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# Machinery

Farmers' Report No. 137

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## The Cost of Repairs and New Parts for Farm Machinery

An Investigation on 118 Yorkshire Farms in 1957

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November, 1957

Price Three Shillings

AGRICULTURAL ECONOMICS SECTION  
THE UNIVERSITY OF LEEDS

WITH THE COMPLIMENTS OF  
MR. W. H. LONG

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INCLUDED

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## THE COST OF REPAIRS AND NEW PARTS FOR FARM MACHINERY

### AN INVESTIGATION ON 118 YORKSHIRE FARMS in 1957

In spite of the increasing importance of mechanisation, little information is available about the cost of keeping the various types of farm machinery in running order. The following notes discuss these costs for some of the more common machines and implements.

The basis for the study is a postal questionnaire which was completed by 118 Yorkshire farmers in the summer of 1957. (1) The University takes this opportunity of thanking them for their valuable help. A fairly accurate picture of repair costs can usually be obtained from tradesmen's bills, but it is not always so easy to estimate how many days are worked by a machine in the course of a year. However, enough farmers filled in the questionnaire to give averages which are probably representative of current practices in the sample as a whole. (2)

The farms were drawn from most districts of the county and include a variety both of farming systems and soil types. Broadly speaking the records relate to two main types of farming, the grass-land farms of the Pennine regions and the mixed arable farms of the Vale of York, the Yorkshire Wolds and Holderness. Different soil types predominate in each of the arable districts. The Vale of York is mainly a region of lighter loams and sands, Holderness of heavier loams and clays, while chalk with flints predominates on the Wolds. These differences are of some significance in determining the cost of machinery repairs.

Table 1 gives some indication of the types of farms covered in this survey. The grassland farms were the smallest both in actual size and in the amount of arable land. The implements found there were usually confined to hay-making machinery with an odd harrow, roll and fertiliser drill and occasionally a tractor plough. The great mass of information on cultivating machinery, fertiliser drills, binders and pick-up balers was supplied by the arable farmers.

- (1) Appendix C contains a blank copy of the questionnaire.
- (2) Statistical analysis of the data shows that for many of the implements concerned, there was a significant correlation between the size of the annual repair bill and the number of days a machine worked a year.

TABLE 1.  
118 YORKSHIRE FARMS

TYPE OF FARM. AVERAGE SIZE & ARABLE ACREAGE  
(excluding temporary grass)

Type	Number of Farms	Average Acreage Per Farm	
		Total	Arable
Grassland farms	37	88	1
Arable farms			
Wolds	12	390	278
Holderness	14	243	146
Others (mainly Vale of York)	55	187	108
<b>TOTAL</b>	<b>118</b>	<b>-</b>	<b>-</b>

The cost of repairs is determined by several factors. In use machinery is subject to wear and tear; when idle to physical deterioration. How much of this damage is inevitable and how much is escapable through careful use, maintenance and storage is a point which the present study does not attempt to elucidate.

A factor, however, which is considered is the effect of soil type on repair costs. The presence of a high proportion of stones in the soil leads to excessive breakages and bending. Sand is an abrasive and can cause considerable wear to metal surfaces. In the sample studied there was a marked tendency for Yorkshire Wold farms (chalk with flints) to incur higher repair costs than farms on other soil types, for ploughs, harrows, cultivators and mowers - all implements whose working parts come into close contact with or actually pass through the soil surface. (1)

(1) The number of records from Wold farms is too small to carry any statistical significance. The broad tendency shown, however, bears out opinions on the relative costs on the Wolds and elsewhere, obtained in conversations with farmers and machinery agents.

Repairs can be classified under two broad headings. The first covers running repairs which are incurred in the course of ordinary use and usually represent a small but steady source of expense. The second category includes repairs which are incurred occasionally, not necessarily every year. This category has been confined here to major overhauls to the more complicated farm machines.

The cost figures which follow are expressed as average costs per eight hour day the machine concerned was in use during the year. To give some indication of costs per acre, these figures have been recalculated on an acreage basis, using data on working speeds obtained in an earlier Yorkshire investigation. (1)

### 1. CULTIVATING MACHINERY

#### Tractor Ploughs

Information about repair costs of tractor ploughs was provided by 63 farmers. The number of tractor ploughs per farm averaged 2.4, representing a rate of one plough per 65 acres of arable land - excluding temporary grass. The total repair bill per plough in the year amounted to £11.4s.0d. and with an annual usage of 21 days, this figure gave a cost of 10/8d a day for the sample as a whole. Average annual repair costs per plough are given in Table II.

TABLE II.  
TRACTOR PLOUGHS  
ANNUAL REPAIR COSTS PER PLOUGH

Part	Number Used	Total Cost
Shares	11.1	£. s. d. 4. 0. 9.
Breasts	0.6	2. 4. 6.
Grounds/Slades	1.6	1. 8. 0.
Discs	0.6	1. 8. 3.
All Other Repairs	-	2. 2. 6.
<u>TOTAL</u>		<u>11. 4. 0.</u>
Number of days used a year		21 days
Average repair costs per day		10/8d
Average repair costs per acre (2)		3/6½d

(1) University of Leeds, Department of Agriculture  
Farmers' Report 130. "The Use of Labour in Yorkshire Farming"  
November, 1956.

(2) Assuming a working rate of 3 acres in an 8 hour day.

Most of the repairs on tractor ploughs result from wear and tear on the working parts in the course of ordinary use. Shares, breasts and the like all require renewal at regular intervals. The rate of wear depends partly on soil conditions. Farms on chalk with flints (Yorkshire Wolds) had the highest repair bills, followed by farms on predominantly light soils (mainly the Vale of York), while those on the heavier loams and clays (Holderness) returned the lowest costs.

TABLE III.  
TRACTOR PLOUGHS  
REPAIR COSTS & SOIL TYPE

Average repair costs per day per plough

	f. s. d.	Number of Farms
Wolds - Chalk with Flints	16. 9.	10
Holderness - Heavy Loams and Clay	6. 7.	9
Others - Mainly lighter loams	10. 1.	44
<u>Average</u>	<u>10. 8.</u>	<u>63</u>

The same trends hold for plough shares. Most farmers used iron shares costing about seven shillings each. The approximate life of a single share was one day on the Wolds, nearly three days in Holderness and two days on the remaining farms - mainly in the Vale of York. (1)

(1) Compare J.A.S.Watson and J.A.More  
 "Agriculture. The Science & Practice of British Farming"  
 Page 123 1956 edition

"Shares are very subject to wear in certain soils. For example, on dry hard flinty land a day's ploughing can cause one to be worn to the point of requiring renewal or repair."

### Disc Harrows

Most farmers using disc harrows possessed one set only. Repair costs varied considerably. Disc harrows normally require little attention until major renewals are necessary. It is for this reason that the daily repair costs given in Table IV have been divided into three categories; sets with major repairs, sets with minor repairs and sets which did not require repairing at all in the year surveyed.

TABLE IV.  
DISC HARROWS  
AVERAGE REPAIR COSTS PER DAY PER SET

	Cost per Day	Number of Farms
	£. s. d.	
(a) Harrows with major repairs	18. 10.	8
(b) Harrows with minor repairs	3. 1.	20
(c) Harrows with no repairs	-	16
Average	7. 2.	44
Number of days used a year	13 days	
Average repair costs per acre (1)	8d	

(1) Assuming a working rate of 11 acres in an 8 hour day.

Category A in Table IV refers to discs which had annual repair bills in the region of £15 to £30. These charges are associated with the renewal of the actual discs of the machine which generally wear down evenly and are replaced at the same time. No definite figure can be given for the time which is likely to elapse before such major renewals are necessary. Wear on discs is a matter of the amount of use and of soil conditions. Other things being equal, major overhauls are more frequent on some soil types than on others. The uneven incidence of repair costs in any one year, however, makes an analysis of the present sample on a soil type basis impracticable.

### Ordinary Harrows

Data concerning ordinary harrows were returned mainly from arable farms. The number of harrows per farm averaged 3.3, i.e. one set per 42 acres of arable land excluding temporary grass. Average repair costs are given in Table V.

TABLE V.  
ORDINARY HARROWS  
AVERAGE REPAIR COSTS PER SET

Average repair costs per day per set	10/2d
Number of Farms	69
Average number of days used a year per set	8
Average repair costs per acre per set (1)	7½d

(1) Assuming a working rate of 16 acres in an 8 hour day.

Repair work on harrows arises mainly from wear in the course of every day use. Harrow teeth especially require frequent attention. Soil conditions affect the rate of wear. Stones cause bending and breakages. It is not surprising therefore to find that repair costs on the Wolds were higher than elsewhere. (2) Holderness farms did not enjoy any marked advantage in costs over the Vale of York group, a position which also applies to cultivators.

### Cultivators and Scrufflers

Cultivators were confined almost entirely to arable farms. Numbers per farm averaged 2.2, one cultivator per 72 acres of arable land, excluding temporary grass. Repairs are mainly a matter of wear and tear arising from ordinary use. Shares need renewing and tines get bent. Wold farms incurred higher charges than the rest of the sample. Average repairs per cultivator per day amounted to 12/1d on 8 Wold farms compared with 9/5d on 48 non Wold holdings. The average for all groups was 9/9d. See Table VI.

(2) Average repair costs a set per day amounted to 19/10d on 9 Wold farms compared with 8/9d on 60 non Wold farms.

TABLE VI  
CULTIVATORS AND SCRUFFLERS  
AVERAGE REPAIR COSTS PER IMPLEMENT

Average repair costs per day per implement	9/9d
Number of Farms	56
Average number of days used a year per implement	10
Average repair costs per acre per implement (1)	10 <sup>1</sup> d

(1) Assuming a working rate of 11 acres in an 8 hour day.

Gang Rolls

Gang rolls were not so common as the other cultivating implements discussed previously. They were found on both arable and grassland farms. Most owners of gang rolls had only a single set. Average repair costs are shown in Table VII.

TABLE VII.  
GANG ROLLS.  
AVERAGE REPAIR COSTS PER SET

Average repair costs per day per implement	4/10d
Number of Farms	51
Average number of days used a year per implement	11
Average repair costs per acre per implement. (2)	2 <sup>1</sup> d

(2) Assuming a working rate of 24 acres in an 8 hour day.

## II. FERTILISER AND COMBINE DRILLS

### Ordinary Fertiliser Drills

Most farmers with a fertiliser drill possessed only one. Repair costs varied considerably from farm to farm. Maintenance standards no doubt were one of the main factors responsible for the differences, since with ordinary simple fertiliser drills there is nothing comparable to the occasional major overhaul received by the more complicated farm machines. Repairs to drills, however, can quickly mount up if they are not properly cleaned out before being stored for any length of time.

TABLE VIII  
ORDINARY FERTILISER DRILLS  
AVERAGE REPAIR COSTS PER DRILL

Average repair costs per day per drill	5/8d
Number of Farms	56
Average number of days used a year per drill	12 days
Average repair costs per acre per drill (1)	6d

(1) Assuming a working rate of 11 acres in an 8 hour day.

### Combine Drills

Combine drills were confined to arable farms. Most farmers with this type of drill owned only one but kept an ordinary tillage drill as well. Repair costs fluctuated greatly from farm to farm. As with ordinary drills the effects of corrosion and the standards of maintenance set were probably the main factors which caused variations in cost. Combine drills are complicated machines and the replacement of the intricate seeding mechanism is expensive in both time and materials. Cleaning down, repainting, the avoidance of working and storage under damp conditions, all help to reduce corrosion. It is virtually impossible, however, to keep the whole machine clear of fertiliser so some damage is inevitable.

TABLE IX.  
COMBINE DRILLS  
AVERAGE REPAIR COSTS PER DRILL

	Cost Per Day	Number of Farms
		£. s. d.
(a) Drills with major repairs	1. 18. 1.	5
(b) Drills with minor repairs	11. 0.	40
Average	14. 0.	45
<u>Average all Drills</u>		
Man hours spent on maintenance per drill per day (1)	2 hours	
Average number of days used a year per drill	10 days	
Average repair costs per acre per drill (2)	1/9d	

(1) This is not included in repair costs.

(2) Assuming a working rate of 8 acres in an 8 hour day.

Repair costs in Table IX have been divided into two categories. The first includes machines with annual repair bills in the region of £15 to £40, amounts which cover major items of renewal. The far larger category refers to farms where costs were more modest.

Maintenance labour on the drills averaged two hours a day used. This figure includes a share of the labour time spent cleaning down and preparing for storage after the working season was over.

### III. HAY MAKING MACHINERY

#### Mowing Machines

The cutter bar is the main source of expense with these machines. Knives get worn down in the course of use. Sections and fingers have to be replaced. Mower knives are especially vulnerable to damage from stones and uneven ground. It is probably no coincidence, therefore, that repair costs on Wold farms were considerably higher than on non Wold holdings, averaging 22/11d a day on 8 farms against 12/9d a day on the 85 non Wold farms.

TABLE X.

#### MOWING MACHINES

##### AVERAGE REPAIR COSTS PER MOWER (1)

Average repair costs per day per mower	13/8d
Number of Farms	93
Average number of days used a year per mower	7 days
Average repair costs per acre per mower (2)	1/8 <sup>1</sup> <sub>2</sub> d

(1) Does not include any allowance for sharpening knives.

(2) Assuming a working rate of 8 acres in an 8 hour day.

Hay Tedders. Swath Turners and Side Delivery Rakes. Hay Rakes.

Repair work on all these implements is generally confined to making good bent and broken tines. Average repair costs are set out in Table XI below.

TABLE XI.

HAY TEDDERS. SWATH TURNERS AND SIDE DELIVERY RAKES. HAY RAKES.

AVERAGE REPAIR COSTS PER IMPLEMENT

	Hay Tedders	Swath Turners & Side Delivery Rakes	Hay Rakes
Average repair costs per day per implement.	4/10d	7/7d	3/11d
Number of Farms	17	76	48
Average number of days used a year per implement	6	7	5
Average repair costs per acre per implement (1)	3 $\frac{1}{2}$ d	5 $\frac{1}{2}$ d	3d

(1) Assuming a working rate of 16 acres in an 8 hour day for all three implements.

IV. HARVESTING MACHINERY

Binders

Fifty farmers supplied information about these machines. Most owned a single binder. Some of the larger arable men possessed a combine and used their binders in a subsidiary capacity. Hence the rather low average figure of 6 days for annual use shown in Table XII.

TABLE XII  
B I N D E R S  
AVERAGE REPAIR COSTS PER BINDER

	Cost Per Day	Number of Farms
	£. s. d.	
(a)Binders with major overhauls	3. 9. 7.	11
(b)Binders with minor repairs	1. 3. 10.	39
Average	1. 13. 11.	50
Average all Binders		
Man hours spent on maintenance per binder per day (1)		2 hours
Average number of days used a year per binder		6 days
Average repair costs per acre per binder (2)		4/3d

(1) This is not included in repair costs.

(2) Assuming a working rate of 8 acres in an 8 hour day.

Repairs on binders have been divided into two classes, "A" major overhauls and "B" ordinary running repairs incurred in the course of day to day use. The term major overhaul covers repair costs of £15 to £40 in the current year. These were generally associated with the renewal of binder canvases, a complete set of which can cost from £20 to £30. Approximately one-fifth of the binders covered in the sample had overhauls in the current year; a figure which assuming an even age distribution, suggests major replacements every five years or so.

Ordinary running repairs are mainly concerned with the cutter bar and the mechanism of the knotter. Wear on knives is a constant source of expense. Normally, however, binder knives give less trouble than mower cutter bars. Corn is cut higher from the ground than grass so that there is less damage from stones and uneven surfaces.

Labour time spent on maintenance averaged two hours a day. Besides covering such daily jobs as sharpening knives this figure includes a share both of the time spent getting the binder ready for harvest and of the time involved in dismantling the machine afterwards, prior to storage.

### Pick-up Balers

Information about these machines was supplied by twenty farmers, each with a single baler. Considerable variations in annual costs were reported. The majority had expenses of between £10 and £25 in the current year. Three farmers, however, spent no money at all on their machines which were new and in their first working season. At the other extreme, two had their balers completely overhauled at a cost of about £100 each. These variations have been taken into account in Table XIII.

TABLE XIII  
PICK-UP BALERS  
AVERAGE REPAIR COSTS PER BALER

	Cost per Day	Number of Farms
	£. s. d.	
(a) Balers with major overhauls	4. 1. 3.	2
(b) Balers with minor repairs	1. 4. 8.	15
(c) Balers with no repairs	-	3
Average	1. 6. 8.	20
	Average all Balers	
	Hay	Straw
Acres baled a day (1)	8 $\frac{1}{2}$	11
Repair costs per acre	3/1 $\frac{1}{2}$ d	2/5d
Days used a year baling	7	11

(1) These working rates are the averages returned by the farmers co-operating in this investigation.

The above figures confirm the impression that when new, balers require little attention; after the first year a small steady repair cost is incurred until in perhaps 5 to 7 years an expensive overhaul is necessary. There is a growing tendency, however, for farmers faced with major repairs to such expensive machines as balers, combines and tractors, to avoid these charges by trading in their old models in part exchange for new machines. This tendency may explain why only two out of twenty machines in the sample received major overhauls.

SUMMARY TABLE  
AVERAGE REPAIR COSTS PER IMPLEMENT  
1957

	Average Number of Days used a Year	Average Repair Cost per Day	Rate of Work per Day(acres) (1)	Average Repair Cost per Acre
		f. s. d.		f. s. d.
Tractor Ploughs	21	10. 8.	3	3. 6½.
Disc Harrows	13	7. 2.	11	8.
Ordinary Harrows	8	10. 2.	16	7½.
Cultivators	10	9. 9.	11	10½.
Gang Rolls	11	4.10.	24	2½.
Ordinary Fertiliser Drills	12	5. 8.	11	6.
Combine Drills	10	14. 0.	8	1. 9.
Mowing Machines	7	13. 8.	8	1. 8½.
Hay Tedders	6	4.10.	16	3½.
Swath Turners/Side Delivery Rakes	7	7. 7.	16	5½.
Hay Rakes	5	3.11.	16	3.
Binders	6	1.13.11.	8	4. 3.
Pick-up Balers				
baling Hay	7	1. 6. 8.	8½	3. 1½.
baling Straw	11	1. 6. 8.	11	2. 5.

All eight hour days

(1) Working rates for pick-up balers, averages returned in this investigation.

Working rates for other implements based on figures published in:-

University of Leeds. Department of Agriculture.  
 Farmers' Report 130 "The Use of Labour in Yorkshire Farming".  
 November 1956.

For many of the implements the rates of work adopted above are slower than those given on Page 164 of the Ministry of Agriculture, Fisheries and Food's, "The Farm as a Business", 1957 edition. Consequently if the latter rates were used instead, the level of repair costs per acre would be reduced for many of the machines included in the table.

APPENDIX B.

METHODS OF LOADING FARM YARD MANURE

The questionnaire dealing with machinery repairs also contained a section on methods of loading farm yard manure. Four methods of manure loading were considered and the results are set out in the following table.

FOUR METHODS OF LOADING FARM YARD MANURE

	Loading by Hand		Loading by Mechanical Loader	
	Into a Tractor Trailer	Into a Mechanical Spreader	Into a Tractor Trailer	Into a Mechanical Spreader
Number of Observations	24	23	22	8
Average Size of Team (1)(men)	1 $\frac{1}{2}$	1	2	1
Weight of a Load (tons)	1 $\frac{3}{4}$	1 $\frac{1}{2}$	2 $\frac{1}{4}$	1 $\frac{3}{4}$
Time taken to fill a Load(mins)	17 $\frac{1}{2}$	15	13	6
Total Weight of Manure loaded mechanically during the Year (tons)	-	-	400	420
Total Weight of Manure spread mechanically during the Year (tons)	-	280	-	420

(1) Excluding the tractor driver.

## ENQUIRY INTO THE USE OF IMPLEMENTS ON FARMS

Code No.....

NAME .....

ADDRESS .....

Total Acres of Crops and Grass. .... acres.

Acres of Arable (excluding temp.grass) .... acres.

1. PLOUGHS

- 1) No. and type (2/3/4 furrow) of tractor ploughs on farm. ....
- 2) Total number of 8-hour days ploughing each year. ....
- 3) Annual repairs and renewals for all ploughs in an average year, i.e.: -

Number	Cost
a. Sharcs	£
b. Broasts	£
c. Grounds/Slades	£
d. Discs.	£
e. Other repairs.	£

2. DISC HARROWS

- 1) Number of sets of discs on farm. ....
- 2) Total number of 8-hour days discing each year. ....
- 3) Annual repairs and renewals for all discs in an average year, i.e.: -

Number	Cost
a. Discs.	£
b. Spools.	£
c. Bearings.	£
d. Other repairs.	£

3. <u>OTHER CULTIVATING EQUIPMENT</u>	Other Harrows.	Cultivators, Scrufflers or Scarifiers.	Gang Rolls.	Fertilizer Drills.
1) Total number on farm. 2) Total no. of 8-hour days used each year. 3) Annual cost of repairs and renewals in an average year.	£	£	£	£

4. COMBINE DRILL

- 1) If you have a combine drill, how many 8-hour days is it used yearly?.....
- 2) What is the average annual cost of grease, repairs and renewals? £.....
- 3) What is the average no. of hours spent on maintenance each year, (cleaning, greasing etc.) ? ..... hrs.

5. <u>HAY MAKING EQUIPMENT</u>	Mowing Machine.	Tedder	Swath-Turner/ Side Delivery Rake.	Tractor Horse Rake.
1) Total number on farm 2) Total no. of 8-hour days used each year. 3) Annual cost of repairs and renewals in an average year	£	£	£	£

6. PICK-UP BALERS.

1) If you own a pick-up baler, how many 8-hour days yearly is it used for:-  
(a) baling hay? ..... days (b) baling straw? ..... days

2) How many acres are baled per day of:-

(2) hay? ..... acres (b) straw? ..... acres

3) What is the average annual cost of repairs and replacements? £ .....

7. BINDERS.

1) How many 8-hour days do you use a binder? ..... days

2) What is the average annual cost of repairs & renewals? £ .....

3) What is the average no. of hours spent on maintenance each year (cleaning, greasing etc.)? ..... hours

8. FARM YARD MANURE

1) Do you load

- a. By hand into a tractor trailer? ) Cross out items
- b. By hand into a tractor spreader? ) which do not apply.
- c. By mechanical loader into a trailer? )
- d. By mechanical loader into a spreader? )

2) How many men are there in your team (excluding tractor driver?) ..... men

3) What is the weight of a load? ..... tons ..... cwt.

4) How many minutes does it take to fill a load? ..... minutes.

5) How many tons are spread by mechanical spreader in a year? ..... tons.

6) How many tons are loaded by mechanical loader? ..... tons

N O T E S:

