked to record the nature and amount of work done, the amount of time spent on working the tractor and the time spent by the farm staff on maintenance and repairs, the quantities of fuel and oil used, and the cost of spare parts and garage bills.

In addition information was obtained on the size and cropping of the farm, on the number of tractors used on the farm, and on the year of purchase and prices of those tractors for which costings data were provided.

Classification

The sample was divided into three groups, light and medium wheeled tractors and tracklayers. The wheeled tractors were grouped into light and medium types by reference to the efficiency of the engines.

The following table shows the classification according to makes and models. Of the 15 tractors included in the report two were classed as light, 11 as medium and two were tracklayers.

Table 1

Classification of Tractors

Classification	Makes and Type	No. in Survey
Light Tractors:	John Deere B.R. David Brown	1
Medium Tractors:	Fordson Standard Fordson Major John Deere A.N.	4. 5 2
Tracklayers	Caterpillar D.2.	2

Distribution of Sample

(1) <u>By Counties:</u> The sample was distributed over the counties of the East Midlands Province as follows:

Table 2

Distribution by Counties

	Light	Medium	Tracklayer	Total
Derbyshire Nottinghamshire Lincs. (Lindsey) Lincs. (Kesteven) Leicestershire Rutland	 1 	2 4 3 2 -	2	2 7 4 2 -
EAST MIDLANDS	2	- 11	2	15

(2? By Farms: The acreage of arable land for each tractor is shown in table 3.

Tractor No.	Total Farm A Acre A -age	rable creage		No. in . Survey	of Trac Medium	tor Track-	No. of acres arable land per tractor
46 28 40 30 50) 51) 4 50 77) 78) 79) 48 49 36	31 49.5 30.5 172 205.5 370 282.5 315 485 547.5 864	212	1 1 2 2 1 2 3 6 3 8	1 1 1 2 1 1 1 3 2 1	1 1 1 1 2 3 5 3 3 3		18 24 15.25 33 82.25 212 115 83.33 66.66 152.5 100

Table 3 Number of Acres of Arable Land

per Tractor

The main point to note is the small number of acres of arable land per tractor on the smaller as compared with the larger farms.

It will be seen that in one case a farmer with a total of $30\frac{1}{2}$ acres of arable land has two tractors whereas in another case a farmer with a total of 212 acres under arable crops has only one tractor. The table shows in the final column the acres of arable land per tractor on each of the eleven farms, and it will be seen that these vary from $15\frac{1}{4}$ to 212 acres. This illustrates the fact that more effective use was made of tractors on larger farms. Further more, the farmers who employed several tractors of different types were able to allocate the work according to the type of tractor thus ensuring greater efficiency and economy. For example, on one form in this survey employing six tractors, the tracklayer was generally used for heavy ploughing, the

medium tractors for general work and the light tractors for haulage and light cultivations. On the other hand where only one tractor was employed it did all these jobs regardless of the varying degrees of efficiency with which it could tackle them. This is one reason why costs of operating the same type of tractor may vary from farm to farm. The tractors which are confined to heavy work will naturally show higher costs per hour than similar ones which are used for a wide variety of light and heavy jobs. These circumstances should be borne in mind when making a comparison of costs as shown by different groups of tractors.

Hours Worked

(1) Total Hours Worked: The yearly number of hours worked by the different tractors in the sample varied considerably. The smallest number worked was 341 (tractor No. 46) and the greatest was 2,363 (tractor No. 78). Nine tractors worked more than 1,000 hours and six less than 1,000 hours. Of these six, three, No. 36 (928 hours), No. 51 (606 hours), and No. 30 (893 hours) were attached to farms where more than one tractor was maintained. The other three, No. 46 (341 hours), No. 40 (380 hours) and No. 28 (476 hours) were employed on farms with less than 31 acres of arable land. This illustrates the point made earlier that small farmers have little opportunity to use their tractors to full capacity on their own farms.

(2) <u>Monthly Distribution of Work</u>: As regards the annual distribution of tractor work, September and October were the peak months of the autumn, March and April were the peak months in the spring, and December to February was the slackest period of the year.

The greatest range of monthly variation in work done was shown by tractor No. 28. No work was done in December, January, February and May, nearly one-third of the yearly work of 476 hours was done in March and this together with the work done in October accounted for more than one half of the total. On the other hand, tractor No. 77 with a yearly total of 2,191 hours, was used more regularly throughout the year, the proportion of the year's work done each month varying from 5.5 per cent in September to 10.7 per cent in June.

Generally the tractors used for the smaller number of hours tended to have their work concentrated into a few months of the year, whereas those working the greater number of hours, and particularly the two working more than 2,000 hours per annum, showed a more even monthly distribution.

The total number of hours worked by each tractor per month, and the monthly figures expressed as percentages of the yearly totals are given in tables 4 and 5.

Costs

Total costs are composed of two main groups of items namely "Fuel and Oil" and "Repairs and Maintenance". For purposes of comparison the statements have been reduced to costs per working hour. These are set out in table 6.

Fuel and oil covers the consumption of T.V.O., diesel oil, petrol and oil, whilst repairs and maintenance covers costs of farm labour spent on repair work, garage bills, licences and insurance and depreciation. (1) <u>Fuel and Oil</u>: The following prices, operating in 1947/48, were used:

T.V.O. and Diesel Oil Petrol Oil

11 <u>३</u> ैd∎	per	gallon
1s.10d.	11	11
6s. 0d.	11	11

The price of 6s. Od. per gallon for oil is a weighted average of engine oil (5s. 7d. per gallon) and gear oil (8s.10d. per gallon).

Costs per hour for fuel and oil varied from 9d. for No. 78 to 1s. 11³/₄d. for No. 48. Only three of the tractors had costs of less than 1s. 0d. per hour. The low cost of 9d. for No. 78 was largely attributable to the fact that it was used mainly for light work.

Of the separate items included under this head, (a) T.V.O. or diesel oil cost between 7d. and 1s. $7\frac{5}{4}d$. per hour. In six cases it was less than 1s. Od. Only two tracters, the two Caterpillar D.2's, were run on diesel oil.

(b) No petrol engined tractor was included in the survey and the cost of petrol, which was used for starting engines, varied between $\frac{1}{4}d$. and $1\frac{1}{2}d$. per hour.

(c) Oil costs varied between $\frac{1}{2}$ and $4\frac{1}{2}d$. per hour. In the case of six tractors less than 2d. was spent on oil.

(2) <u>Repairs and Maintenance</u>: Costs of repairs and maintenance showed wider variation than did those of fuel and oil. Total costs for repairs and maintenance ranged from 4d. for No. 30 to 5s. $4\frac{1}{2}d$. for No. 28. The main reason for this wide dispersion being the variation in the costs of depreciation, the other items showing smaller differences as between one tractor and another.

(a) <u>Labour Costs</u>: Costs of labour covered time spent on servicing the tractor as well as on home repairs. Costs of driving the tractors were not included. Labour was charged at 2s. 1d. per hour. The costs varied from $\frac{1}{2}$ d. per hour for No. 30 to $8\frac{1}{4}$ d. for No. 46, but in only one case were they below 1d. and in only one case above 5d.

(b) <u>Garage Bills</u>: This item included the cost of garage repairs and also the cost of spare parts. The cost per hour of garage bills was usually only a few pence and it exceeded 1s. Od. in only three cases. The range was from nothing for No. 40 to 1s. $8\frac{1}{4}$ d. for No. 4. This variation in costs is likely to be exaggerated by the limits imposed by taking accounts for only one or two years out of the working life of a tractor. All payments, for overhauls or other extensive repairs and replacements, which were made in the recorded years were fully charged against the tractor in that year, whereas some of these charges represent in fact major expenditure which ought to have been spread over several years. On the other hand tractors with very low costs for repairs in the given year may have incurred heavy costs in previous years or may do so in a subsequent year.

An example is provided by tractor No. 4. In this case an overhaul costing £67 was completed just at the end of the survey year. This was included in the repair costs and as a result these were increased from a little over 5d. to 1s. $8\frac{1}{4}$ d.

(c) Licence and Insurance: The road fund tax for tractors is 5s. Od. per year. As regards insurances some of these were comprehensive, others third party. The costs for these two items varied from $\frac{1}{4}d$. to $1\frac{1}{2}d$. per hour.

(d) <u>Depreciation</u>: In determining costs of depreciation the following rates of wear and tear were applied to the diminished original cost of the tractors:

1936		1940	$22\frac{1}{2}$ per	cent
1940		1945	27 per	
1945	***	yng birg	28 <mark>8</mark> per	cent

These rates correspond to those which a farmer is generally allowed to charge against his farm profit. No adjustment of these rates was made to allow for the differences in the number of hours worked and in the general standard of maintenance of the individual tractors. They do not therefore, represent the true cost of wear and tear of all tractors. The high level of the rates employed results in very high costs of depreciation in the first few years and negligible costs in the latter years of a tractor's life.

Table 7 shows, for each tractor, the date of purchase, the initial cost and the cost of depreciation in the year 1947/48.

The following points may be noted:

- (1) All the tractors were bought new by their present owners.
- (2) The age of the tractors ranged up to 11 years, the oldest tractor, a Fordson Standard, was bought in 1936; only one of the other tractors was bought before the war.
- (3) A Fordson Standard, bought in 1936 cost £135 while a Fordson Major bought in 1947 cost £390.

Depreciation was a significant item in most cases. The yearly cost ranged from £1. 5. Od. (No. 46) to £290. 0. Od. (No. 79); No. 46 was a Fordson Standard bought in 1936 for £135 and No. 79 a Caterpillar D.2 bought in 1947 for £1,079. Thus although the Fordson worked only 341 hours during the year the cost per hour was only $\frac{3}{4}$ d. The Caterpillar, on the other hand, worked 1,433 hours but even then the cost amounted to 4s. $0\frac{1}{2}$ d. per hour.

Though high initial purchase prices are one cause of heavy depreciation charges even moderately priced tractors show heavy costs of depreciation in the first year or two - for example No. 48 a Fordson Major costing £390 has a depreciation charge of £109.10. 0d. in the first year and a light tractor, No. 78, a David Brown has one of £133. 0. 0d. In these two cases the costs per hour were 1s. 4d. for 1,629 hours and 1s. $1\frac{1}{2}$ d. for 2,363 hours respectively.

Total Costs

There was a considerable variation of total costs between individual tractors.

The lowest total cost was 1s. $4\frac{1}{2}d_{\bullet}$ per hour (Tractor No. 30). This tractor showed low costs for fuel and oil and exceptionally low costs for repairs and maintenance. The highest total cost was 6s.11d. per hour (tractor No.28); this was mainly due to heavy costs of depreciation and of repair bills.

Both these extreme cases were in the modium tractor group. The two light tractors, Nos. 78 and 51 cost 2s. $2\frac{1}{2}d_{\bullet}$ and 1s. $9\frac{3}{4}d_{\bullet}$, and the tracklayers Nos. 79 and 36 cost 5s. $\frac{54}{4}d_{\bullet}$ and 3s. 9d. per hour respectively.

The total costs, as shown by table 6 are very much dependent on the costs of repairs and maintenance and chiefly on depreciation charges which vary with the age of a tractor. Since the depreciation charge and expenses on repairs are practically fixed in any given year, their cost per hour varies with the number of hours worked annually by the tractor. The importance of this relationship between the hours worked by a tractor and the amount of fixed charges during the year is illustrated by the example of Tractor No. 40 (Table 6). Depreication charge for this tractor (1947 model) amounted to over 70 per cent of the total cost per hour, mainly due to the fact that the number of hours worked during the year was only 380. On the other hand, No. 48 in the same class of medium tractors and also purchased in 1947 had its depreciation charge reduced to about 33 per cent of the total costs owing to the relatively greater number of hours (1,629) worked throughout the year. Similarly, the costs per hour of other fixed charges, such as payments of licences, insurance and repair bills decrease with an increase in the total number of hours worked by a tractor.

The total annual bill for expenses on fuel and oil rises with the more intensive use of a tractor, but the cost of fuel and oil per hour of work remains almost constant and does not cause any significant variations in the total cost per hour.

Conclusions

The comparison of costs of tractor work shows a great range Total costs per hour, even within one class of tractors, of differences. varied from 1s. 42d. to 6s. 11d. As already pointed out, these differences to a great extent are due to the age of tractors and the more or less favourable relationship between the amount of fixed costs and the number of hours worked by the tractor during the year. But there are also other factors which affect costs and for which allowances should be made in the interpretation of the final costs per hour. The skill in operating a tractor, the technical knowledge required for satisfactory servicing and particularly the standard of the repairs carried out on the farm vary considerably. The lack of skill in handling the machine leads to waste of fuel and premature wear, and The lack of skill in repairs unskillfully done result in further repairs, extra cost and waste of time.

The costs are further related to the geographical position of the farm, the type of soil and lay-out. The costs of tractor work vary also with the system of farming because of differences in the nature of the work, and because of ability, or lack of it, on the part of the farmer, to choose the machine most suitable to his particular conditions of farming.

The enquiry shows that not all the tractors are used to their full capacity and that whereas one tractor (No. 78) worked 2,363 hours during the year, another (No.46) worked only 341 hours and 30 per cent of all the tractors were employed for less than 1,000 hours a year.

This raises important questions of the economical use of agricultural machinery and tractor power. From the point of view of the national economy it appears that if the needs of small farmers who are unable to employ fully their own tractors could be satisfied by extended contract services, then the domand for tractors on the home market could be reduced and a proportion of materials and manpower engaged in tractor building and servicing industries could be diverted to some more urgent needs.

It is evident that there is need for further investigation of the problems of farm mechanisation. It is particularly important to ascertain what are the farm power requirements, especially on small farms, how the use of tractors and other machinery fits into their present organisation and management and what is the nature and the extent of diseconomies in the utilisation of machinery on farms

All these factors should be taken into consideration by farmers who are anxious to analyse the reasons for variations in the cost of their tractor work and who want to put this work on an economic basis.

E.M. J.T.W. Table 4

TRACTOR COSTS INVESTIGATION 1947/48

Distribution of Tractor Work - Hours worked per month

Tractor No.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Total
	<u>2001</u> 200 <u>1</u> 60	15 3 64	146½ 18½	146 -	140 30	161 <u>년</u> 20	209½ 150	221 ¹ 2 95	237 ¹ 16	287 6	237 127	224 20	2 , 363 606
<u>MEDIUM TRA</u> 46 20 40 30 4 50 5 28 48 49	ACTORS: 121 $44\frac{1}{2}$ 135 $\frac{1}{2}$ 38 102 149 $\frac{1}{2}$ 127 $\frac{1}{2}$ 176 27 89 192	$\begin{array}{c} 169^{\frac{1}{2}} \\ 51 \\ 147^{\frac{1}{2}} \\ 14 \\ 163 \\ 168^{\frac{1}{2}} \\ 183 \\ 158 \\ 104^{\frac{1}{2}} \\ 176 \\ 177 \end{array}$	$\begin{array}{c} 147 \\ 747 \\ 772 \\ 377 \\ 138 \\ 116 \\ 4 \\ 168 \\ 366 \\ 166 \\ 160 \end{array}$	$ \begin{array}{r} 186 \\ 3^{\frac{1}{2}} \\ 27^{\frac{1}{2}} \\ 42^{\frac{1}{2}} \\ 42^{\frac{1}{2}} \\ 62 \\ - \\ 79^{\frac{1}{2}} \\ - \\ 130 \\ 157^{\frac{1}{2}} \end{array} $	164½ - 157 21½ 30 91½ 79 95 - 82 149½	$ \begin{array}{c} 163 \\ 24^{\frac{1}{2}} \\ 110 \\ 34 \\ 44 \\ 87^{\frac{1}{2}} \\ 26 \\ 114 \\ - \\ 131^{\frac{1}{2}} \\ 151 \\ \end{array} $	$\begin{array}{c} 206 \\ 51^{\frac{1}{2}} \\ 141 \\ 47^{\frac{1}{2}} \\ 74 \\ 101 \\ 166 \\ 195^{\frac{1}{2}} \\ 150 \\ 178^{\frac{1}{2}} \\ 180 \end{array}$	206 ^{1/2} 54 174 48 27 37 141 ^{1/2} 198 ^{1/2} 174 160	195 22 126 18 24 53 70 ^{1/2} 165 - 111 116 ^{1/2}	$234\frac{1}{2}$ $-$ $124\frac{1}{27}$ $20\frac{1}{2}$ 51 $17\frac{1}{2}$ 54 140 56 25 52	124	223 32 127 83 73 82 100 138 31 ^{1/} 2 179 151 ^{1/} 2	2,191 341 1,482 380 893 1,051 1,045 1,724 476 1,629 1,721
<u>tracitaye</u> 79 36	L ES: 208 158 ¹ / ₂	210 124	186 128	142 <u>1</u> 95	189 <u>⁺</u> 47	1.62½ 85½	154. 119	104 <u>1</u> 45	28½ 79	32 27 1	8 20	8 -	1,433 928

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TRACTOR COSTS INVESTIGATION 1947/48.

Table 5

Distribution of Tractor Work - Monthly figures expressed as percentages of the yearly totals.

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Tractor No.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Total hours
LIGHT TRACTO 78 51	%	% 6 . 5 10 . 6	% 6.2 3.1	% 6 . 2 -	% 5•9 4•5	% 6.8 3.3	% 8 .9 24 . 8	% 9.4 15.7	% 9.9 2.6	% 12 . 1 1 . 0	% 9.9 20.9	% 9•5 3•3	2 , 363 606
MEDIUM TRAC 77 46 20 40 30 4 50 5 28 48 49	FORS: 5.5 13.1 9.1 10.0 11.4 14.2 12.2 10.2 5.7 5.5 11.2	7.7 15.0 10.0 3.7 18.2 16.0 17.5 9.2 22.0 10.8 10.3	6.7 0.1 5.0 9.9 15.5 11.0 0.4 9.7 7.7 10.2 9.3	8.5 1.0 1.9 1.2 4.8 5.9 - 4.6 - 8.0 9.2	7.5 - 10.6 5.7 3.4 8.7 7.6 5.5 - 5.1 8.7	7.4 7.2 7.4 8.9 4.9 8.4 2.5 6.6 .6 8.1 8.8	9.4 15.1 9.5 12.5 8.3 9.6 15.9 11.3 31.5 11.0 10.5	• 9.4 15.8 11.7 12.6 3.0 3.5 13.5 11.5 11.7 10.7 9.3	8.9 6.5 8.5 4.5 2.7 5.1 6.7 9.6 6.9 6.8	10.7 8.4 5.4 5.7 1.7 5.2 8.1 11.8 1.5 3.0	8.0 16.9 9.3 3.6 13.9 8.1 8.9 5.6 3.1 11.5 4.3	10.2 9.4 8.6 21.8 8.2 7.8 9.6 8.0 6.6 11.0 8.8	2,191 341 1,482 380 893 1,051 1,045 1,724 4,76 1,629 1,721
<u>tracklayers</u> 79 36		14.6 13.4	13.0 13.8	9.9 10.2	13.2 5.1	11.3 9.2	10.7 12.8	7•3 4•8	2.0 8.5	2.2 3.0	0.6 2.2	0.6	1 , 433 928

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Table 6

TRACTOR COSTS INVESTIGATION 1947/48.

Costs per hour for Tractors

			FUEL AND OIL REPAIRS AND MAINTENANCE								· · ·
Tractor No.	Hours worked	T.V.O./ Diesel Oil	Petrol	Oil	Total	Labour	Bills	Deprec- iation	Licnece & Insurance	Total	Total
		s. d.	d .	d,	s. d.	d.	s. d.	s, d,	d.	s. d.	s. d.
<u>LIGHT TF</u> 78 51	ACTORS: 2,363 606	7. 9 ¹ / ₂	- - Q#9 4	1 <u>2</u> 1 <u>2</u> 1 <u>2</u>	9. 11 ³ 4	3. 4.	³ /₄ 3∙	1. 1 ¹ 23 123 134	1 ¹ / ₄	1.• 5½ 10.	2. 2½ 1. 9¾
MEDIUM 1 77 46 20 40 30 1. 50 5 28 48 49	TRACTORS: 2,191 341 1,482 380 893 1,051 1,01,5 1,724 4,76 1,629 1,721	11. 1. 1. 1. 2. 1. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2.	이석이석 · 이석~[석양]석 · · · [씨구]씨양]석양]석	21314-102 0 0191914-14-10 22131314-14-102 0 222	$1 \cdot 2^{\frac{1}{2}} \cdot 4^{\frac{1}{2}} \cdot 4^{\frac{1}{2}$	48111 ¹⁰¹⁻¹⁰¹⁻¹⁰¹⁻¹⁰¹ 222110	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	$5^{\frac{1}{2}}_{\frac{1}{2}},\frac{5}{2},\frac{5}{2},\frac{1}{2$	⊷[તે⊷[તે⊷[તે⊷[તે⊷[તે⊷]તે∞]તે⊷[તે⇔[તે⊷[તે	1. $6\frac{1}{2}$ $11\frac{3}{4}$ 5. 4. 3. 1.11\frac{3}{4} 1.11 $\frac{3}{4}$ 1.11 $\frac{4}{7}$ 5. $4\frac{1}{2}$ 1.11. 7	2. 9. 2. 3. 1.11 $^{1}2^{1}3^{1}4^{-1}2^$
TRACKLAY	CERS:										
79 36	1,433 928	$9\frac{1}{4}$ 1. $0\frac{1}{4}$	+ 4- 4	1 ³ 4 42	11 <u>4</u> 1. 5.	2 ¹ 2 3	୬]୍ୟ ୟ	4° 0 ¹ /2 2° 0°	1 	4. 4. 2. 4.	5• 3 ¹ / ₄ 3• 9•

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Table 7

TRACTOR COSTS INVESTIGATION 1947/48.

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Purchase dates - age - depreciation

Code No.	Make	Model	Date of purchase	Initial cost	Value at 1st Sept. 1947	Value at 31st Aug. 1948	Depreciation for 1947/48.
LIGHT	TRACTORS :			£. s.	£. S.	£. s.	£. s.
78 51	David Brown John Deere	- B.R.	Aug. 1947 Mar. 1938	472 310	472.0. 16.11.	339.0. 11.18.	133. 0. 4.13.
MEDIUM	TRACTORS :						
77 46 20 40 30 4 50 5 28 48	Fordson Fordson Fordson Fordson Fordson John Deere Fordson Fordson Fordson Fordson	Major Standard Standard Major Standard Standard A.N. Major Major Major	Feb. 1946 1936 Sept. 1943 Apr. 1947 Mar. 1940 1941 Mar. 1940 Apr. 1946 Mar. 1947 Sept. 1947	299 135 169 307.10. 195 188 480 301 339 390	180. 0. 4.10. 46.12. 271.11. 18. 6. 27. 9. 45.12. 191. 2. 291. 8. 390. 0.	129.0. 3.5. .33.10. 195.6. 13.3. 19.15. .32.16. 137.12. 207.12. 280.10.	51.0. 1.5. 13.2. 76.5. 5.3. 7.14. 12.16. 53.10. 83.16. 109.10.
49 <u>TRACKL</u> 79 36	John Deere <u>AYERS</u> : Caterpillar Caterpillar	A.N. D.2 D.2	1940 July 1947 Dec. 1941	410 1,079 804	43.17. 1,029.0. 128.14.	31.11. 739.0. 92.10.	12. 6. 290. 0. 36. 4.

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