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The Use of Labour in Yorkshire Farming

A Study of Records Relating to Man and Tractor Labour

University of Leeds
Economics Section
Department of Agriculture

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CONTENTS

INTRODUCTION

The principal aim of this bulletin is to furnish factual information about the use of manual labour on farms but data are also included on tractor and horse use. The types of work undertaken on farms are divided into three categories, work on crops, work on stock and " other work "—mainly of an overhead nature. Labour requirements for crops, stock and other work are examined separately in the first three chapters. The fourth chapter illustrates how the requirement figures for each class of work fitted into the pattern of employment on certain Yorkshire farms in 1951 and 1952. The final chapter is a self-contained study of the tractor and horse position on a sample of Yorkshire farms.

The figures of Chapters I and II, relating to crops and stock, have been based on Yorkshire enterprise cost studies undertaken by this department through the co-operation of many individual farmers. This material, which was collected for other purposes in the first place, lent itself admirably to the present analysis. Details of these studies are given in Appendix A.

A special investigation has provided the basis for that part of this bulletin which studies the seasonal employment of labour. In 1951, 27 farmers kept complete daily records of the work done by men, tractors and horses on their farms. Twenty-two farmers continued the diary investigation in 1952. These data are discussed in Chapters III, IV and V.

This report is in every way a co-operative effort. In the first place it depends on the work of the farmers who provided the information on their farms and especially on those of them who took the trouble to enter up in the diaries the work done by themselves and their men, generally for a two year period. The work of tabulating and analysing the diary records was done by Miss J. B. D. Radford, who also wrote the final chapter, dealing with the place of tractors and horses in the economy of these farms. The preparation of the histograms was done by Miss Olive Gaunt, and Mrs. Mary Archer tabulated and helped with the statistical analysis on the enterprise cost records. All these deserve gratitude for the thorough way in which they tackled a heavy task.

A special word of thanks is due to Miss Morag Mathieson, who has undertaken the writing of the report and has thereby shouldered the heaviest share of responsibility in its production.

W. HARWOOD LONG.

The opportunity is taken here to make a general acknowledgment to those who gave their time and energies in helping the writer.

M. C. Mathieson.

CHAPTER I.

MANUAL LABOUR AND TRACTOR WORK REQUIREMENTS FOR CROPS.

Crop production is the branch of agriculture which has been most affected by recent technological changes. The application of the discoveries of the agricultural scientist and engineer has led to a partial revolution in cultural methods. One of the most marked features of these changes is the reduction in the amount of manual work required for growing and harvesting crops. The revolution still continues and further reductions in manual labour requirements will undoubtedly be secured.

Manual labour requirements per acre for growing and harvesting a particular crop are determined to a considerable extent by the degree of mechanisation adopted. Unit labour requirements for a quantity of a crop produced are influenced not only by technical methods but also by yield per acre. With a given method of production, unit labour costs are determined in part by yield. This is because much of the manual labour involved in crop production is of a fixed rather than a variable cost nature. In practice the cultivations done for a given crop are very similar from farm to farm, while yields on the other hand, fluctuate considerably. Labour for cultivations can be said to be relatively independent of yield—a fixed rather than a variable cost. Where harvesting is concerned, higher than average yields go with higher than average manual labour requirements per acre, but with most crops there are some economies of scale where high yields are concerned, so that even for harvesting some of the manual labour involved represents a fixed rather than a variable cost.

This chapter is concerned with manual labour and tractor work requirements for some common crops. It will be noted that no reference is made to horse work. During the period studied, horses became of decreasing importance on the sample farms and at the time of writing it would seem that the horse is rapidly becoming an anachronism.

The method adopted in this chapter for compiling work requirements is as follows. The basic data used are 1,400 Leeds crop cost records relating to the period 1948-1954. From this material standard times were calculated for the major cultivations. The figures adopted are given in Table I. These times are averages of a large sample of records. With the great majority of cultivations the individual times returned were found to fit in a normal distribution curve with the group average coming at the peak of the curve.

Table I.

STANDARD TIMES FOR CULTIVATIONS.

Manual Labour and Tractor Work Requirements Per Acre Per Operation.

(a) **Arable Crops**

	Man Hours	Tractor Hours
Seed Bed Preparation		
Ploughing medium depth two-furrow tractor plough	2½	2½
Cultivating and disc harrowing	¾	¾
Other types of harrowing	½	½
Rolling	½	½
Ridging for potatoes	1	1
Sowing Seed		
Drilling cereals	1½	¾
Drilling beans	2	1
Drilling roots	2	1
Planting potatoes by hand	10	1
Broadcasting grass and clover	1	—
Applying Artificial Fertilisers		
Drilling artificials for corn	¾	¾
Drilling artificials for roots	2	1
Inter-Row Cultivations		
Tractor hoeing potatoes	1	1
Tractor hoeing other roots	2	1
Hand hoeing beans	7	—
Hand hoeing potatoes	10	—
Hand hoeing sugar beet(1)		
first time over	33	—
second time over	22	—
Hand hoeing mangolds, swedes and kale(1)		
first time over	27	—
second time over	20	—

(1) LEEDS CROP COSTS, 1948-1954
Number of times Root Crops Hand Hoed.

Number of times crops hoed	Percentage of Total Records Involved			
	Sugar Beet	Mangolds	Swedes	Kale
None	—	—	—	23
Once	5	11	19	34
Twice	89	83	77	43
Three times	6	6	4	—
TOTAL RECORDS	100	100	100	100

Table I (*continued*).

(b) **Grassland**

	Man Hours	Tractor Hours
Harrowing	$\frac{1}{2}$	$\frac{1}{2}$
Rolling	$\frac{1}{2}$	$\frac{1}{2}$
Cutting thistles etc. ...	1	—
Drilling artificials ...	$\frac{3}{4}$	$\frac{3}{4}$

These standard times do not relate only to a particular crop. They are in the main averages for given operations which are carried out for a whole range of different crops. Work requirement figures for the cultivations performed for any one crop were compiled by applying the relevant standard times given in Table I to a set of cultural operations which were representative of the number and type of cultivations carried out for that particular crop on the co-operating farms. It is interesting to note that there was a considerable degree of homogeneity between farms in the operations done for a crop.

Work requirements for harvesting were compiled in a different manner, the object being to allow for the effects of yields. For most crops, with a given method of harvesting, a correlation was found between yields and manual labour requirements per acre. Where in the subsequent tables of the chapter, figures are given for manual labour requirements at different levels of crop yields, these are based on linear regression lines. Tractor work requirements per acre for the average crop yields were worked out and expressed as a ratio of the corresponding manual labour requirements. This ratio was then assumed to apply to other levels of yield.

In this way sets of model work requirements for some fourteen individual crops have been compiled. These are, therefore, broad approximations based on the simplification of a mass of detail, which relate to the experiences of a considerable number of Yorkshire farmers. The figures describe averages while reality usually consists of deviations from the average. But the average is not without its use if its limitations are realised and it has the great advantage that it is the measure of a central tendency.

Most of these models are illustrated by histograms which give estimates of the seasonal distribution of the work concerned. These seasonal distributions are based on the Farm Diary investigation records. The times of the year at which the main operations involved in growing and harvesting a crop were carried out, were noted and a representative cultural time table drawn up. To such time tables the model work requirement figures were applied and distribution histograms constructed.

The tables of this chapter do not include all the labour which is involved directly or indirectly in crop production. For example no allowances are made for hedging and ditching or for work of a

Table II.

CARTING AND SPREADING FARM YARD MANURE.
(Hand Loading and Spreading.)

(a) **Estimated Manual Labour and Tractor Work Requirements Per Acre.**

Dressing Applied per Acre (tons)	Man Hours per acre	Tractor Hours per acre
5	9	4½
6	9¾	5
7	10½	5¼
8	11¼	5¾
9	12	6
10	12¾	6½
11	13½	6¾
12	14¼	7¼
13	15	7½
14	15¾	8
15	16½	8¼
16	17¼	8¾
17	18	9
18	18¾	9½
19	19½	9¾
20	20¼	10¼

(b) **Crops Commonly Mucked. Leeds Crop Costs, 1948-1954.**
Percentage of Crops Mucked and Average Dressings Applied per Acre.

Crop	Percentage of Crops Mucked	Average Dressing Applied per Acre where muck given (tons)
Potatoes ...	85	12
Sugar Beet ...	52	12
Mangolds ...	78	11
Swedes	73	11
Kale	67	12
Meadow Hay ...	56	7

more general overhead nature such as the servicing and repair of farm machinery. The subject of " other work " is dealt with in Chapter III.

The type of work included in this chapter is based on the classification adopted in enterprise cost studies with one important exception. Figures for work requirements involved in the carting and spreading of farmyard manure are excluded from the main body of the tables of this chapter and from the histograms illustrating the seasonal distribution of work. Muck is applied for its effects over the whole rotation, consequently to charge all the labour concerned to one particular crop is somewhat unrealistic. The point in the rotation at which dung is applied depends on the type of farming system followed. Where cash roots are grown, potatoes have priority for farm yard manure. The fodder crop records used came from predominantly milk producing farms, where cash roots were relatively unimportant. Dung on these farms tended to be applied to the fodder roots break. On mainly grassland farms most of the muck went on to the hay meadows.

Although work on farm yard manure is classified under the heading " other work " and as such falls into the orbit of Chapter III, it is thought that some passing reference to the work requirements for this job, would not be out of place in this chapter. Table IIA gives model work requirement figures for carting and spreading dung. The figures cover the hand loading of manure into trailers, carting to the field and subsequent spreading. This was the general practice followed on the co-operating farms where mechanical spreaders and hydraulic loaders were seldom found. The figures given for manual labour requirements are based on a linear regression line—a correlation having been found between the weight of dressing applied and manual labour requirements per acre. It will be noted that economies of scale are suggested. (1) Table IIB gives details of manuring practices found on the co-operating farms. The percentage of total crops mucked is shown together with the average dressing applied where dung was given.

Cereals.

The individual cereals costed, wheat, barley and oats are not discussed separately. Work requirement figures and their seasonal distribution were drawn up for each of these three crops, but differences between the resulting figures were slight and appear to have arisen from the peculiarities of the sample rather than intrinsic qualities of the individual crops. Consequently the presentation of lists relating to each crop separately, was thought to be unwarranted and instead the distinction is made between winter and spring sown cereals and between harvesting with binders and with combines.

(1) A similar tendency exists with lime-spreading. The presence of economies of scale in the spreading of lime by contractors' machines was taken into consideration when the rates of contribution towards costs were drawn up for the Agricultural Lime Scheme under Section 95 of the 1947 Agriculture Act.

Table III.

WINTER SOWN CEREALS.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

(a) **Cultivations and Harvesting**—the latter related to a yield of 1 ton an acre head of corn.

	Man Hrs.	Trac. Hrs.
Cultivations:		
Ploughing once	2½	2½
Cultivating once	¾	¾
Harrowing twice	1	1
Drilling seed	1½	¾
Drilling artificials	¾	¾
Total Cultivations	6½	5¾

Harvesting by Binder	Man Hrs.	Trac. Hrs.	Harvesting by Combine(1)	Man Hrs.	Trac. Hrs.
Cutting	2	1	Combining ...	2	—
Stooking and righting	3½	—	Leading grain ...	2½	1
Leading and Stacking	7½	2½	Pick-up Baling ...	1	1
Raking	½	½	Leading and Stacking bales ...	2¼	1½
Threshing(2) ...	8	—			
Total Harvesting ...	21½	4	Total Harvesting	7¾	3½
Total Growing and Harvesting	28	9¾	Total Growing and Harvesting	14¼	9¼

(1) Self-propelled combine. Arithmetical average of records.
(2) This assumes the hire of tackle and the services of a tractor and two men supplied by the contractor.

(b) **Work Requirements for Harvesting by Binder, and Yields per Acre.**

Yield per Acre (cwts)	Man Hours per Acre	Tractor Hours per Acre
15	17½	3¼
17½	19½	3½
20	21½	4
22½	23½	4¼
25	25	4½
27½	27	4¾
30	29	5¼

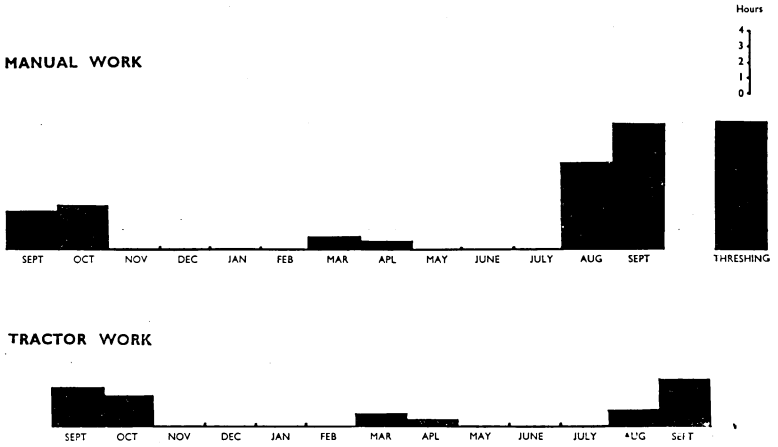
Tables III and IV refer to winter and spring sown cereals respectively. In Yorkshire, wheat is the only cereal widely winter sown. The differences between the two tables are confined entirely to cultivations. Winter sown corn requires a rougher seedbed than spring corn, so work requirements for cultivations are lower. The

Histogram A(1.)

WINTER SOWN CEREALS (Cut by Binder).

Seasonal Distribution of Manual Labour and Tractor Work Requirements.

Hours per month per acre.



Histogram A(2).

WINTER SOWN CEREALS (Cut by Combine).

Seasonal Distribution of Manual Labour and Tractor Work Requirements.

Hours per month per acre.

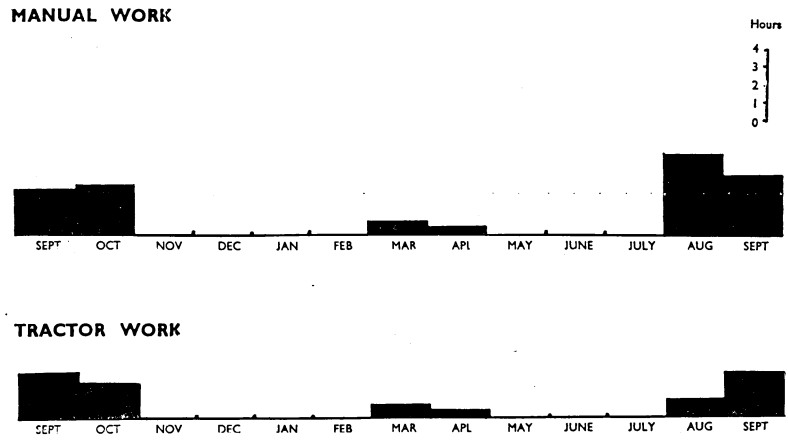


Table IV.

SPRING SOWN CEREALS.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

(a) **Cultivations and Harvesting**—the latter related to a yield of 1 ton an acre head corn.

	Man Hrs.	Trac. Hrs.
Cultivations:		
Ploughing once	2½	2½
Cultivating once	¾	¾
Harrowing three times	1½	1½
Rolling once	½	½
Drilling seed	1½	¾
Drilling artificials	¾	¾
Total Cultivations	7½	6¾

Harvesting by Binder	Man Hrs.	Trac. Hrs.	Harvesting by Combine(1)	Man Hrs.	Trac. Hrs.
Cutting	2	1	Combining ...	2	—
Stooking and righting	3½	—	Leading grain ...	2½	1
Leading and stacking	7½	2½	Pick-up baling ...	1	1
Raking	½	½	Leading and stacking bales ...	2¼	1½
Threshing (2) ...	8	—			
Total Harvesting ...	21½	4	Total Harvesting	7¾	3½
Total Growing and Harvesting	29	10¾	Total Growing and Harvesting	15¼	10¼

(1) Self-propelled combine. Arithmetical average of records.
(2) This assumes the hire of tackle and the services of a tractor and two men supplied by the contractor.

(b) **Work Requirements for Harvesting by Binder, and Yields per Acre.**

Yield per Acre (cwts)	Man Hours per per Acre	Tractor Hours per Acre
15	17½	3¼
17½	19½	3½
20	21½	4
22½	23½	4¼
25	25	4½
27½	27	4¾
30	29	5¼

main differences, however, lie in the seasonal distribution of the work—see Histograms A and B.

For winter sown cereals, land was generally ploughed in September and the seed drilled in October. If, however, corn followed potatoes, the seed went in later—up to mid November. In the following spring crops were usually top dressed with a nitrogeneous fertiliser and afterwards harrowed. Then unless sprayed in late May and the first half of June, fields received no further attention until harvest.

Land for spring sown cereals was usually ploughed once, the work being done at any time during the winter when conditions were suitable. Seed beds were worked up in early spring and wheat and oats sown generally in March, followed by barley in early April. Crops were usually rolled in May, then except for spraying, they were left alone until harvest.

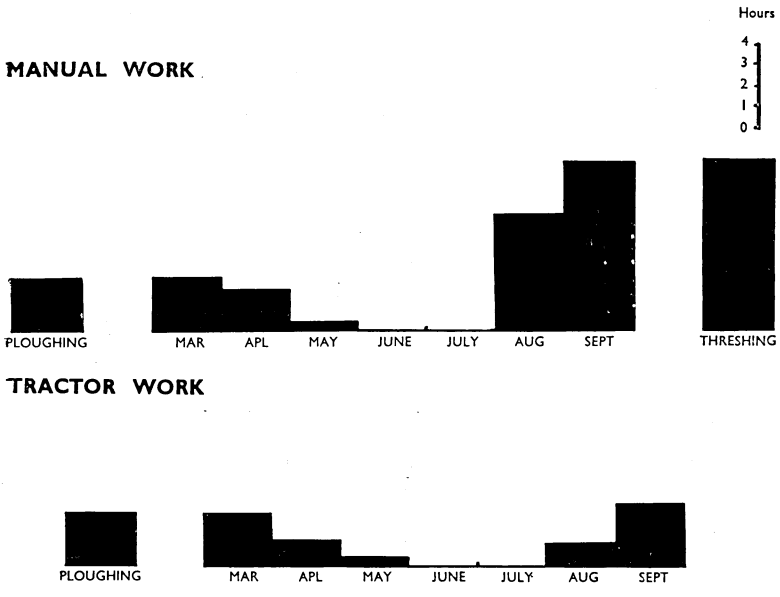
The exact time of harvesting depends on many factors including climatic conditions, locality and variety grown. Climatic conditions are responsible for the striking difference between the harvests of 1951 and 1952 experienced by Farm Diary farmers. In 1951 the bulk of the harvest work came in September. In the next year most of the crops were led by the end of August. Locality is also relevant; to give an extreme example, oat crops on Yorkshire upland farms

Histogram B(1).

SPRING SOWN CEREALS (Cut by Binder).

Seasonal Distribution of Manual Labour and Tractor Work Requirements.

Hours per month per Acre.

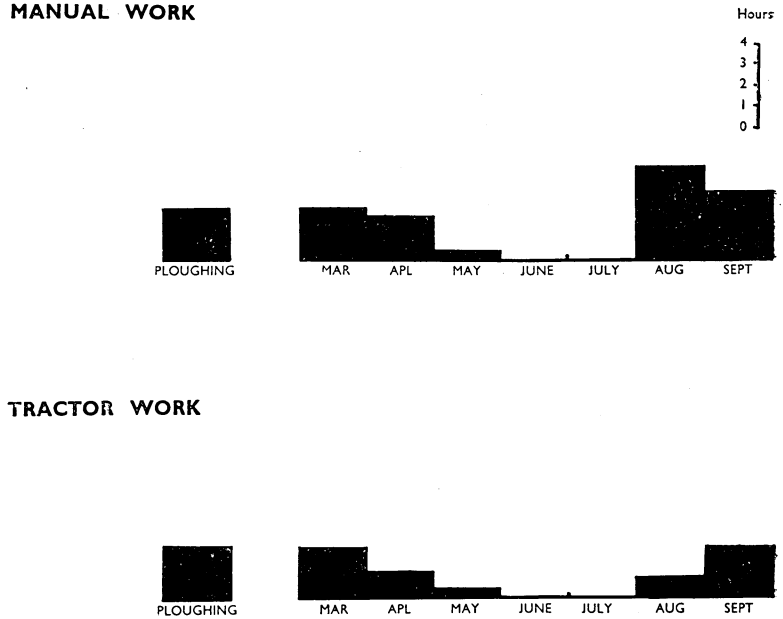


Histogram B(2.)

SPRING SOWN CEREALS (Cut by Combine).

Seasonal Distribution of Manual Labour and Tractor Work Requirements.

Hours per month per acre.



are often harvested a month later than similar crops in the lowland areas. The seasonal distributions of harvesting work given in Histograms A and B refer to conditions prevailing in lowland areas of Yorkshire in a normal year, i.e. from the aspect of weather.

No definite date is given for threshing, an operation which can be done at any time after a crop is led. Nor do the work requirement figures given for this job include the labour of any men supplied by the threshing contractor. Most farmers hired threshing tackle, the charges for which usually include the services of two men.

Mention has been made of the connection between crop yields and labour requirements for harvesting. Unfortunately with cereals this relationship can only be demonstrated for crops harvested by binder. Shortage of data precludes similar analyses being made for combined crops. As regards the latter it would be surprising if there were not some connection between yields and work requirements for harvesting, a point which is in need of elucidation since it has some bearing on comparisons of harvesting methods.

Tables III and IV show the relationship between crop yields and manual labour requirements for harvesting with a binder. Within the range of yields studied, increased yields meant higher manual

labour requirements per acre and lower manual labour requirements per ton, a point which suggests the presence of factors working towards economies of scale.

With combining, the level of work requirements is very much influenced by the type of machine used, the method of straw disposal adopted and whether the grain is dried or dressed on the farm. The figures given in the tables refer to self-propelled bagger type machines working in conjunction with pick up balers and cover combining, baling and leading grain and bales from the field. They do not cover drying or dressing corn. The work requirements given are the arithmetical averages of the records concerned.

There is no doubt, of course, that combines save a considerable amount of manual labour, but not all this work is saved at the peak time of harvest, since some is concerned with threshing, an operation which is usually done at a slack time of the year.

Winter Beans

In the sample studied, a considerable number of dairy farmers grew beans for feeding to cows. The great majority of these crops were winter sown. Work requirement figures for winter beans are given in Table V while Histogram C is concerned with the seasonal distribution of the necessary man and tractor labour.

Histogram C.

WINTER BEANS (Cut by Binder).

Seasonal Distribution of Manual Labour and Tractor Work Requirements.

Hours per month per acre.

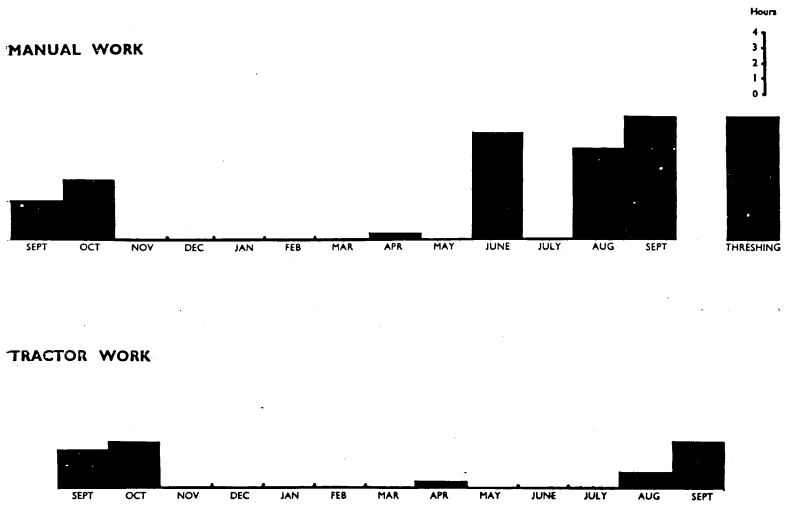


Table V gives a very similar set of operations for seed bed preparation and sowing, to that given earlier for winter sown cereals.

The seasonal distribution of the work is also almost identical. The differences between the crops as regards cultivations comes with hand hoeing. While hand hoeing cereals is a dying practice, the great majority of bean crops costed were hand hoed in early summer—the operation on average involving seven man hours per acre. Consequently, the total manual labour requirements for cultivations shown in the tables are considerably higher for beans than for cereals.

The set of cultivations given in Table V refer to the most common cultural method followed in the sample. There was, however, quite a common alternative, which reduced the amount of work necessary in seed bed preparation and sowing. This involved ploughing the seed in by using a special drill attached to the plough.

Table V.

WINTER BEANS.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

	Man Hours	Tractor Hours
Cultivations:		
Ploughing once	2½	2½
Cultivating once	¾	¾
Harrowing twice	1	1
Drilling artificials	¾	¾
Drilling seed	2	1
Hand hoeing	7	—
Total Cultivations	14	6
Harvesting by Binder:(1) ...		
Cutting by binder	2	1
Stooking and righting	4	—
Carting and stacking	8	3
Threshing(2)	8	—
Total Harvesting	22	4
Total Growing and Harvesting ...	36	10

(1) Arithmetical average of work requirements shown in sample records. Crops yielded on average 16 cwt an acre of head and tail corn.
(2) This assumes the hire of tackle and the services of a tractor and two men supplied by the contractor.

There were insufficient records to allow an analysis of the relationship between labour requirements for harvesting and crop yields. Instead the arithmetical average for beans cut by binder and threshed is given. Few crops were combined. Yields were not high, averaging only 16 cwt an acre. Labour requirements for

harvesting this yield—i.e. the figures given in Table V—are greater than those shown in Tables III and IV for similar yields of cereals.

Main Crop Potatoes

Yorkshire provides one-tenth of the potato acreage of England and Wales. The great majority of the potatoes produced in the three Ridings are grown in the Vale of York. Much of the data used for the discussion here are based on records supplied by the farmers of this district.

Table VI. gives a model of labour and tractor work requirements for main crop potatoes lifted by spinner, clamped and then riddled with a power operated sorter. Histogram D shows the seasonal distribution of the work involved.

Land was generally ploughed for potatoes during the autumn or winter and then ploughed again in March. On heavy land, however, an extra cultivation with discs was usually substituted for the March ploughing. The soil was then broken down with cultivators and harrows, ridged ready for planting and artificials applied. Planting took place in April and the seed was usually set by hand. Some farmers used mechanical planters of various designs.(1) Table VI gives standard work requirements for hand planting, the tractor work involved is for carting seed.

After planting, the furrows were covered by splitting back the ridges, and a week or so later the crop was harrowed to control weeds and flatten out the ridges. The rest of the pre-harvest operations are concerned with cleaning and earthing up the crop. The fields were generally tractor hoed twice and hand hoeing was also carried out to remove the rubbish growing in the potato rows themselves. Crops were finally earthed up in early July and left alone until harvest.

On the sample farms, lifting began in late September, the bulk of the crop being harvested in October and by early November the work was generally completed. Most crops were clamped until marketed, the final process, riddling and bagging up, involved a considerable amount of labour.

The bulk of the crops were lifted by spinners. Some farmers, however, had the work done by contract while others used their own mechanical harvesters (2). Most farmers employed casual labour to reinforce their own staff at potato harvest. Local women, school children and itinerant Irishmen comprised the bulk of this labour.

In calculating labour requirements for harvesting, the hours of all classes of labour are given equal weight, no attempt being made to reduce them to man equivalents. The fact that a highly significant correlation was found between labour requirements for picking up, carting and clamping and yields per acre, suggests that in effect this labour force was more homogeneous in quality than in appearance.

(1) Shortage of records precludes the publication of figures relating to the various types of mechanical planters used.
(2) Shortage of records precludes the publication of figures relating to the various types of mechanical harvesters used.

Histogram D.

MAIN CROP POTATOES (Lifted by Spinner).

Seasonal Distribution of Manual Labour and Tractor Work Requirements.

Hours per month per acre.

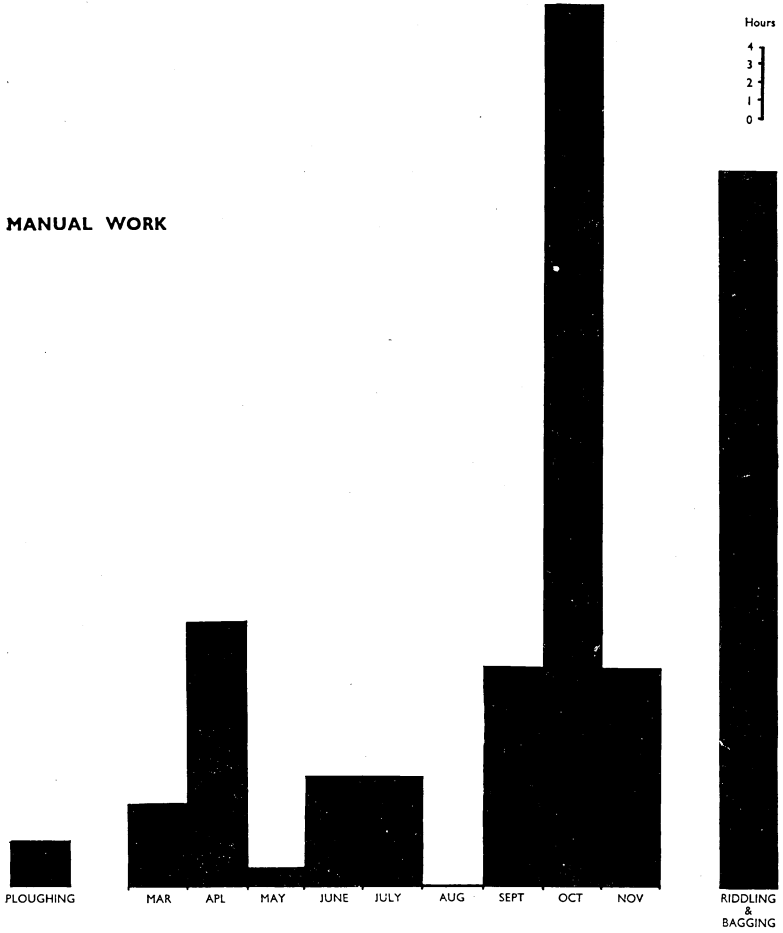


Table VI.

MAIN CROP POTATOES.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

(a) **Cultivations and Harvesting**—the latter related to a yield of 10 tons an Acre (ware, seed and chat).

	Man Hours	Tractor Hours
Cultivations: (1)		
Ploughing twice	5	5
Cultivating twice	1½	1½
Harrowing twice	1	1
Ridging and splitting three times ...	3	3
Planting seed by hand	10	1
Drilling artificials	2	1
Hand hoeing	10	—
Tractor hoeing twice	2	2
Total Cultivations	34½	14½
Harvesting:		
Spinning out	4½	4½
Picking, carting and clamping ...	66	13
Cleaning up field	1½	1
Riddling and bagging(2)	39	—
Total Harvesting	111	18½
Total Growing and Harvesting ...	145½	33

(1) If F.Y.M. were applied at the rate of 12 tons an acre, the average dressing given in the Leeds Potato Costs, then additional work requirements are incurred of 14¼ man hours and 7¼ tractor hours per acre. See Table II.
(2) Power operated riddle.

(b) **Work Requirements for Harvesting by Spinner and Yields Per Acre** (ware, seed and chat).

Yield per Acre (tons)	Man Hours per Acre (3)	Tractor Hours per Acre
5	56	12
8	89	16
9	100	17½
10	111	18½
11	122	20
12	132	21½
15	165	25½

(3) Of these totals, 65% represents time spinning out, picking, carting, clamping and cleaning up and 35% riddling and bagging.
All the tractor hours refer to lifting and carting.

Table VI gives the breakdown of work requirements for potato harvesting with a yield of ten tons an acre. Picking up, carting and clamping absorb most of the labour at harvest time. These tend to be continuous operations and it proved impossible to break down the figures among the individual items. Riddling and bagging involve a considerable amount of manual labour but have the advantage that the operations are usually done during a slack time of the year.

Estimated labour requirements for harvesting at varying yields are given in Table VI. About 65% of the time comprised work at the harvest season, while the rest covers riddling and bagging. Within the range of yields studied, no economies or diseconomies of scale were noted; at any given yield total manual labour requirements for all harvesting operations averaged eleven hours per ton.

Sugar Beet

Sugar beet is an important crop in the Vale of York, where two out of the eighteen British sugar beet factories are situated. Beet is grown in other arable districts of Yorkshire but not on so wide a scale, nor does the crop assume such importance in farm rotations.

Table VII gives model manual labour and tractor work requirements for growing and harvesting beet, while Histogram E illustrates the seasonal distribution of work on the crop.

Land for beet was usually ploughed twice, once in autumn or winter and again in March. On heavy soils an extra disc harrowing was substituted for the spring ploughing. The seed bed was then worked down, tillage applied and the crop sown—the latter operation being done usually in April. Inter-row cultivation began with an initial tractor hoeing directly the crop was up. Crops were usually singled in late May and early June. The second hand hoeing followed in late June and early July, then after a final tractor hoeing, fields were left alone until harvest time.

Rates of work for hand hoeing averaged about one-quarter of an acre per day per man for singling, and just over one-third of an acre per day for the second hoeing. Crops were generally gone over twice, although a few farmers only hoed once. Others, where the rows were very dirty, went over the crop three times.

Beet harvesting took place mainly in November and December. Most farmers had their beet lifted by hand and the general practice was to employ casual labour for the work, much of which was done on piece rates by gangs of itinerant Irishmen (1). The regular farm staff did the other jobs associated with harvesting, such as ploughing out, loading and carting from the field and finally reloading the beet for transport to the factory.

Examination of the records relating to manual labour and tractor work requirements for hand lifted beet shows that work requirements are related to yields (2). A significant correlation was found between

(1) In the 1954 Sugar Beet Costs, common rates paid for lifting and topping were from £8 to £10 an acre. Weather and soil conditions rather than crop yields were the criteria by which rates were fixed.

(2) Model work requirements for hand lifting and topping are based on a comparatively small sample, since where beet was lifted on piece work, labour times are not usually available.

Histogram E.

SUGAR BEET (Lifted by Hand).

Seasonal Distribution of Manual Labour and Tractor Work Requirements.

Hours per month per acre.

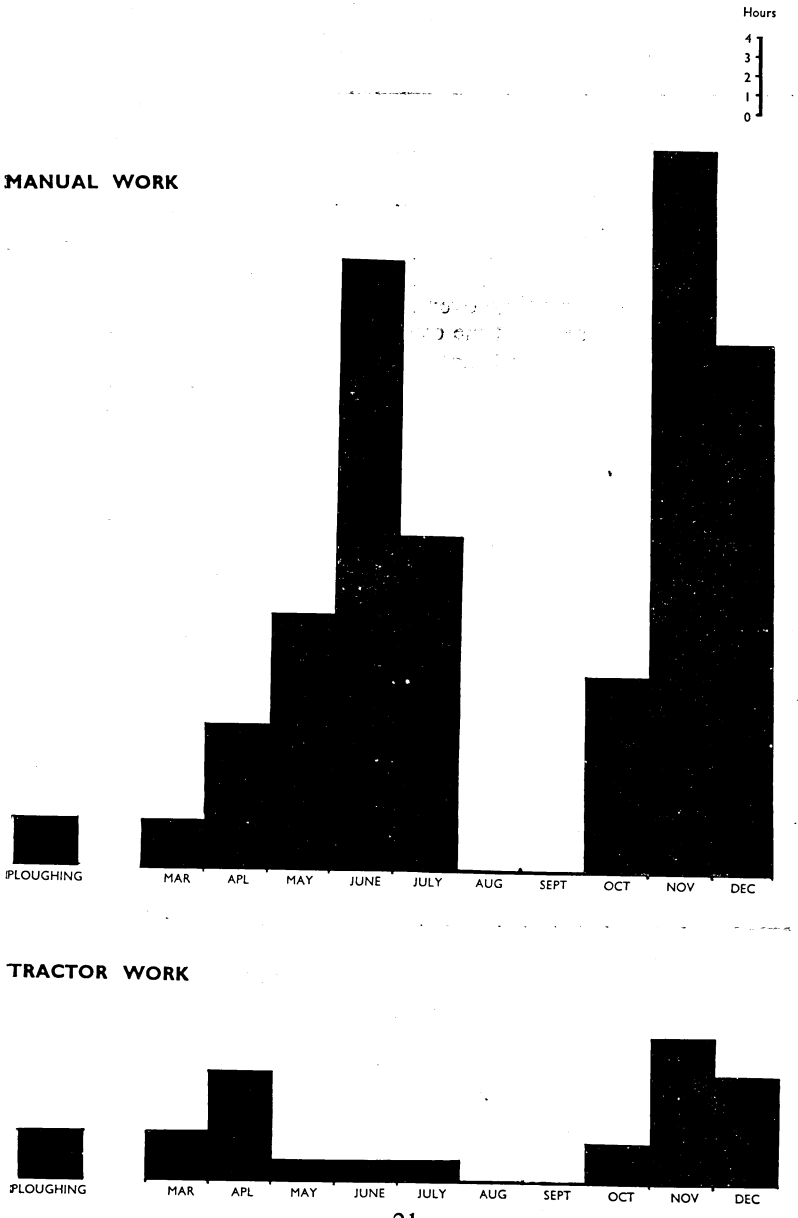


Table VII. SUGAR BEET.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

(a) **Cultivations and Harvesting**—the latter associated with a yield of 10 tons an Acre (Clean Beet).

	Man Hours	Tractor Hours
Cultivations: (1)		
Ploughing twice	5	5
Cultivating twice	1½	1½
Harrowing three times	1½	1½
Rolling once	½	½
Drilling seed	2	1
Drilling artificials	2	1
Hand hoeing first time over	33	—
second time over ...	22	—
Tractor hoeing three times	6	3
Total Cultivations	73½	13½
Harvesting (by hand):		
Ploughing out	2½	2½
Lifting and topping	46½	—
Carting and loading	25	12½
Total Harvesting	74	15
Total Growing and Harvesting ...	147½	28½

(1) If F.Y.M. were applied at the rate of 12 tons an acre, the average dressing given in the Leeds Sugar Beet Costs, then additional work requirements are incurred of 14¼ man hours and 7¼ tractor hours per acre. See Table II.

(b) **Work Requirements for Harvesting, and Yields Per Acre** (beet lifted by hand).

Yields per Acre (tons)	Man Hours per Acre	Tractor Hours per Acre
5	49	10½
8	64	13
9	69	14
10	74	15
11	79	16
12	84	16½
13	89	17½
15	98	19
17½	111	21½

labour requirements for topping and lifting and yields, and also between labour requirements for carting and loading and yields. The slopes of the regression lines obtained suggest the presence of economies of scale with increasing yields per acre.

Hand lifting and topping are jobs requiring considerable amounts of manual labour, consequently many growers have considered the possibilities of mechanising the work. In the sample studied some farmers had their beet topped and lifted mechanically, by either their own or contractors' machines. Contract rates for mechanical lifting and topping were generally lower than the piece rates paid to casual workers.

In 1950 a special survey was made in Yorkshire of the costs of operating separate toppers and lifters and complete harvesters. Table VIII below gives average manual labour and tractor work requirements for these machines.

Compared with total manual labour requirements of 49 hours an acre for ploughing out, lifting and topping, given in Table VII, mechanical harvesters afford great possibilities of saving labour. It will be noted that the comparisons drawn here are in terms of lifting and topping only. Beet still had to be carted and loaded whatever the method of harvesting employed.

No correlation was possible between working speeds of mechanical harvesters and yields per acre. In many instances the weight of beet lifted per acre was not known, especially where contractors' machines were costed.

Beet tops are an important source of stock food and most farmers feed them to cattle and sheep. No allowances are made in the tables for the work involved in saving and collecting tops. Saving only enters in when mechanical harvesters with no top saving devices are used. With such machines the tops have to be removed before the next row is lifted otherwise they are damaged and tend to get buried.

Table VIII.

Estimated Work Requirements for Mechanically Lifting and Topping Beet, Yorkshire, 1950.(1)

	Separate Toppers and Lifters	Complete Harvesters
Man hours per acre	12	8
Tractor hours per acre	4	4
Horse hours per acre	4	—

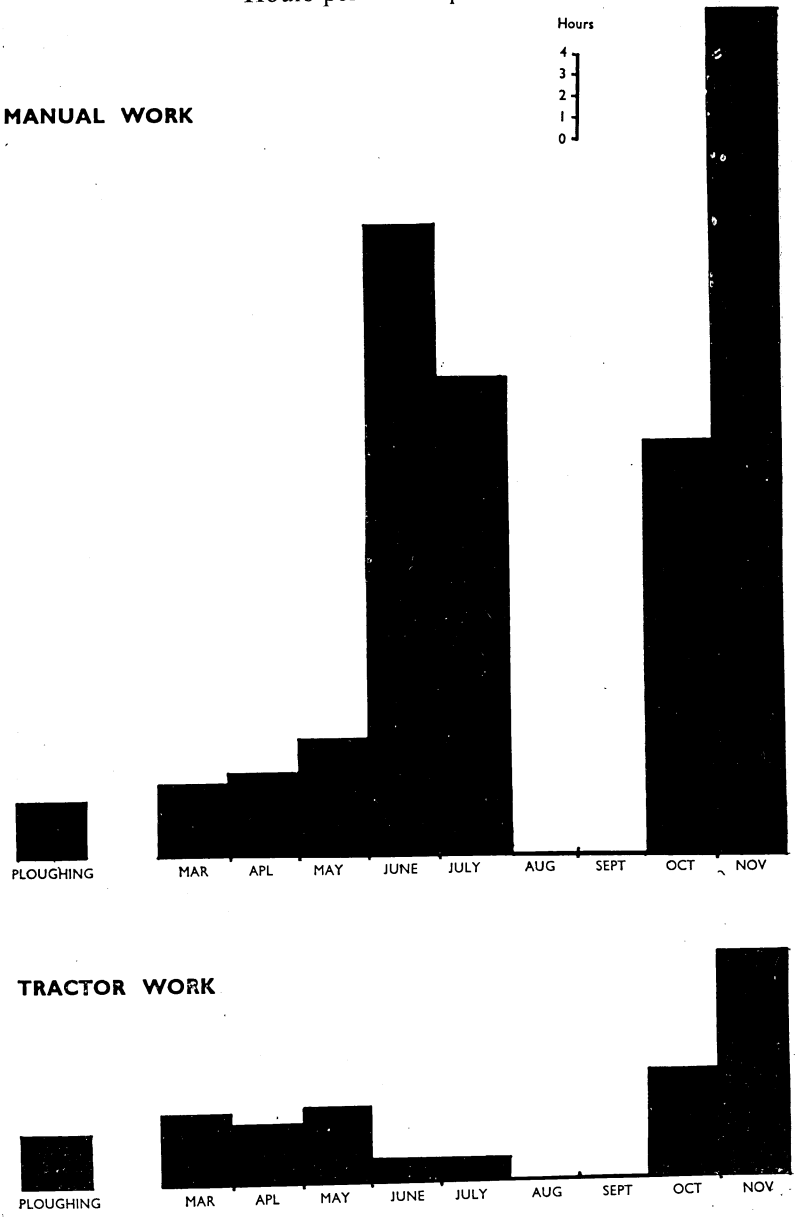
(1) Figures for the complete harvesters assume a working team of two men; the universal arrangement found in the 1950 investigation. In the 1954 Sugar Beet Costs the most popular complete harvester was operated by one man only. But average manual labour requirements per acre for complete harvesters were not very different in 1950 and 1954, while tractor work requirements were considerably higher in the latter year—exceptionally bad weather conditions at lifting time slowed down working speeds.

Histogram F.

MANGOLDS (lifted by hand).

Seasonal Distribution of Manual Labour and Tractor Work Requirements.

Hours per month per acre.



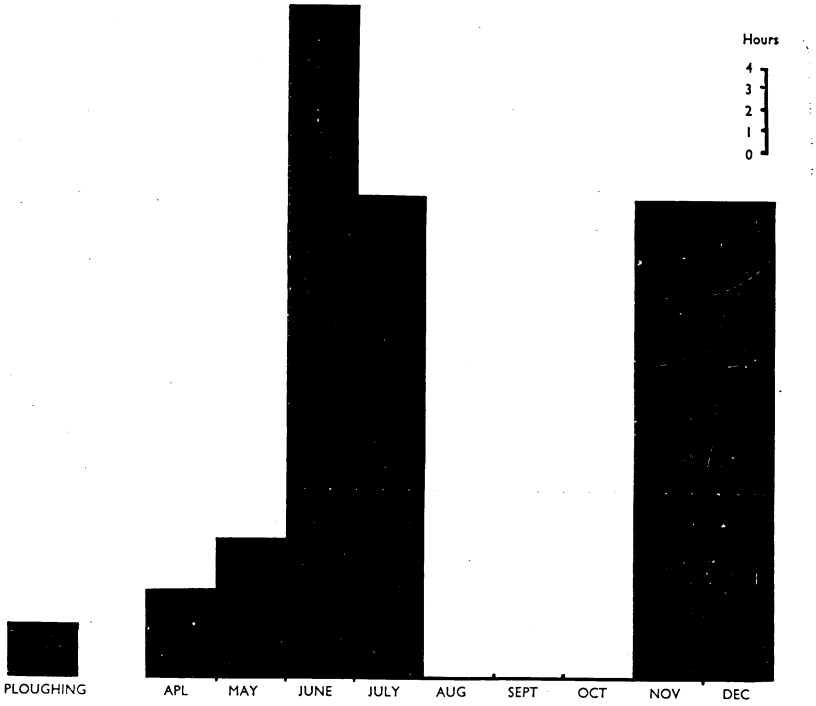
Histogram G.

SWEDES (Lifted by Hand and Clamped).

Seasonal Distribution of Manual Labour and Tractor Work Requirements.

Hours per month per acre.

MANUAL WORK



TRACTOR WORK

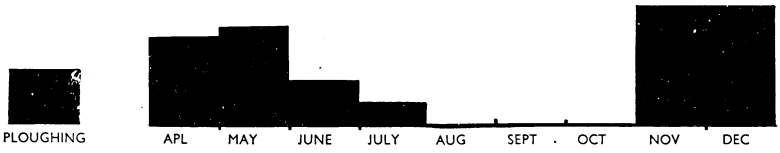


Table IX.

MANGOLDS.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

(a) **Cultivations and Harvesting**—the latter associated with a yield of 20 tons an Acre.

	Man Hours	Tractor Hours
Cultivations: (1)		
Ploughing twice	5	5
Cultivating twice	1½	1½
Harrowing three times	1½	1½
Rolling twice	1	1
Drilling seed	2	1
Drilling artificials	2	1
Hand hoeing first time over	27	—
second time over ...	20	—
Tractor hoeing three times	6	3
Total Cultivations	66	14
Harvesting:		
Lifting and topping	27	—
Carting and clamping	31	15½
Total Harvesting	58	15½
Total Growing and Harvesting ...	124	29½

(1) If F.Y.M. were applied at the rate of 11 tons an acre, the average dressing given in the cost records, then additional work requirements are incurred of 13¾ man hours and 6¾ tractor hours per acre. See Table II.

(b) **Work Requirements for Harvesting, and Yields per Acre.**

Yields per Acre (tons)	Man Hours per Acre	Tractor Hours per Acre
10	30	6
12½	37	8½
15	44	10½
17½	51	13
20	58	15½
22½	65	18
25	72	20
27½	79	22½
30	86	25

Mangolds and Swedes

Model work requirements for mangolds and swedes are given in Tables IX and X and the relevant seasonal distributions in Histograms F and G. All figures given relate to crops which have been harvested and carted from the field (1).

Cultivations carried out for fodder roots were very similar to those for sugar beet. The crops, however, were sown later, mangolds generally in early May and swedes in about the middle of that month. Considerable amounts of manual labour were involved in hand hoeing. Most growers went over their crops twice. Singling averaged about one-third of an acre a day per man while seconding was done at a slightly faster rate.

Table X.

SWEDES.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

	Man Hours	Tractor Hours
Cultivations: (2)		
Ploughing twice	5	5
Cultivating twice	1½	1½
Harrowing three times	1½	1½
Rolling twice	1	1
Drilling seed	2	1
Drilling artificials	2	1
Hand hoeing first time over	27	—
second time over ...	20	—
Tractor hoeing three times	6	3
Total Cultivations	66	14
Harvesting: (3)		
Lifting and topping	22	—
Carting	22	11
Total Harvesting	44	11
Total Growing and Harvesting ...	110	25

(1) Figures are based on Milk Costs records, where the general practice is to charge the crops with delivery costs to the farm buildings.

(2) If F.Y.M. were applied at the rate of 11 tons an acre, the average dressing given in the cost records, then additional work requirements are incurred of 13½ man hours and 6¾ tractor hours per acre. See Table II.

(3) Arithmetical average. Average yield of swedes 16 tons an acre

Swedes can of course be grown on much more extensive lines than the figures in Table X suggest. Recent cost investigations into sheep production on the Yorkshire Wolds give some idea of the general practice followed in growing swedes for sheep folding. Most farmers confined hand hoeing to rough singling, the necessary work being done at the rate of about half-an-acre per man a day. A few farmers eliminated hand hoeing by cross blocking their crops. No firm average figures are available for the latter operation.

On the farms studied, mangolds were lifted in October and November and swedes in November and December. A significant correlation was found between yields and manual labour requirements for harvesting mangolds but not for swedes. The number of swede records was smaller than that for mangolds and the range of yields and harvesting times were not so marked. But there would appear to be no reason why such a relationship should not exist and a correlation would probably result if a larger sample were available.

Comparing work requirements at a yield of 16 tons an acre—the average yield of the swede crops costed—little difference is seen in the level of work requirements for harvesting mangolds and swedes. It may be noted too that harvesting mangolds involves less work than a similar yield of sugar beet. Mangolds are easier to lift than beet, the individual roots larger and the plant population per acre lower so that a given yield is obtained with a smaller number of separate roots.

Kale

Table XI gives a set of model work requirements for kale while Histogram H illustrates the seasonal distribution. The figures, as will be seen from the table, refer to kale crops sown in drills, singled by hand and cut and carted. Grown in this manner, the work requirements for kale are similar to those for the other fodder roots discussed here. The numbers and types of cultivations carried out are much the same, except that the second hoeing is omitted in the model given for kale.

Kale crops were cut and carted when required for feeding, invariably during the winter months. A correlation was found between yields per acre and labour requirements for harvesting. At a given crop yield, manual labour requirements for harvesting kale are very similar to those for harvesting mangolds. Kale, however, has a much higher tractor work requirement—in fact the highest of any crop considered in this chapter.

Kale crops, of course, are not necessarily singled nor are they invariably cut and carted. The records used here relate to dairy farms where the general practice was to treat the kale crop in the manner described above. Table XIA gives an indication of the potential saving in labour which might be achieved if hand hoeing

Table XI.

KALE.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

(a) **Cultivations and Harvesting**—the latter associated with a yield of 20 tons an Acre.

	Man Hours	Tractor Hours
Cultivations:[1]		
Ploughing twice	5	5
Cultivating twice	1½	1½
Harrowing three times	1½	1½
Rolling twice	1	1
Drilling seed	2	1
Drilling artificials	2	1
Hand hoeing once over only ...	27	—
Tractor hoeing once	2	1
Total Cultivations	42	12
Harvesting:		
Cutting and carting	52	37
Total Harvesting	52	37
Total Growing and Harvesting ...	94	49

(b) **Work Requirements for Harvesting, and Yields per Acre.**

Yields per Acre (tons)	Man Hours per Acre	Tractor Hours per Acre
10	30	21
12½	35	25
15	41	29
17½	47	33
20	52	37
22½	58	41
25	64	45
27½	69	48
30	75	52

(1) If F.Y.M. were applied at the rate of 12 tons an acre, the average dressing given in the cost records, then additional work requirements are incurred of 14¼ man hours and 7¼ tractor hours per acre. See Table II.

and harvesting were eliminated. Out of the total labour requirement of 94 man hours an acre given, 79 are concerned with singling and harvesting.

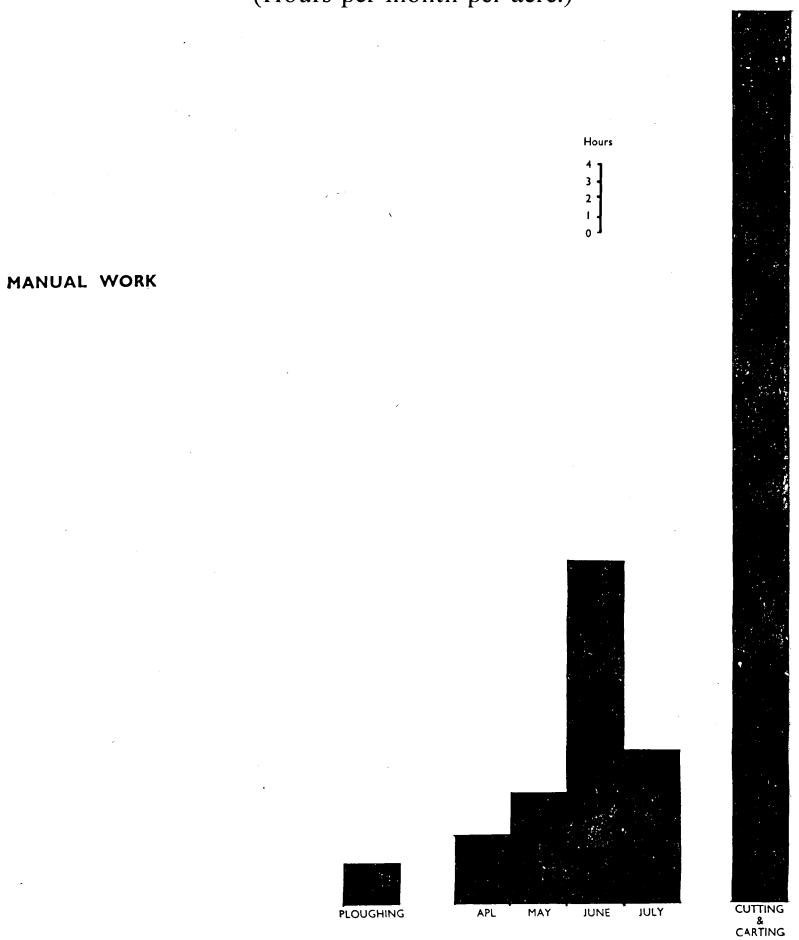
Singling is generally avoided by broadcasting the seed, a method which with a good "take" gives a dense stand of small leafy plants, ideal for grazing but difficult to handle if the crop has to be cut and carted. Most people who feed their kale to inwintered stock favour

Histogram H.

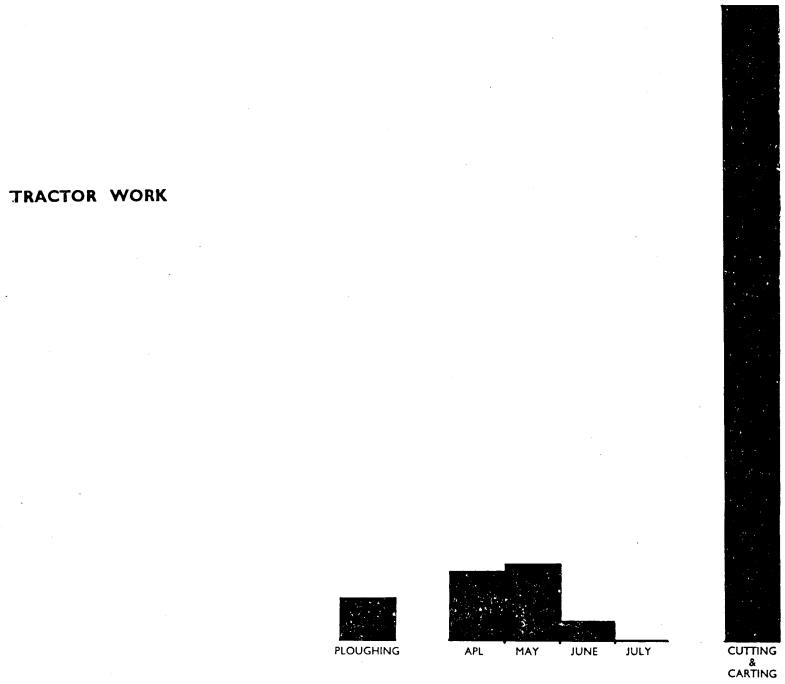
KALE (Cut and Carted).

Seasonal Distribution of Manual Labour and Tractor Work Requirements.

(Hours per month per acre.)



Histogram H (*continued*)



the large plant produced by drilling and singling. If stock can be folded, it is obvious that broadcasting has many advantages. Yields are important in making comparisons of the rival merits of the two methods. Unfortunately, however, the effects of the cultural method followed on yields is not very clear, experimental evidence tends to be somewhat contradictory (1).

Ley Establishment

The leys studied ranged from one year clover seeds to long term leys verging on permanent grass. Undersowing barley or oats was the most popular method of establishment and 80% of the fields costed were sown in this way. Cultivations were very simple, seed usually being fiddled in by hand and then covered by a light harrowing. The work was done at the time the nurse crop went in or soon afterwards. Direct sowing involved considerably more effort since a seed bed had to be worked down. Table XII gives models for direct and indirect seeding. No seasonal distributions, however, are included. Work requirements for under-sowing hardly justify illustration in a histogram, while direct seeding can be done at different times of the year.

(1) See H. G. Sanders' "An Outline of British Crop Husbandry." Chapter VII.

Table XII.

LEY ESTABLISHMENT.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

(a) **Sown with a Nurse Crop** (covering only the direct operations concerned).

	Man Hours per Acre	Tractor Hours per Acre
Broadcasting seed ...	1	—
Harrowing once ...	$\frac{1}{2}$	$\frac{1}{2}$
Total	$1\frac{1}{2}$	$\frac{1}{2}$

(b) **Direct Seeding.**

	Man Hours per Acre	Tractor Hours per Acre
Ploughing once ...	$2\frac{1}{2}$	$2\frac{1}{2}$
Cultivating twice ...	$1\frac{1}{2}$	$1\frac{1}{2}$
Harrowing twice ...	1	1
Rolling twice ...	1	1
Broadcasting seed ...	1	—
Drilling Artificials ...	$\frac{3}{4}$	$\frac{3}{4}$
Total	$7\frac{3}{4}$	$6\frac{3}{4}$

Arable and Grass Silage

Arable and grass silage are discussed together in this section since a study of the records relating to the actual silage making process suggests that at a given weight of crop per acre the composition of the material being ensiled has little effect on work requirements for harvesting.

The great majority of arable silage crops costed were cereal—legume mixtures, oats with peas being especially popular. These crops were treated in much the same way as regards cultivations as other spring sown cereals. Table XIIIA gives model work requirements for cereal silage mixtures.

Grass silage crops are much more flexible. A common practice is to take a hay crop first and then use the aftermath for silage. Another popular alternative is to shut a field up in the spring, cut for silage in late May or early June, rest and then turn stock in to graze. A field can be shut up for silage for a whole season and with

the help of generous top dressings of tillage and favourable weather, three or more cuts can be taken. The presence of all these alternatives has led to the exclusion of work requirements for cultivations relating to grass silage from Table XIII. Since grass silage can be made intermittently throughout the growing season, no seasonal distribution diagram is given.

Various alternative methods of ensiling exist but in the sample two methods predominated, the difference between them being the presence or absence of a green crop loader. The usual procedure was to cut the crop with a tractor-mower, load the green stuff either by hand or with a green crop loader, cart and fill the silo. The most common types of silo found were the clamp or pit varieties. The figures given in Table XIII do not refer to permanent tower silos, the silage making process is different with these since a cutter-blower is essential.

Table XIIIB shows that green crop loaders afford some reduction in work requirements for silage harvesting. These savings are more

Table XIII.

ARABLE AND GRASS SILAGE.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

(a) **Growing and Ensiling a Cereal Silage Mixture. Yield 6 tons an Acre.**

	Man Hrs.	Trac. Hrs.
Cultivations:		
Ploughing once	2½	2½
Cultivating twice	1½	1½
Harrowing twice	1	1
Rolling once	½	½
Drilling seed	1½	¾
Drilling artificials	¾	¾
Total Cultivations	7¾	7

Ensiling Green Crop Loader	Man Hrs.	Trac. Hrs.	Ensiling Hand Loading	Man Hrs.	Trac. Hrs.
Cutting, carting and making	15½	6	Cutting, carting and making ...	17½	7
Total Growing and Ensiling	23¼	13	Total Growing and Ensiling	25¼	14

Table XIII (*continued*).

(b) **Work Requirements per Acre for Ensiling (Grass and Arable Silage)** 1 cut only (1)

Yield per Acre (tons)	Green Crop Loader		Hand Loading	
	Man Hours per Acre	Tractor Hrs. per Acre	Man Hours per Acre	Tractor Hrs. per Acre
1½	8½	3½	12	4½
2	9	3½	12½	5
2½	10	4	13	5
3	10½	4½	13½	5½
3½	11½	4½	14½	5½
4	12	5	15	6
4½	13	5	15½	6
5	14	5½	16	6½
5½	14½	6	17	6½
6	15½	6	17½	7
6½	16	6½	18	7½
7	17	6½	19	7½
7½	17½	7	19½	8
8	18½	7½	20	8
8½	19	7½	20½	8½

Average yield of grass silage per cut 4 tons an acre.

noticeable with the lower ranges of crop yields per acre. With higher yields economies of scale set in and these would appear to be more marked with hand than with green crop loading, under the conditions prevailing in the sample.

Seeds and Meadow Hay

The construction of a model set of work requirements for hay is a rather more complicated business than that for other individual crops. Work requirements for hay are largely determined by the number of cuts taken in the course of a season and the technique of haymaking adopted. These factors, weather and the labour involved if hay meadows are mucked, help to explain the divergences in published manual labour requirement figures for this crop.

Seeds and meadow hay are discussed together, since work requirements for haymaking depend on the technique adopted and yields rather than the nature of the crop. Seeds hay generally gives a higher yield per acre, consequently other things being equal, it involves more work than meadow hay. In the sample studied, seeds hay yielded on average 28 cwts per acre per cut against the 24 cwts of meadow hay.

(1) Yields, silage actually fed, i.e. not including waste.

Table XIV.

SEEDS AND MEADOW HAY.

Estimated Manual Labour and Tractor Work Requirements Per Acre.

(a) **Growing and Making**—the latter associated with a yield of 25 cwts. an acre (Land shut up for hay in the spring and one cut only taken).

	Man Hours	Tractor Hours
Cultivations:		
Harrowing once	½	½
Rolling once	½	½
Drilling artificials	¾	¾
Total Cultivations	1¾	1¾
Hay Making: (1)		
Mowing	1	1
Turning by machine twice	1	1
Collecting and stacking loose ...	7	2
Raking	½	½
Total Hay Making	9½	4½
Total Growing and Making	11¼	6¼

(b) **Work Requirements for Hay Making, and Yields Per Acre.** One Cut Only.

Yield per Acre (cwts)	Man Hours per Acre	Tractor Hours per Acre
12½	7	3½
15	7½	3½
17½	8	4
20	8½	4
22½	9	4
25	9½	4½
27½	10	4½
30	10½	5
32½	10½	5
35	11	5½
37½	11½	5½
40	12	5½
42½	12½	6

(1) Covers sweeping and stacking in the field and subsequent carting to the farm buildings, *or* alternatively carting and stacking by the steading.

Most farmers took only one cut of hay from a field in the course of a season, the general practice being to cut for hay in June and then graze the aftermath. Crops cut twice were almost invariably seeds hay (1).

Techniques of hay making varied but the common procedure was to cut with a mower, turn by machine and either to hand load into trailers and stack loose by the farm buildings, or else to sweep and stack loose in the field. In the latter case the records include the amount of labour involved in subsequent cutting out and carting to the farm buildings.

Table XIV is based on the technique of hay making described in the previous paragraph. The whereabouts of the stack would not seem to be of much importance if the hay has to be carried eventually to inwintered stock. A significant coefficient of correlation was found between yield per cut and manual labour requirements for hay making where the hay was stacked loose. It is interesting to note that the records used were drawn from four separate years when weather conditions differed, yet a correlation was obtained so indicating that weather is perhaps not of overriding importance where labour requirements are concerned. One point brought out by the figures for hay making shown in Table XIVB is the presence of economies of scale. Lower than average yields per cut mean—other things being equal—higher labour costs per ton.

Other methods of hay making, of course, were found on the sample farms. Some farmers, especially in the Dales, cocked or piked their hay, an operation which on average took three man hours an acre. Another quite common practice was to sweep hay to a stationary baler (2). Cocking and stationary baling increased the manual labour requirements above the levels shown in Table XIV. Alternative methods, which should lead to a reduction in the level of work requirements per acre, were not much in evidence. Few pick-up balers, for example, were recorded.

Pasture

The model work requirement figures given in Table XV refer to permanent and temporary grazing and include the cultivations carried out by the great majority of the farmers in the sample. Drilling artificials covers either slagging or top dressing with a nitrogeneous fertiliser—most farmers did either one or the other. Pastures were usually harrowed in spring, and during the course of the summer they were gone over by hand to cut out thistles, ragwort, nettles and other weeds. A few farmers topped their fields with a tractor mower but the practice was not very common.

(1) 5% of the meadow fields and 36% of the seeds hay fields were cut twice. No cases of more than two cuts were recorded.

(2) Owing to lack of data it is impossible to give work requirements for stationary baling.

Table XV.

PASTURE.

Estimated Annual Manual Labour and Tractor Work Requirements Per Acre.

	Man Hours	Tractor Hours
Harrowing once ...	½	½
Drilling artificials ...	¾	¾
Cutting thistles etc....	1	—
Total	2¼	1¼

No allowances are made in Table XV for the work involved in hedging and fencing, which are perhaps the most labour exacting tasks as far as pasture is concerned. The omission arises from the nature of the basic material, no direct labour times for these operations being given in the records used for this section. However, some at least of these omissions are rectified in Chapter III where the whole subject of manual work other than that on crop and livestock enterprises, is discussed.

CHAPTER II.

MANUAL LABOUR REQUIREMENTS FOR LIVESTOCK.

The care of stock is one of the main occupations of the British farm worker, an occupation in which men are still relatively unaided by machines. Stock work has not lent itself readily to mechanisation and with the notable exception of the milking machine, methods show no changes comparable to those which have revolutionised arable farming in the last two decades.

Figures for tractor and horse work requirements for stock are not given in this chapter. The general experience on the enterprise cost study farms was that except for occasional carting, little demand arose for such work in connection with livestock enterprises. This trend is also reflected in the pattern of horse and tractor use on the Diary Farms (1).

In this chapter, the exclusive concentration on manual work does not mean, however, that the question of manual labour requirements for livestock is a simple matter. The converse rather is true. The compilation of a set of standard labour requirements for the different classes of stock is a more complex task than the construction of a similar series for crops. One of the main reasons for this is the wealth of alternative management systems which can be adopted for a particular class of stock—a situation which is not paralleled in crop production. The system chosen has an important influence on the level of labour requirements. Logically speaking, therefore, labour requirements for a given class of stock should be differentiated according to the system adopted. In order to do this adequately, sufficient records should be available relating to all the various systems in common use. Such samples would have to be considerably larger than those of the enterprise cost studies on which this section is based. Lack of data precludes the discussion here of all but the most common production methods followed on the co-operating farms.

A complicating factor arises from the presence of a variable and fixed cost aspect as regards the labour requirements for livestock. Variable costs are those which depend directly on the volume of production while fixed costs are independent of the the amount produced. Part of the work involved in caring for livestock comes under the variable cost definition but part has more of a fixed cost aspect. However, much of the work classified as a fixed cost is not entirely independent of the scale of production, so by definition does not constitute a true fixed cost. But for enterprises falling

(1) See Pages 77 and 79.

within certain size ranges, labour requirements for work of this type are independent of fluctuations in stock numbers. Consequently within these size ranges total labour requirements per head (variable plus fixed labour) decrease with increases in the numbers kept.

Perhaps the conception of this quasi fixed cost labour can be visualised as steps in a staircase which climb upwards with increases in the scale of production. Each step represents the amount of " fixed cost labour " necessary for a particular size range in output. On any single step unit costs will be highest at the beginning and lowest at the end. Other things being equal it does not pay to adopt that scale of production which involves a move to the beginning of the next step, it is better to remain at the end of the previous one.

This conception would seem to be of considerable importance in the determination of unit labour costs for livestock. Unfortunately, however, little is known about the size ranges in the scale of production in which these quasi fixed costs remain constant or at what points they change. The position of the margin is probably a matter peculiar to an individual farm but there can be little doubt that some general tendency exists. When labour requirements for various classes of stock are discussed in this section, certain size range figures are mentioned but owing to lack of data the treatment given to this important subject is very cursory.

The influence of the management system adopted together with the effects of the scale of production on unit labour requirements, make the seasonal distribution of manual work on a particular class of stock very much a matter peculiar to the individual farm. Consequently no seasonal distribution histograms are given here. Instead reference is made in the text to the time of year at which jobs were usually done by the farmers who co-operated in the relevant enterprise cost studies. With this and other information contained in this section it should be possible to gain some impression of the probable seasonal distribution of labour in certain situations.

Another omission in this chapter is the absence of any reference to the labour requirements for horses and pigs. Horses have not been the subject of any Leeds enterprise cost study, while the sample of pig costs available proved inadequate for the compilation of reliable requirement figures. The records were few in number and covered a heterogeneous collection of management systems. Labour, however, is only a relatively minor item in the costs of pig production(1).

Dairy Cows

Of all the aspects of labour use on the farm, labour requirements for milk production have perhaps attracted most the attention (2).

(1) In a recent Yorkshire pig cost study, labour accounted for 8% of total costs. See " Costs and Returns from Keeping Pigs on Thirteen Yorkshire Farms, 1953/54." Farmers' Report 121, University of Leeds, Department of Agriculture. 1955.

(2) See especially J. S. Nalson, " Labour in Relation to Economic Efficiency on Dairy Farms." University of Nottingham, School of Agriculture. 1952.

This is not surprising in view of the great importance of milk in the farming economy of this country and the fact that the care of dairy cows absorbs a greater proportion of the total labour on the National Farm than any other single enterprise.

Labour on milk production is defined here as the manual work involved in milking, feeding, and in the general care of the dairy herd including both dry cows and cows in milk. Work on young stock and herd replacements is not included.

Labour requirements for milk production depend on a variety of factors, one of the most obvious being the method of milking adopted. Table XVI. gives simple average labour requirements based on Milk Cost data collected by the University of Leeds in 1948/49-1953/54, for three common methods—hand milking, machine milking in cowsheds with bucket type machines, and machine milking in yards and parlours with combine machines. The majority of the farmers in the investigations used bucket type milking machines in conventional cowsheds. During the period studied, the number of hand milked herds fell steadily while the yard and parlour system spread slowly. Those herds which remained hand milked were small. The yard and parlour system on the other hand tended to be adopted by the larger herds.

Table XVI.

THREE SYSTEMS OF MILKING.

Average Annual Labour Requirements Per Cow.

	Hand Milked, in Cowsheds	Bucket Type Milking Machines, in Cowsheds	Yard and Parlour, Combine Milking Machines
Annual Labour Requirements per Cow (man hours) ...	185	136	116
Average Herd Size (cow numbers) ...	10	26	31
Average Annual Yield Per Cow (gallons)...	654	713	779

Herd size is another factor of importance in determining the level of labour requirements. Within each of the three milking systems shown in Table XVI, a negative correlation was found between herd size and annual labour requirements per cow, the marginal labour involved in keeping an extra cow being normally lower than the average labour requirements per cow for the herd ([1]).

(1) The divergence between marginal and average labour requirements per cow would seem to be especially marked in the very small herds. Compare also J. S. Nalson. Op. Cit., Page 49.

The annual milk yield per cow also appears to influence the amount of manual work necessary. A positive correlation was found between labour requirements and milk yields for hand and bucket machine milked cows but not for herds run in yards and parlours. With the first two systems labour requirements per cow rise as milk yield increases, most of this additional work being required for actual milking (1).

In the discussion of standard times, therefore, it is desirable to construct a series of annual labour requirements per cow at different herd sizes and levels of milk yields for each of the common systems of milk production. Unfortunately in the present chapter this approach can be adopted only for the bucket type milking machine group, since the other groups contain too few farms for satisfactory analysis.

Herds using Bucket Type Milking Machines in Conventional Cowsheds

The majority of these herds were on mixed farms and consisted of some 20-35 cows both dry and in milk. Very few herds were managed solely by one man. The usual practice was for the work to be done by a team of three to four persons who spent only part of their time with the cows. A full-time cowman was often responsible for the cows, but he usually spent part of his time looking after young stock and on other work, so that for the purpose of milk production (which alone is considered here) he was working part-time. The rest of the dairy team were not necessarily all adult men; youths and girls often being employed. On some farms, the farmer's wife undertook the washing up and sterilising of the dairy utensils. A common arrangement was for a herd of about 20-25 cows to be run by a team of three workers using two milking machine units, while herds of about 25-35 cows required an extra person and an extra unit. Since the number of workers exceeded the number units, one member of the team obviously did not milk.

Table XVII gives a series of estimated standard annual labour requirements per cow, relating to herd sizes between 20 and 35 cows with milk yields ranging from 500-800 gallons annually per head. The table shows a range of annual labour requirements per cow of 117-145 man hours per year, according to herd size and yield. With a given herd size, labour requirements rise with increases in yields. With a given yield, labour requirements fall with increases in herd size.

The discussion so far has been confined to annual labour requirements. No details are available of the daily routine followed on the co-operating farms at the time of the cost studies. Some of the farms, however, have been visited subsequently and details

(1) Compare R. Turner. "An Investigation into the Time taken to Milk Cows." The West of Scotland Agricultural College, 1951.

Table XVII.

ESTIMATED ANNUAL LABOUR REQUIREMENTS PER COW(1)

Bucket Type Milking Machines in Cowsheds Group.

Herd Size (number of cows)	Annual Milk Yield Per Cow			
	500 gallons	600 gallons	700 gallons	800 gallons
	Man Hours per Cow per Year			
20	124	131	138	145
25	122	129	136	143
30	119	127	134	141
35	117	124	132	139

obtained of the routine work involved in their dairy herds. From such information and the weekly total labour input figures given in the original cost data, it is possible to make a rough subdivision of the annual labour figures.

In winter daily work on the cows included milking, washing and sterilising dairy utensils, feeding, mucking out and bedding. In summer the time involved in the last three jobs was reduced considerably but extra work was incurred in other directions. The cows had to be fetched from the fields and on many farms electric fences demanded attention. Consequently the differences in labour requirements between the winter and summer periods, were not very marked (2). On average, labour input in the summer period was 85% of that of the winter. The great majority of herds costed were inwintered for about six months from mid October to mid April.

Table XVIII gives 'some estimated standard labour requirement figures for herds between 20-35 cows with milk yields ranging from 500-800 gallons per cow. It will be noticed that a range of requirement figures are given. Those for the daily routine cover the possible combinations of herd size and yield. The lowest figures apply to large herds with small yields, the highest to small herds with large yields. The allowance for work other than that covered by the daily routine, is included in the form of an annual charge per herd which is related to herd size only and increases with the rise in the numbers of cows kept. Other work includes the spring cleaning and white-washing of cowsheds and work of a veterinary nature undertaken by the dairy staff.

(1) The figures are based upon linear multiple regression equations which have been constructed from data contained in the individual farm records.
(2) In the sample studied, half the annual milk production per cow came in the winter and summer periods respectively, while one-fifth of all the cows were dry during both seasons.

Table XVIII.

ESTIMATED STANDARD LABOUR REQUIREMENTS.

Bucket Type Milking Machines in Cowshed Group.
Herds of from 20-35 cows
and annual milk yields per cow of 500-800 gallons.

	Labour Requirements
Daily Routine—Winter:	
Labour per **cow** per **day** (1)	20-25 mins.
Daily Routine—Summer	
Labour per **cow** per **day** (1)	17-21 mins.
Other Work:	
Labour per **herd** per **year** (2)	50-75 hours

Rearing and Finishing Beef Cattle

This section is concerned with cattle rearing and finishing on farms on the predominantly arable districts of Yorkshire—the Vale of York, the Wolds and Holderness. The main role of cattle on these farms is to aid in the preservation of soil fertility. Cattle are kept more for their ability to convert straw into farm yard manure than for their direct contribution to farm profit.

Manual labour with cattle is almost entirely accounted for by routine tending and feeding. The amount of work necessary depends on the season of the year and whether cattle are kept inside or are at grass. The discussion of labour requirements, therefore, falls under two broad headings.

Housed Cattle

Cattle were generally inwintered, a policy which with the older beasts, reflected the emphasis on muck production rather than the harshness of the climate. In the 1954/55 Investigation the average number of beasts inwintered per farm was about 60 head and these ranged from newly born calves to fattening bullocks. Most farmers had cattle of all ages.

Beasts usually came in during November and those which were to be run on grass during the following summer were turned out in April or May, according to age and the amount of grazing available. The only cattle likely to be housed in the summer were calves being reared on the bucket or by multiple suckling. Farmers did not favour turning calves out for the first time after the beginning of June for fear of husk, so calves not old enough to go out by that time, usually remained inside until the following spring.

During the winter the usual policy was to employ most of the farm staff to look after the cattle rather than to leave the work to a

(1) According to both yield and herd size.
(2) According to herd size only.

specialised beastman. A common practice was to have a team of two or three men to fodder and water twice daily. They would also cart hay and straw, and bed down the yards at frequent intervals. Other work included pulling and carting swedes and kale. The cleaning out of the fold yards was an annual operation requiring the services of most if not all the farm workers.

A standard manual labour requirement figure of six minutes a day per head of cattle kept inside, is adopted here. This flat rate applies to all age groups (1). Work covered includes feeding, watering, preparing roots, chaff and meal, carting hay and straw, and bedding down. It does not include pulling and carting roots—such work is classified in this bulletin as crop harvesting. Nor is any allowance made for cleaning out fold yards—such work is charged to farm yard manure.

Considerable variations were recorded in the level of daily labour requirements per beast housed. For example in the 1954/55 Investigation times ranged from two to fifteen minutes per head. Over a quarter of the sample, however, returned times between five and seven minutes and over a half between four and eight minutes, all times inclusive.

A full explanation of these variations cannot be attempted on the evidence available (2). Part of the reason may lie in the extent to which farmers had an incentive to save labour on their cattle enterprise in winter. There is not much point in rigorously planning work on cattle with a view to cutting down labour to a minimum, if no alternative work can be found for the men concerned. In this connection one farmer's experience is of interest. This man, who returned one of the highest labour requirements per head of cattle inwintered, had little work for his staff to do during the height of winter, so they spent part of their day under-employed, tending cattle.

Cattle at Grass

Grazing cattle were usually looked over once a day and it was exceptional for this to take up more than an hour of a man's time. Few instances of supplementary feeding were reported while outwintering was very uncommon and confined to breeding cattle and the older stores.

The standard manual labour requirements suggested for grazing cattle are one-half to one hour a day according to the distances and numbers involved. These times cover looking over only, and refer to all the cattle at grass on the farm. Labour requirements per head, of course, are calculated by dividing these totals by the number of cattle concerned.

(1) The evidence of the investigations suggests that age is not of great importance in determining unit labour requirements for cattle kept inside. Averages for all the investigations, whether concerned solely with one age group of cattle or mixed groups, fall between 5-7 minutes per head per day for housed stock.

(2) It would seem that economies and diseconomies of scale did not enter in. The date was tested statistically but no correlation was found between labour requirements per head and the numbers of cattle housed.

All other Work with Cattle

Compared with tending and feeding, very little time is required for the other jobs associated with cattle. These include moving and drawing out beasts and general doctoring. Calves were earmarked for subsidy purposes and males castrated. Some farmers had their calves vaccinated, other subjected them to tuberculin tests. Older cattle received less doctoring, the only widespread treatment being dressing against warble fly. To cover all this type of work a

Table XIX.

SOME ESTIMATED MANUAL LABOUR REQUIREMENTS FOR BEEF CATTLE.

(a) **Some Standard Figures.**

	Man Hours
Feeding and Tending.	
Time per head per month:	
Cattle housed inside	3
Feeding and Tending.	
Time per farm per month:	
Cattle at grass (1)	15-30
All Other Work. Time per head per year:	
Cattle up to one year old	$\frac{3}{4}$
All other cattle	$\frac{1}{2}$

(b) **Some Estimated Labour Requirements for Different Classes of Beef Cattle.**

	Man Hours Per Head
Calves housed inside for first year:	
Annual labour requirements per head ...	$36\frac{3}{4}$
Other Cattle and Calves:	
Housed inside $5\frac{1}{2}$ months in winter, at grass $6\frac{1}{2}$ months in summer	
Annual labour requirements per head ...	20
of which winter period	$16\frac{3}{4}$
summer period (2)	$3\frac{1}{4}$
Feeding Cattle:	
Finished in yards, 5 months period only ...	15
Finished on grass, 6 months period only (2)...	3

(1) 20-100 grazing cattle per farm. Times depend on size of herd grazing and the distances between fields and farm buildings.
(2) Assuming fifty beasts of all ages at grass per farm and a total labour requirement of $\frac{3}{4}$-hour a day for looking over.

standard annual labour requirement is adopted of three-quarters of an hour per calf and half-an-hour for an older beast.

Model Labour Requirements for Beef Cattle

The standard figures mentioned previously provide the bases for the estimates given in Table XIX. Perhaps the most noticeable feature of this table is the great difference between the amount of labour involved when cattle are inside compared with when they are at grass. Hence the importance of the length of the period for which they are housed. The periods quoted are based on the general experiences of the farmers covered by the enterprise cost studies.

Sheep.

Yorkshire provides illustrations of most types of sheep production found in this country, ranging from extensively run hill flocks to the fattening of sheep on folded roots. Limitations in the available data, however, confine the present discussion to two types of sheep production, grassland breeding flocks and arable fattening sheep.

Grassland Breeding Flocks

The sample studied was drawn from lowland farms. The sheep concerned were run almost entirely on grass but most received some form of supplementary feed during the winter. Flocks were small, most containing less than 100 ewes and no individual flock exceeded 150 ewes. Sheep were a relatively minor enterprise on these lowland farms which were pursuing mixed farming systems.

Manual labour requirements for the various operations associated with grassland breeding sheep may be divided into fixed labour costs where the work involved is relatively independent of flock size and variable labour costs which depend on the numbers kept. Into the first category come routine tending and supplementary feeding, the second includes such jobs as lambing and other work involving the handling of individual animals; shearing and dipping for example.

With jobs coming under the classification of fixed cost labour, much of the work involved was spent travelling to and from the sheep. Table XXA gives flat rates of half-an-hour per day per flock for routine inspection and an additional half-hour if feeding was done at the same time. Supplementary feed was usually given for half the year, from mid October to mid April, and for flocks of the sizes included in the sample one load of feed a day sufficed.

Table XXA gives unit labour requirements for the tasks coming under the variable cost heading. A standard charge of one-and-a-quarter hours per ewe is adopted to cover extra work at lambing time. This figure is based on the arithmetical average of the sample. A considerable range in times was recorded, however, which can be ascribed mainly to differences in flock management. Work at lambing was generally undertaken by the farmer. Flocks were too small to justify a shepherd and the work too responsible to entrust to a non-specialist. Most flocks lambed in March. Sheep were

Table XX.

GRASSLAND BREEDING FLOCKS.

Flocks up to 150 Breeding Ewes including Labour on Rams and Unweaned Lambs.

(a) **Some Estimated Manual Labour Requirements for Individual Operations.**

	Man Hours
Per Flock per Day:	
Routine inspection	$\frac{1}{2}$
Supplementary feeding	$\frac{1}{2}$
Per Ewe per Year:	
Lambing	$1\frac{1}{4}$
Shearing	$\frac{1}{3}$
Dipping (1)	$\frac{1}{4}$
All other work	$\frac{1}{2}$

(b) **Manual Labour Requirements and Flock Size:** (2)

Size of Flock (number of breeding ewes)	Manual Labour Requirements per Flock per Year (Hours)	Manual Labour Requirements per 100 Ewes per Year (Hours)
50	390	780
75	450	600
100	505	505
125	565	452
150	625	417

generally sheared in May, the job usually being done by hand at the average rate of three ewes an hour. Dippping was done twice a year, usually in October and June. The standard time, a quarter-hour per ewe, covers the autumn dip of the breeding flock together with the summer dip of the ewes and their lambs. An allowance of half-an-hour annually per ewe is made to cover all other work including castrating and tailing lambs, dosing and injecting, and drawing sheep from the flock for marketing.

The division of labour requirements into two classes, fixed and variable, has an important influence on unit labour requirements. Within the size ranges of flocks costed, the smaller the flock the higher were labour requirements per ewe. This trend is illustrated in the individual sample records by the existence of a significant negative correlation between flock size and labour requirements per ewe, a trend which is reflected in the model figures given in Table XXB.

(1) Covers autumn dip of the breeding flock and the summer dip of ewes and lambs.
(2) Assuming supplementary feeding for half the year.

Arable Fattening Flocks

In marked contrast to the other chalkland areas of England, arable sheep still play an important part in Yorkshire Wolds farming. In this district the crop rotations followed are determined to some extent by the need to provide winter roots and summer seeds for the sheep. Flocks tend to be large and full-time shepherds are found on many farms.

The general practice is to run a fattening flock in conjunction with breeding sheep. The latter flock is run on seeds during the summer and folded on roots in winter. The fattening flock is generally kept in winter only and folded on a sequence of root crops Home bred stores are supplemented by bought in sheep in order to fit the density of stocking to the carrying capacity of the land.

The fattening period can generally be divided into two parts. In the first, from October to say mid January, the hoggs are folded on roots, foraging for themselves. Where a breeding flock is kept, the general practice is for the ewes to follow after the hoggs and clean up behind them. In the second period, from say mid January to April, the breeding and fattening flocks part company. Early in the year, the hoggs lose their first teeth and can no longer forage satisfactorily, consequently roots are generally cut for them.

Where breeding and fattening sheep were foraging on roots, one full-time shepherd generally looked after both groups. The individual records suggest that a full-time man was employed where the total number of breeding and fattening sheep exceeded 200 and that such a man would appear capable of dealing with flocks of up to say 700 sheep. With the large flocks the shepherd would often have a tractor and trailer for moving folds.

Root cutting reduced the size of flock which one full-time shepherd could manage, but there was still considerable variation in the

Table XXI.

ESTIMATED MANUAL LABOUR REQUIREMENTS FOR WINTER FATTENED HOGGS FOLDED ON ROOTS. (1)
Flocks of 100-300 sheep.

	Man Hours
Folded on Roots—not cutting:	
Labour requirements per flock per week (2) ...	30
Folded on Roots—cutting:	
Labour requirements per flock per week—	
Flocks up to 200 sheep	50
Flocks 200 sheep and over	75

(1) All figures assume shepherd works a fifty-hour week including some time on Sundays.
(2) Assuming a fattening flock is run with a breeding flock sharing a full-time shepherd, whose time is split between the two on a basis of the ratio of three hoggs to two ewes. This ratio was the most common proportion found in the sample.

numbers handled per man on different farms. The information available suggests that one full-time man could move folds and cut for up to 200 sheep using a power driven cutter. With flocks of about 200 to 350 sheep an extra man working part-time would appear to be necessary.

Table XXI gives some suggested standard labour requirements on a weekly basis. No allowances are made for work other than that involved in routine shepherding, an operation which accounted for almost all the labour time spent with the sample flocks. No attempt is made to give a standard labour requirement figure for the fattening period as a whole. The amount of work necessary is partly determined by factors peculiar to a given farm, for example the length of time during which roots are cut. The figures in Table XXI, however, should be of some use in budgeting for given situations.

Laying Hens(1)

The majority of laying flocks costed were run as supplementary enterprises on general farms. The main emphasis of the poultry unit was on egg production with the sale of cull birds as the only other major source of income. Most of these flocks were between 300-400 layers in size; too small for the employment of a full-time specialist poultry man. They were looked after on a part-time basis either by the farmer or a member of his family or by a general farm worker.

A wide variety of management systems were recorded, six of which are singled out for discussion here—ordinary batteries, cafeteria batteries, deep litter houses, straw yards, free range houses and fold units. Table XXII gives average annual labour requirements for each of the six systems.

Table XXII.

SIX SYSTEMS OF POULTRY KEEPING.

Average Annual Labour Requirements per 100 Layers

Flocks of 300-400 Laying Hens.

System	Man Hours per Year per 100 Layers
Ordinary Batteries	318
Free Range	302
Cafeteria Batteries	268
Fold Units	267
Deep Litter Houses	195
Straw Yards	167

(1) This section is based on some unpublished work of D. H. Lloyd's on labour requirements for poultry production.

Table XXIII.

ESTIMATED LABOUR REQUIREMENTS PER 100 LAYERS. (1)

Flocks of 300-400 Layers.

System	Routine Daily Jobs Mins. per day	Routine Weekly Jobs Hrs. per week	Other Work Hours per year
Ordinary Batteries ...	35	1¾	18
Free Range	30	1¾	17
Cafeteria Batteries ...	30	1¼	18
Fold Units (2) ...	30	1½	15
Deep Litter Houses	15	1½	20
Straw Yards ...	15	1¼	20

Straw yards and deep litter houses have obvious advantages from the aspect of labour economy. Ordinary hen batteries on the other hand need a lot of attention. The amount of work can be cut by installing a " cafeteria " with mobile receptacles for food and water, but judging by the figures given in Table XXII the saving in labour is not very spectacular.

Table XXII refers to flocks of 300-400 layers. It is not possible to give labour requirement figures for flocks of other sizes. Economies of scale, however, are known to exist and the figures relating to smaller flocks would probably be higher than those given above, while the converse would be true for larger flocks.

The annual labour requirements of Table XXII have been subjected to more detailed subdivision in Table XXIII. Labour with the laying flocks has been divided into three categories, that necessary for jobs which are done daily, for jobs done weekly and finally for jobs which are carried out at infrequent intervals. Under the first category come feeding, providing water and collecting eggs. The second includes cleaning and packing eggs, attention to litter and cleaning out. The final category covers jobs such as the annual spring cleaning of batteries, hen houses and the like, the initial installation of the birds in batteries, deep litter houses and straw yards, and the culling of unsatisfactory layers.

(1) These figures have been rounded, consequently if totalled on a yearly basis they do not correspond exactly with those given in Table XXII.
(2) Assuming the fold units are moved daily.

CHAPTER III.

MANUAL LABOUR REQUIREMENTS FOR OTHER WORK.

In the two previous chapters, manual labour requirements for the individual crops and classes of stock have been discussed. Where total labour input per farm is concerned, the use of unit requirement figures is subject to a severe limitation. They tend to understate the amount of work necessary (1). This weakness of unit labour requirement figures arises from the great difficulty of apportioning all manual work on a farm to a specific branch of farm production.

In discussing labour requirements from the aspect of the farm as a whole, the first problem is the definition of total labour input. Should the term be confined to actual hours of manual work or be extended to include work of a non-manual nature and some allowance for the loss of potential working time through sickness, holidays and other causes ? The type of definition adopted depends perhaps on the context of a particular situation. If the main interest is with purely physical inputs of labour time, the first and less complex type of definition has much in its favour. The use of the second type, however, offers certain advantages where the emphasis is on the economic cost of labour.

Another set of problems arises when the division of total labour input per farm among the various enterprises is attempted. Broadly speaking two main alternatives can be adopted. Either the objective is to allocate all the labour to specific enterprises or to concentrate on classifying residual labour under a separate heading. While it is probably impossible to achieve the first objective, a certain degree of success can be attained, leaving only a very small fraction of labour input in a residual class. The second approach raises problems of definition. A decision has to be made as regards what classes of work are of a residual nature and what are directly attributable to specific enterprises. Such a decision is essentially of rather an arbitrary nature and subject to controversy (2).

It will be realised, therefore, that the total labour input and its subdivision among the different farm enterprises is a subject of diverse interpretation. The emphasis in this bulletin is on actual physical inputs of labour time rather than the assessment of the real costs of labour. Hence total labour is defined as the amount of

(1) This is a widely recognised feature. In enterprise costs some provision is made for possible omissions by the use of a standard charge for share of general farm overheads. Where unit labour requirement figures based on such studies are concerned, the usual practice in farm management work is to increase the total obtained by a given percentage in order to allow for omissions. All these charges are of a somewhat arbitrary nature.

(2) A rather extreme example of this is the scope for distinguishing between work necessary for the running of an enterprise and the work actually put in. Where excessive labour is recorded some of this may well represent work of a less essential nature, undertaken for the sole reason that the farm staff had nothing else to do at the time.

manual work actually put in on a farm; no allowance is made for the loss of potential working time or for work of a non-manual nature.

The subdivision of total labour input is made here on a job analysis basis. All the work recorded in the performance of a specific task is classified under one of three headings—crops, stock and other work. The choice of the specific tasks to be charged under a particular heading has been governed—with one exception, carting and spreading farm yard manure—by the procedure adopted in Leeds enterprise cost studies. The two previous chapters give details of the types of jobs allocated to crop and livestock production. This chapter is concerned with those jobs classified as other work and the labour they require; topics which have eluded discussion until now.

This chapter is based on 49 Farm Diary records which cover total manual labour use on certain Yorkshire farms. In the subsequent analysis of these records, labour time has been apportioned to crop and livestock enterprises according to the same definitions adopted in Chapters I and II, leaving a residual item averaging 17½% of the total to be classified under the heading of other work.

Jobs grouped under this heading include the carting and spreading of farm yard manure (1). The manual work charged to this particular task consisted of the labour time spent on transporting manure from yards and storage heaps and its subsequent distribution over the land. The work involved in the routine cleaning out of stock is charged to the relevant animals with the exception of the annual clearance of open and covered yards which is charged direct to the manure.

Next comes a heterogeneous collection of jobs which have been grouped for convenience under the general heading of repairs and maintenance. This covers the labour time spent on maintenance work on buildings, roads, fences and field drains, and the servicing of machinery by the farm staff. General running repairs to farm buildings are included, but not work which can be defined as improvements or additions. Work on hedges is not included and the time spent on drains is confined to the maintenance of their flow by the removal of blockages and the renewal of broken pipes and does not include ditching.

The next category, hedging and ditching, is easy to define. It includes all work on the upkeep of hedges and the cleaning out and grading of ditch bottoms. Work on field drains is not included.

Capital improvement works cover the labour of the farm staff on improvements and additions to the fixed equipment and amenities of the holding. Work classified under this heading includes the

(1) The inclusion of farm yard manure requires some explanation in view of the widespread practice of charging the labour involved to the crop grown directly after the dung is applied. This practice would seem rather unrealistic since farm yard manure is applied for its effect over the rotation as a whole. It could be argued, especially where animals are not kept primarily for muck production, that some of the labour should be charged to the stock concerned. Consequently the more rational course would appear to be the inclusion of the labour involved in carting and spreading farm yard manure under the heading of other work. See also Page 8.

erection of such new buildings as piggeries and Dutch barns, the construction of farm roads, the installation of piped water supplies to fields and buildings and the tile drainage of land.

The term field overheads has been used to cover such work as stone picking and the removal of the growth on field sides and headlands. The final category miscellaneous labour includes jobs which so far have eluded classification—for instance unloading fertilisers from merchants' lorries and tidying up stack yards. Also included is unspecified labour—an hour spent on general odd work is a common entry on the daily labour record sheets kept by the farmers who co-operated in the Diary investigation.

Table XXIV.

MANUAL LABOUR CLASSIFIED UNDER THE HEADING, "OTHER WORK."

(a) **As a Percentage of Total Labour Input per Year.**

Other Work as a percentage of total annual labour input	Number of Records
Under 10%	2
10.0%–14.9%	13
15.0%–19.9%	18
20.0%–24.9%	13
25% and over	3
	49
Average 49 Records	17.5%

(b) **Other Work. Man hours per 100 acres per Year.**

Other Work—Man Hours per 100 Acres	Number of Records
Under 700	5
700–999	11
1,000–1,299	14
1,300–1,599	12
1,600–1,899	5
1,900–2,199	2
	49
Average 49 records (man hours per 100 acres)	1,206
Average Farm Size (acres)	244

Labour spent on the various jobs classified as other work, accounted for on average 17½% of the total labour input on the farm. Table XXIV gives the range of the individual record figures. It will be seen that these are normally distributed, the largest size range class being that in which the group average appears. This latter represents approximately twelve man hours per acre a year.

It may well be argued that the relative magnitude of other work to total labour input is partly determined by size of farm and by the system of farming followed. In the sample studied no evidence was found of the existence of such relationships. It should be stressed, however, that in selecting the Diary farms extremities in both farm sizes and farming systems were avoided. The co-operating farms were of medium size (mostly from 100-350 acres) and were situated in the arable districts of Yorkshire. The systems of farming pursued were essentially mixed. The main differences between farms lay in the relative importance of cash root crops and in the presence or absence of dairy herds.

Table XXV gives details of the subdivision of labour input on other work among the main categories described earlier. The average figures for the sample as a whole are given in Part (a) of the table. Of the individual jobs, carting and spreading farm yard manure, repair and maintenance of farm buildings and equipment, and hedging and ditching were the most important and accounted for over 60% of the total.

The ranges of the individual record figures for the various constituent items are given in Part (b) of Table XXV. The variation in times taken for these jobs is somewhat irregular. One point of interest, however, deserves comment. Those records where much higher than average figures were returned for particular jobs, tended to show lower than average figures for some of the other tasks listed in the table. All this suggests a rather narrow element of flexibility in the total time available for other work, a surmise which is supported by the 1951 and 1952 records for identical farms. The total labour input on other work on a given farm was very similar in both years but the distribution of work between the various jobs differed, on some farms the variation was considerable.

A very brief account of some of the jobs classified as other work has been given already. Two further points which were omitted previously in the interests of brevity, are perhaps worth mentioning at this stage. These refer to the carting and spreading of farm yard manure and to capital improvement works.

The amount of time spent carting and spreading manure depends on the quantity made, the distance it has to be carted and the methods of handling adopted. Consequently, there is room for considerable farm to farm variation in the labour time involved. In the sample, the annual time spent averaged three hours an acre over the whole farm acreage. It is difficult to assess from this figure how much land actually received farm yard manure. A very rough estimate

Table XXV.

"OTHER WORK"

MAN HOURS PER 100 ACRES PER YEAR.

(a) **Breakdown of Group Average into the Main Constituent Items**

	Total	Carting and Spreading F'm Y'd Manure	Repairs and Maintenance	Hedging and Ditching	Capital Improvement Work	Field Overheads	Miscellaneous
Average per Farm man hours per 100 acres ...	1206	299	257	208	157	61	224
Percentage Breakdown	100	25	21	17	13	5	19

(b) **Range of the Individual Record Figures for the Main Constituent Items.**

Man Hours per 100 Acres	Carting and Spreading Farm Yard Manure	Repairs and Maintenance	Hedging and Ditching	Capital Improvement Work	Field Overheads	Miscellaneous
	Number of Records					
None	—	—	—	7	4	—
1-99	1	7	10	21	34	12
100-199	13	17	18	7	11	17
200-299	9	11	10	2	—	11
300-399	16	4	6	5	—	5
400-499	6	6	2	3	—	—
500 and over	4	4	3	4	—	4
	49	49	49	49	49	49

based on Table II, Page 8, would suggest somewhere in the region of one-fifth of the total acreage of crops and grass (1). In this connection it is of interest to note that 27 Vale of York farmers co-operating in the 1954/55 Cattle Costs reckoned to muck on average about one-sixth of their total acreage annually. These figures may seem high, but the farmers supplying records came from the arable districts of Yorkshire where a considerable degree of reliance is still placed on the muck cart in the maintenance of soil fertility.

As might be expected, a wide variation was shown from farm to farm in the amount of labour time spent on capital improvement

(1) Based on hand loading and carting and a dressing of muck of about 11-12 tons an acre.

works. Seven records contain no reference to work of this kind while at the other extreme four show an annual labour input of over 500 hours per 100 acres. Whether a farmer was an owner-occupier or a tenant bore little relationship to the amount of time spent on such work or for that matter on general repairs and maintenance. The Agricultural Holdings Acts on the one hand, have increased the opportunities for tenants to carry out improvements to their farm, while on the other, have tended to diminish the incentives for landlords to undertake such responsibilities.

Compared with work on crops and stock there is much more flexibility in the precise time of the year at which the jobs associated with other work have to be undertaken. The general tendency is to squeeze in such work when there is nothing more important to be done. Consequently these jobs play a useful part in filling in the troughs of the seasonal demand curve for labour required by the crop and livestock enterprises of a farm. For this reason no mention is made of the seasonal distribution of other work in this chapter, instead the subject is discussed in the context of the pattern of labour use on the farm as a whole—the subject of the next chapter of this bulletin.

CHAPTER IV.

THE PATTERN OF MANUAL LABOUR, TRACTOR AND HORSE USE ON TWO TYPE OF FARMING GROUPS.

The emphasis so far has been on unit labour requirements for the different farm enterprises. The discussion now turns to the subject of labour use on the farm as a whole and an attempt is made to illustrate how the segmented labour requirement figures fit into the pattern of labour employment on certain Yorkshire farms in 1951/52. The material used for this section comes from the Farm Diary investigation and is based on the records suppled by eleven farms. These farms are divided into two type of farming groups and all figures are given in terms of group averages for the average year 1951/52.

The chapter begins with a short description of the farms and is followed by a discussion of their pattern of manual labour, tractor and horse use respectively.

Vale of York, Arable Farms (Seven Farms)

Table XXVI gives the group averages for cropping and stocking. The greater part of the farm acreages were under arable cultivation. Potatoes and sugar beet were the most important crops from the aspect of farm output, although the acreage under corn exceeded that under cash roots. Much of the corn was retained for feed. Fodder roots were grown on quite a large scale primarily for feeding to cattle but also to a lesser extent for winter feeding to sheep. The remainder of the arable acreage was mainly accounted for by temporary grass.

The farms were generally well stocked; beef cattle being the most important class of livestock. The general policy was to supplement home bred calves with bought-in suckers and stores and run the beasts until fat. The winter yarding of cattle was a common practice—the muck cart being held more or less essential in keeping land in good enough heart for potatoes and sugar beet. Sheep were of much less importance than cattle and consisted of either small breeding flocks or hogg flocks for winter fattening. Since the end of the war, pig numbers had increased markedly: a growth which was given extra impetus by the abolition of the rationing of feedingstuffs.

The farms were well mechanised, tractors providing the main source of motive power. Large specialised harvesting machinery was found on several of the farms and a considerable proportion of the corn acreage was combined. Besides combines, other such machines included pick-up balers and sugar beet harvesters.

Table XXVI.

VALE OF YORK—
ARABLE TYPE OF FARMING GROUP
(Group Average based on seven farms).
Cropping and Stocking per 100 Acres. Average, 1951/1952.

Cropping	Acres	Stocking	Number
Wheat	10¼	Cows and Bulls ...	3
Barley	14¾	Other Cattle	30
Peas for Threshing ...	—	Ewes and Rams ...	15
Oats and Mixed Corn	13¼	Other Weaned Sheep	23
Other Corn	1¼	Sows, Gilts and Boars	4
Total Corn ...	39½	Other Weaned Pigs ...	25
		Poultry	200
Potatoes	9	Horses	1
Sugar Beet	6		
Total Cash Roots ...	15		
Mangolds	2		
Swedes and Turnips...	1¾		
Kale and Other Fodder Roots ...	1¾		
Total Fodder Roots	5½		
Seeds Cut	10¾		
Seeds Grazed ...	8¼		Acres
Other Crops	2¾		
Fallow	¼	Average size of Farm	245
Total Arable ...	82		
Meadow	1¾		
Pasture	16¼		
Total Permanent Grass	18		
Total	100		

Financial accounts are available for these farms and show that in 1951/52 labour costs were on average the largest single item of farm expenditure. Financial results are of course influenced by other factors besides farming system followed, but there is little doubt that in 1951/52 the Vale of York system was exceedingly profitable.

Holderness, Mixed with Milk Farms (Four Farms)

The soils of the Holderness plain are heavier than those of the cash root growing areas of the Vale of York; a factor which does much to explain the differences found in the farming of the two districts. The type of farming exemplified in the farms analysed

Table XXVII.

HOLDERNESS — MIXED WITH MILK TYPE OF FARMING GROUP.

(Group Average based on four farms.)

Cropping and Stocking per 100 Acres. Average, 1951/1952.

Cropping	Acres	Stocking	Number
Wheat	16	Cows and Bulls ...	15
Barley	9	Other Cattle	14
Peas for Threshing ...	3½	Ewes and Rams ...	3
Oats and Mixed Corn	14	Other Weaned Sheep	1
Other Corn	4	Sows, Gilts and Boars	2
		Other Weaned Pigs ...	11
Total Corn ...	46½	Poultry	129
		Horses	1
Potatoes	—		
Sugar Beet	½		
Total Cash Roots...	½		
Mangolds	1		
Swedes and Turnips...	1		
Kale and other Fodder Roots	1		
Total Fodder Roots	3		
Seeds Cut	10¾		
Seeds Grazed ...	1		
Other Crops	—		
Fallow	4		
Total Arable ...	65¾		Acres
Meadow	6¾	Average size of Farm	193
Pasture	27½		
Total Permanent Grass	34¼		
Total	100		

here is based on a combination of milk and corn. Sales of dairy produce contributed the major portion of farm income, and corn crops occupied a large extent of the farm acreage.

Table XXVII gives average cropping and stocking figures. Corn was the most important crop. The acreage of cash roots grown was negligible and that of fodder roots modest. Farmers relied to a certain extent on fallows for cleaning. The acreage of temporary grass was considerably less than on the Vale of York group and a higher proportion of the farms were given over to permanent grass. Dairy cattle were the main class of stock kept. The heading " Other Cattle " in Table XXVII covers mainly replacements for the dairy herd. Beef production was not undertaken except for a few sales of fat cows. Only one farm kept sheep, while in comparison with the other group, pigs and poultry numbers were relatively low. The farms were not so well equipped with machinery as those of the Vale of York; a difference which was especially marked with regard to corn harvesting machinery such as combines and pick-up balers.

Financial accounts, which are available for only three of the farms, suggest that the group as a whole did not secure such favourable results as those obtained by the other group. Little difference, however, was shown in the average labour costs per 100 acres for the two groups.

THE PATTERN OF MANUAL LABOUR USE.

Daily records of manual labour use kept by eleven farmers over the 1951 and 1952 calendar years, provide the basic material for this section, which begins with a short description of the labour force employed followed by an account of the seasonal distribution of work among crops, stock and other work. The definitions of these three categories are identical with those adopted in the previous chapters. Seasonal peaks of labour demand are then examined and the methods in which the co-operating farmers coped with them described.

The Labour Force

The labour force was taken to include only persons undertaking manual work. People engaged solely in managerial and clerical duties are excluded. Regular full time workers comprised the most important class of manual workers and were taken to cover both hired hands and farmers' relations who put in the equivalent of a full working week. Part-time regular workers were mainly confined to the farmers and their families. Ten out of the eleven farmers are included in the latter category. The remaining farmer did not undertake any manual work. On some holdings the farmer's wife or daughter did such part-time work as feeding poultry or helping in the dairy. The time involved was not very great, usually two to three hours daily. On all the farms the regular staff was reinforced by the employment of casual workers at times of peak seasonal demand. The services of agricultural contractors were extensively utilised especially for ploughing, crop spraying, threshing and baling.

Table XXVIII.

TWO TYPE OF FARMING GROUPS.

The Labour Force.

Per 100 Acres. Average, 1951/1952.

	Vale of York Arable	Holderness Mixed with Milk
Total number of hours worked annually by all regular workers (1)	6,757	6,783
Total number of hours worked annually by all casual workers ...	944	604
Total Labour Input per Year (hrs.)	7,701	7,387
Number of regular **full-time** manual workers per 100 acres (2) ...	2.3	2.2

Table XXVIII gives details of the labour force and the total annual labour input measured in terms of the number of man hours worked. The annual labour input figures cover all the different classes of labour employed, apart from labour supplied by agricultural contractors for which detailed information was not available. The term man hours includes female and child labour. These latter classes are not expressed as man equivalents, but given equal weight as regards input per hour with the labour of adult males on the assumption that for the work for which they were employed—mainly potato picking—they would be as effective as adult men.

The Division of Labour among Crops, Stock and Other Work

The division of total annual labour input among crops, stock and other work is given in Table XXIX. On the Vale of York farms crops absorbed just over half the total labour input while the care of stock accounted for a little less than one-third. The positions of crops and stock were almost reversed in the Holderness group. It will be noted that the percentages of total labour input classified as other work differs slightly from the figure of $17\frac{1}{2}\%$ given on Page 53.

The annual figures of Table XXIX were subdivided into thirteen four-week periods and the subsequent seasonal distributions for the two groups are shown in Histograms I1 and I2.

(1) Full and part-time, includes manual work of the farmers.
(2) Full-time workers only; does not include any farmers.

Table XXIX.

TWO TYPE OF FARMING GROUPS.

The Division of Total Annual Labour Input on Crops, Stock and Other Work

Man Hours per 100 Acres. Average, 1951/1952.

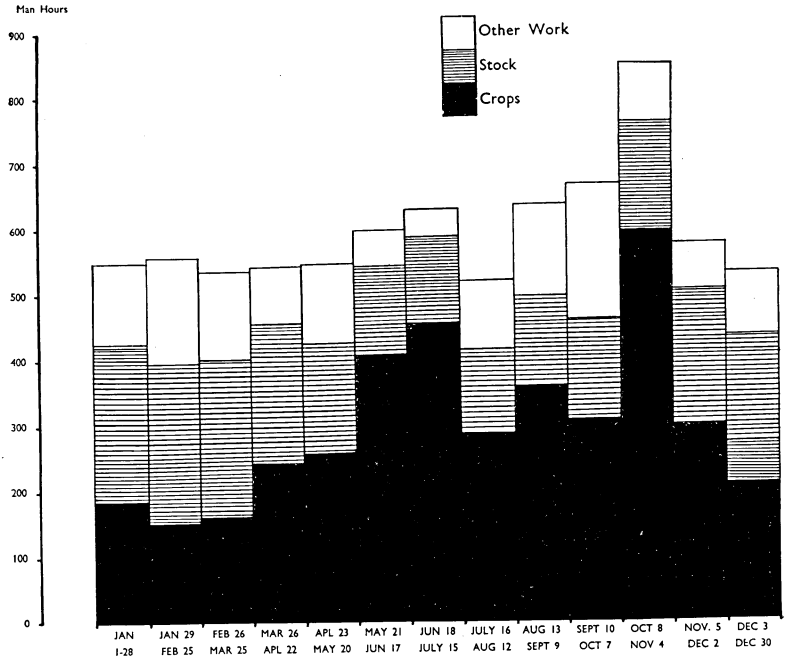
	Vale of York Arable		Holderness Mixed with Milk	
	Hours Worked per Year	Per-centage	Hours Worked per Year	Per-centage
Crops	3,890	51	2,412	33
Stock	2,397	31	3,410	46
Other Work	1,414	18	1,565	21
Total Labour Input	7,701	100	7,387	100

Histogram I(1).

VALE OF YORK—ARABLE GROUP.

Seasonal Distribution of Total Manual Labour on Crops, Stock and Other Work.

Man hours per 100 acres.

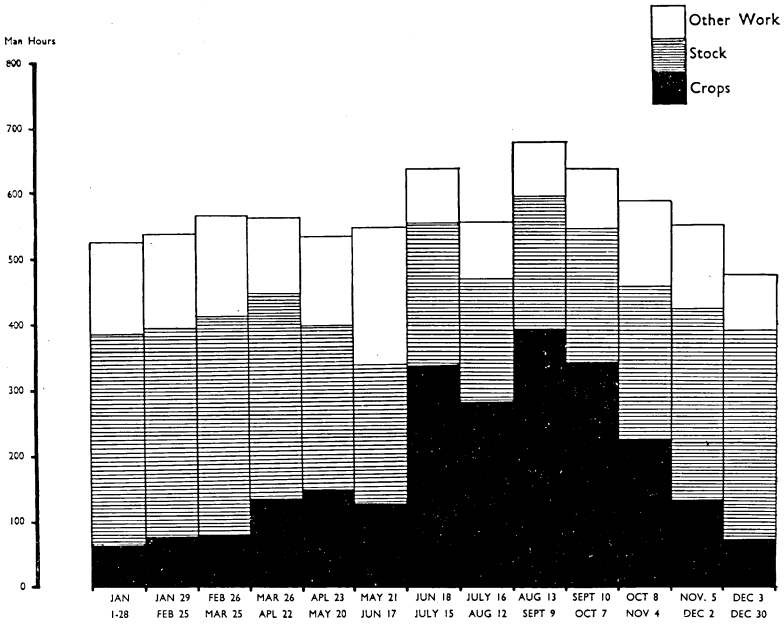


Histogram I(2).

HOLDERNESS — MIXED WITH MILK GROUP.

Seasonal Distribution of Total Manual Labour on Crops, Stock and Other Work.

Man hours per 100 acres.



Works on crops shows a very marked seasonal variation; the effects of which are offset to some extent by compensatory movements in the demands for labour by stock and other work. All this emphasises the advantage enjoyed by mixed farming systems in that crop and livestock enterprises can complement one another in their seasonal demands for labour.

The Seasonal Distribution of Labour on Crops

Total labour input on crops is subdivided here under four headings—corn, cash roots, fodder roots and all other crops. Details of the percentage of total farm acreage occupied by these classes of crops are given in Tables XXVI and XXVII on Pages 58 and 59 respectively.

Table XXXA shows the subdivision of total annual labour among the four main classes of crops, while Table XXX.B gives particulars of the amount of labour absorbed per acre by the different classes. A point which is strongly brought out is the labour-exacting nature of root crops. In the Vale of York group where roots accounted for one-fifth of the farm area, 62% of the total labour on crops went

Table XXX.

TWO TYPE OF FARMING GROUPS.

Labour on Crops.

(a) **Total Labour Input per 100 Acres of Farm Area.**

Average, 1951/1952. Man Hours.

	Vale of York Arable		Holderness Mixed with Milk	
	Hours per Year	Per-centage	Hours per Year	Per-centage
Corn	993	26	1,443	60
Cash Roots	1,946	50	63	3
Fodder Roots ...	473	12	360	15
All other Crops and Grass	478	12	546	22
Total	3,890	100	2,412	100

(b) **Annual Labour Input per Acre of the Different Classes of Crops Grown.**

	Vale of York Arable	Holderness Mixed with Milk
Corn	25	31
Cash Roots	130	—
Fodder Crops ...	86	120
All Other Crops ...	12	11

into their cultivation. In the Holderness group the small root break of 3½% of the farm acreage absorbed 18% of the total labour input on crops.

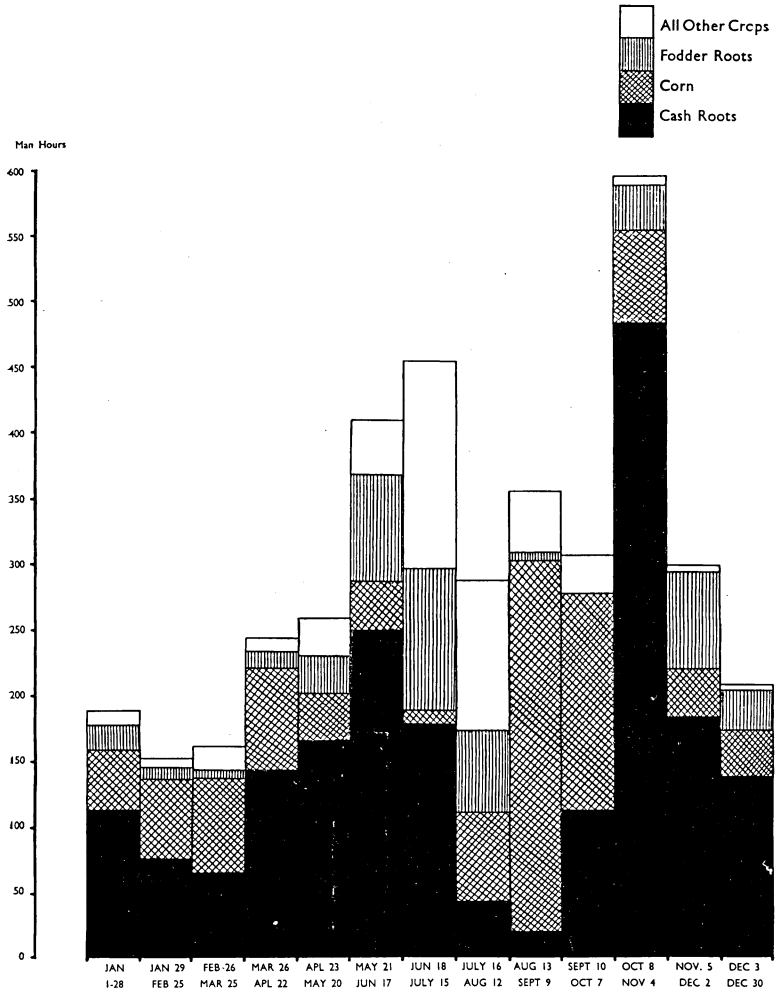
In Table XXXB the figures for annual labour input refer to time spent on crops in a calendar year. They are not synonymous with the labour required by the 1951 and 1952 harvest year crops, which may well have included manual work done in the 1950 and 1953 calendar years. The group averages also cover a variety of production methods. For these reasons they are not directly comparable with the average unit labour requirements given in Chapter I. of this bulletin.

Histogram J(1).

VALE OF YORK — ARABLE GROUP.

Seasonal Distribution of Labour on Crops.

Man hours per 100 acres.



Histograms J1 and J2 show the seasonal distribution of labour on crops for the Vale of York and Holderness groups respectively. In both, labour input per month varies considerably and marked seasonal peaks are shown. On the Vale of York farms these are mainly associated with the seasonal demands of cash and fodder root crops. In the Holderness group, peaks coincide with the hay and corn harvests.

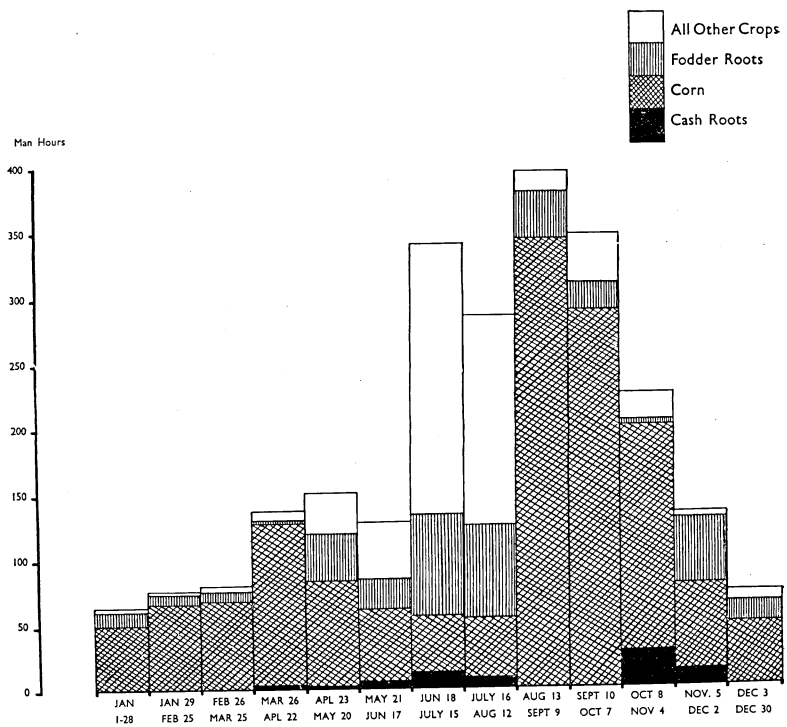
Histogram J1 illustrates the importance of cash root crops in the pattern of labour use on the Vale of York farms. Work on these crops is done at all times of the year but the peak comes at harvest, especially during October when most of the potato crops were lifted. Lesser peaks are shown in early summer for singling and hand hoeing. On the sample farms potatoes were picked by hand but some of the sugar beet was harvested mechanically. The seasonal labour demands of fodder roots show a similar series of peaks for singling, hoeing and harvesting. It should be mentioned that a considerable proportion of the latter crops were not lifted but eaten off in the field and the labour involved charged to the stock, not to the crop. The peak in June, July for labour input on other crops is mainly accounted for by hay making. It will be noted that mid-July to mid-August was a relatively slack time for crop work. Hay making and root hoeing were almost completed and the corn harvest had not yet begun in earnest.

Histogram J(2).

HOLDERNESS — MIXED WITH MILK GROUP.

Seasonal Distribution of Labour on Crops.

Man hours per 100 acres.



A rather different seasonal pattern is shown in Histogram J2. Corn growing was the main crop enterprise on the Holderness farms and its importance is reflected in the diagram. The highest peak of labour input on crops came at corn harvest. Most of the corn was cut by binder. One farmer bought a combine for the 1952 harvest and another had some of his crop combined by a contractor. Hay making gave rise to the work peaks in June and July and in addition part of the crop was baled on contract. The root acreage absorbed a far greater proportion of labour input than of farm area but was not large enough to have such an important effect on labour use as on the Vale of York farms.

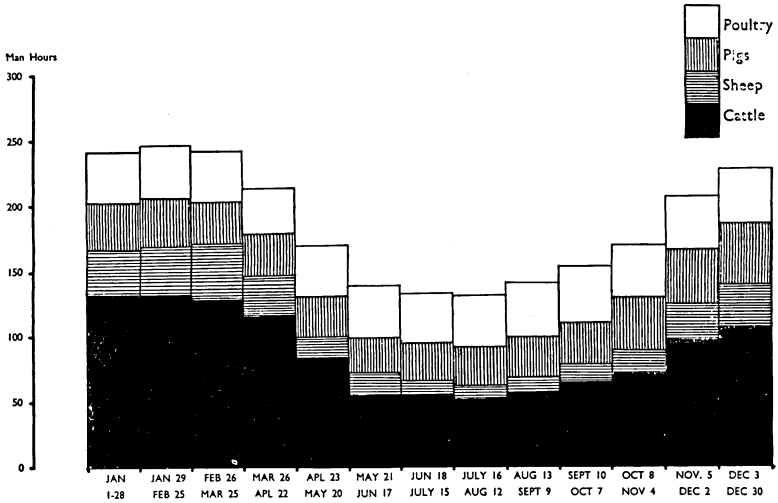
The Seasonal Distribution of Labour on Livestock

Table XXXI gives total annual labour input figures for stock work subdivided into four classes—cattle, sheep, pigs and poultry. No labour is included for horses. All the farms kept work horses but the amount of labour they required was very small. When not in use they were generally at grass and the time spent fetching and harnessing them was charged to the job on hand. Figures for stocking per 100 acres are given in Tables XXVI and XXVII, Pages 58 and 59.

Histogram K1 shows the seasonal distribution of labour on stock for the Vale of York group. The importance of cattle is emphasised. It may be remembered that these farms were concerned with rearing and finishing beef cattle, most of the beasts

Histogram K(1).

VALE OF YORK — ARABLE GROUP.
Seasonal Distribution of Labour on Livestock.
Man hours per 100 acres.



Histogram K(2).

HOLDERNESS — MIXED WITH MILK GROUP.

Seasonal Distribution of Labour on Livestock.

Man hours per 100 acres. (1)

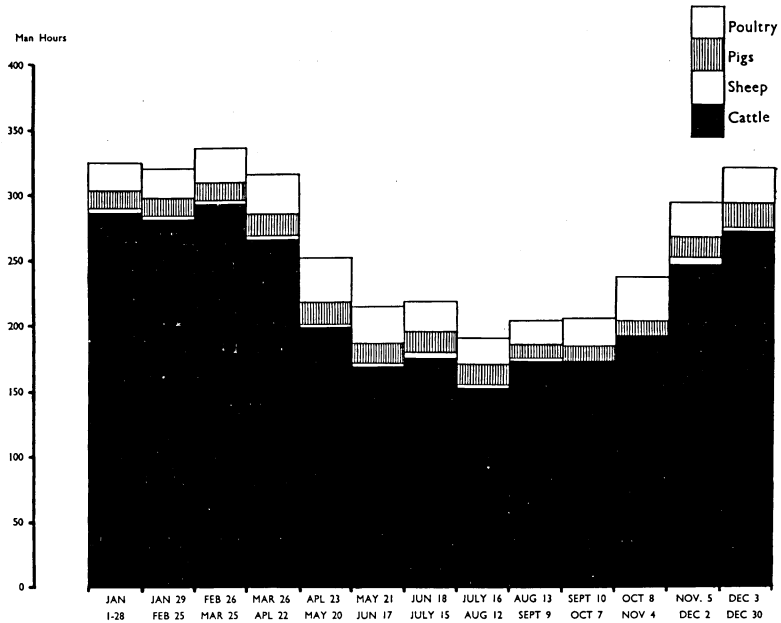


Table XXXI.

TWO TYPE OF FARMING GROUPS.

Labour on Livestock.

Man Hours per 100 Acres. Average, 1951/1952.

	Vale of York Arable		Holderness Mixed with Milk	
	Hours per Year	Per-centage	Hours per Year	Per-centage
Cattle	1,140	48	2,857	84
Sheep	298	12	33	1
Pigs	440	18	185	5
Poultry	519	22	335	10
Total Livestock ...	2,397	100	3,410	100

(1) Owing to the small amount of time spent on sheep, the relevant part of the histogram is left unshaded. The comparatively large white sections at the top of Histogram K2 refer to poultry, the smaller white bands to sheep.

being inwintered. Consequently labour requirements are considerably higher in winter than in summer; a feature which is common to the sheep enterprises of the group, where breeding ewes and winter fattening hoggs were kept. In contrast the labour demands of pigs and poultry were relatively steady from month to month.

On the Holderness farms, dairy cows tended to dominate the scene. Manual work with cattle was naturally the main item and this was greater in winter than in summer (1). Little seasonal variation was recorded in the labour requirements for pigs and poultry. Sheep were kept only on one farm so the group averages relating to them are very low—see Histogram K2.

The Seasonal Distribution of Labour on Other Work

The definition of other work adopted here is the same as that used in Chapter III. but in the present section the number of subheadings has been reduced to four—carting and spreading farm yard manure, repairs and maintenance, hedging and ditching and miscellaneous work. Capital improvement work and field overheads have been amalgamated with miscellaneous work, with the result that the latter is the largest single category.

The heading carting and spreading of farm yard manure covers the labour time spent hauling manure and spreading it on the land. The annual clearance of yards is included but not the routine

Table XXXII.

TWO TYPE OF FARMING GROUPS.

Labour on Other Work.

Man Hours per 100 Acres. Average, 1951/1952.

	Vale of York Arable		Holderness Mixed with Milk	
	Hours per Year	Per-centage	Hours per Year	Per-centage
Carting and Spreading Manure	337	24	329	21
Repairs and Maintenance	278	20	206	13
Hedging and Ditching	164	11	347	22
Miscellaneous Work	635	45	683	44
Total	1,414	100	1,565	100

(1) In most instances it was impossible to subdivide further the labour on cattle. With the Holderness group, however, there is very little doubt that most of the labour on cattle can be attributed to dairy cows.

cleaning out of cowsheds, loose boxes, pig sties and other buildings. Repairs and maintenance refer to work spent on the general upkeep of the existing farm equipment such as buildings and machinery. The term hedging and ditching is more or less self explanatory.

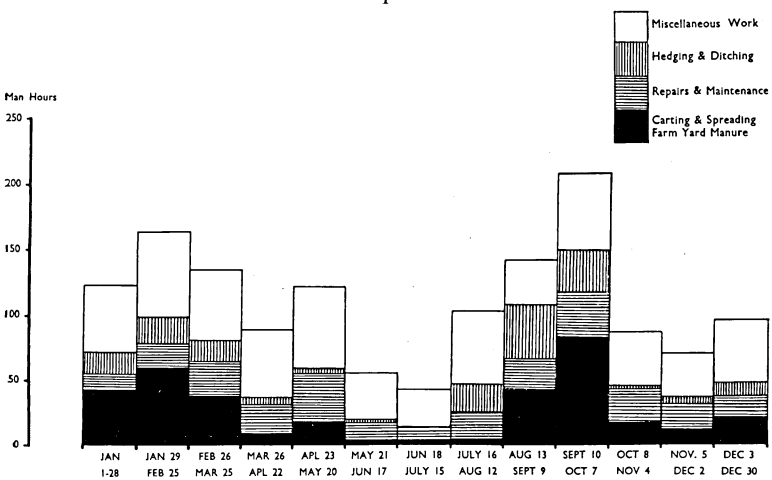
Histogram L1 shows two seasonal peaks for the Vale of York group; the late winter, and late summer-early autumn. The first comes at a period when work on crops and stock is slack. The second would appear to occur at one of the busy seasons of the year. It results, however, from filling in time between hay, corn and potato harvest. Two jobs done extensively then were leading and spreading manure and the summer trimming of hedges. The position on the Holderness farms is illustrated in Histogram L2.

Histogram L(1).

VALE OF YORK — ARABLE GROUP.

Seasonal Distribution of Labour on Other Work.

Man hours per 100 acres.



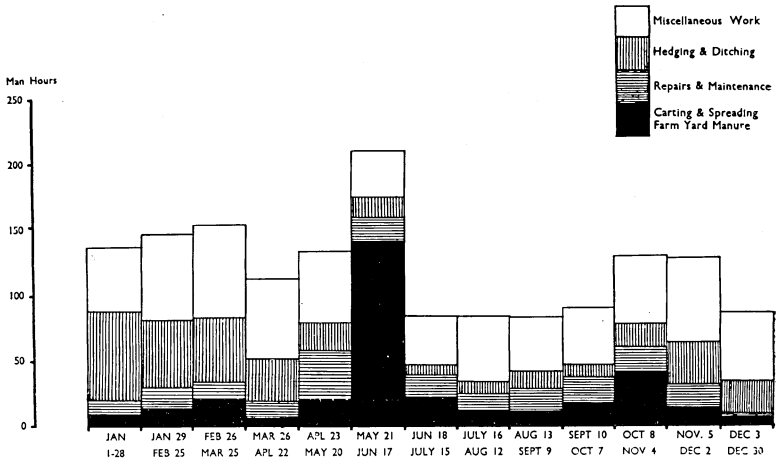
The seasonal distribution of work on farm yard manure in these groups is interesting. In the Vale of York group the great bulk of manure was produced by cattle inwintered in yards. By the time the yards were empty, usually about mid-May, root singling had started. Most of the carting of manure from yards to field storage heaps was postponed until a slacker time of the year. Consequently the late summer-early autumn peak of work on manure represents not only spreading muck preparatory to autumn ploughing, but includes a considerable amount of labour time leading muck from the yards. The situation on the Holderness farms was different. Mid-May to mid-June was a slack time as regards field work so the bulk of the manure produced by inwintered stock was led during that period.

Histogram L(2).

HOLDERNESS — MIXED WITH MILK GROUP.

Seasonal Distribution of Labour on Other Work.

Man Hours per 100 Acres.



The Supply of Labour at Periods of Peak Demand

The matching of the seasonal demand for labour with supply calls for managerial skill and the ability to cope with human relationships. On the farms studied, the amount of labour supplied by the regular staff was varied without changes in the numbers of workers employed, by such devices as overtime working, the arrangement of holidays at slack times of the year, performing contract work for neighbours and, a common practice in winter months, lending men out to other farmers for threshing. Where a regular man left, he was often not replaced until a busy season of the year. The existence of dependable sources of casual labour also increased farmers' opportunities for manoeuvre. Agricultural contractors were relied on to a considerable extent and their services called in to reduce the volume of pressing work.

Table XXXIII gives annual totals for regular and casual work. The seasonal distribution of these figures is given in Histograms M1 and M2. Details of both annual and seasonal figures for overtime are shown in Table XXXIII. These relate to 1952 only, data for the earlier year not being available. Other labour figures do not show much variation between the two years, so there is no reason to suppose that those for overtime are an exception. Table XXXIII also gives the number of days lost per regular full-time worker through sickness and holidays.

Table XXXIII.

TWO TYPE OF FARMING GROUPS.

Casual and Overtime Work

Time Lost through Sickness and Holidays

(a) **Annual Totals.**

	Vale of York Arable	Holderness Mixed with Milk
Average, 1951/1952:		
Hours per 100 acres worked by Regular Workers ...	6,757	6,783
Hours per 100 acres worked by Casual Workers ...	944	604
Hours per 100 acres worked by all Workers	7,701	7,387
1952 only:		
Hours per 100 acres worked overtime by regular workers	390	853
Days a year lost through holidays and sickness per regular full-time worker (1)	11	11

(b) **The Seasonal Distribution of Overtime Worked by Full-Time Regular Workers, 1952**

Man Hours per 100 Acres.

	Vale of York Arable	Holderness Mixed with Milk
1st-28th January	20	49
29th January-25th February	23	50
26th February-25th March ...	26	53
26th March-22nd April ...	36	79
23rd April-20th May ...	19	60
21st May-17th June	36	47
18th June-15th July ...	35	96
16th July-12th August ...	33	71
13th August-9th September	70	110
10th September-7th October	21	67
8th October-4th November ...	23	55
5th November-2nd December	21	47
3rd-30th December	27	69
Total	390	853

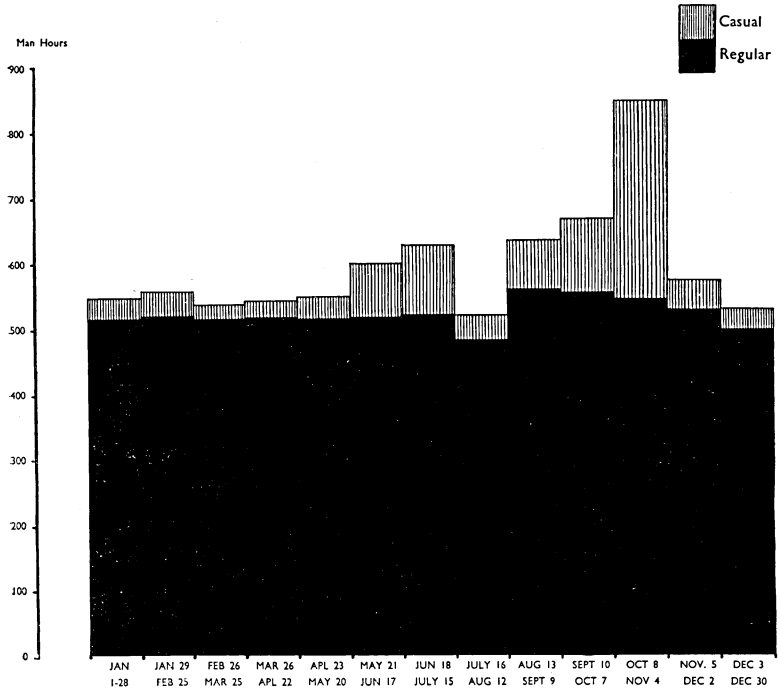
(1) Not including Bank Holidays.

Histogram M(1).

VALE OF YORK — ARABLE GROUP.

Seasonal Distribution of Regular and Casual Labour.

Man hours per 100 acres.



On the Vale of York farms more reliance was placed on casual labour than on overtime working for meeting peak demands. This is true of the potato harvest where the usual practice was to engage a gang of women or school children. (1) It will be noticed that casual labourers were employed at all seasons of the year. The work for which they were engaged in the winter consisted mainly of threshing, and riddling and bagging potatoes, jobs which give rise to localised peaks of labour demand. Broadly speaking the input of regular labour did not vary much from month to month by comparison with the totals involved. Overtime was not particularly important except at corn harvest. Reductions in the input of regular labour at slack times of the year were secured mainly by decreases in the amount of manual work done by the farmers themselves and by arranging the annual holidays at convenient periods. The most popular time for taking holidays was between hay and corn harvest.

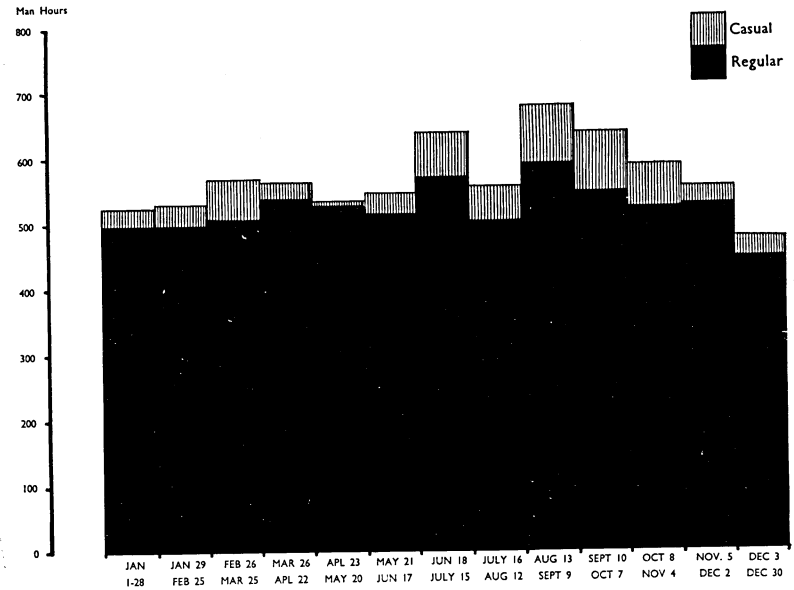
(1) Village schools in the potato growing districts were closed for a fortnight during the potato harvest in both years.

Histogram M(2).

HOLDERNESS — MIXED WITH MILK GROUP.

Seasonal Distribution of Regular and Casual Labour.

Man hours per 100 acres.



Overtime working was an important feature on the Holderness farms, much of the time concerned being spent with the dairy herd, especially at weekends. Seasonal peaks in overtime also occurred, being associated with the hay and corn harvests and to a lesser extent with the spring cultivations. Casual labour was not so important as in the other group. Casual workers, however, were engaged for hay and corn harvesting and hoeing and harvesting fodder roots. Casual labour in the winter months was mainly employed for threshing.

In Table XXXIII the figures for the time lost through sickness and holidays suggest that on the farms concerned the workers were not prone to sickness nor anxious to avail themselves of all the holiday time to which they were entitled (1).

The two groups described here are essentially concerned with mixed farming. One of the main reasons for adopting a system of mixed farming is the possibilities afforded for keeping the farm staff fully occupied over the whole year. By the judicious combination of crop and livestock enterprises, a farmer can employ a regular

(1) At that period, the statutory annual holiday was twelve days besides bank holidays. The figures given in Table XXXIII. do not include bank holidays.

full-time staff of a given size (1). The basic point, however, is not that a man should never be idle but that the work he does should be economically productive. This raises problems of the choice of enterprises and the size of labour force to be employed.

While a varied cropping programme can do much towards evening out the curve of seasonal labour demand in the spring, summer, and autumn months, winter is inevitably a slack period for field work. Consequently a farmer who wishes to provide all-the-year-round employment for a staff adequate for his arable commitments, develops livestock enterprises as a means of utilising his surplus labour in winter. Cattle rearing and feeding and some forms of sheep production offer distinct advantages since, under most systems of management their labour requirements are considerably higher in winter than in summer. Pigs and poultry, on the other hand, have a much more even curve of seasonal labour requirements. Dairy cows are rather a special case. While under normal conditions their labour requirements are higher in winter, the amount of work called for in summer is considerable. Therefore they tend to be competitive with, rather than complementary to crop production as regards labour. A farmer of course can run a livestock enterprise in the winter only, as is the common practice with fattening cattle and sheep. This is not so common with pigs and poultry, and impossible with dairy cows.

Mixed farming systems, however, have their disadvantages. There is always the danger that owing to bad weather, peak labour requirements periods for different crops may coincide. More serious probably, is the effect of too great a diffusion of enterprises on unit labour costs. With a given class of livestock it has been noted that unit labour requirements tend to fall with increasing numbers kept. Consequently a policy of having a few of each class of stock as opposed to specialisation on only one or two types would appear to be less advantageous. With crop production, modern specialised harvesting machinery reduces unit labour costs but its use is only economically justified where a sufficient acreage of the crop concerned is grown.

On predominantly arable farms, the policy of being more or less self-sufficient as regards labour, except for some casual assistance at exceptionally busy periods, has led in the past to the diffusion of enterprises and the underemployment of labour during the winter. Now that labour is becoming both scarce and expensive the choice of enterprises and the problems of the seasonal supply of labour are assuming fresh importance.

It is impossible to give an accurate assessment of the economic efficiency of labour use on the eleven farms studied. The majority returned what most people would regard as a satisfactory rate of profit. This suggests a reasonable level of production costs and some degree of success as regards labour management. Whether profits have been maximised is another matter. Therefore the

(1) With root crops especially, the effects of high yields in accentuating peaks of seasonal labour demand should be borne in mind.

figures given here are not ideals to be attained but rather indicative of conditions on actual farms.

THE PATTERN OF TRACTOR USE.

Details of the tractor position in the two farming groups are given in Table XXXIV. The figures suggest rather a generous level of equipment with tractors. Comparisons of individual farm figures with some averages for different types of farming systems in 1950 suggest that certain farms were somewhat lavishly stocked with tractors ([1]), an impression which is strengthened by the rather low figures given in Table XXXIV for the average number of hours worked annually per tractor.

Table XXXIV.

TWO TYPE OF FARMING GROUPS.

Tractor Numbers, Farm Acreages and Hours Worked per Tractor a year

Average, 1951/1952.

	Vale of York Arable	Holderness Mixed with Milk
Average size of Farm (acres)	245	193
Average Acreage of Arable Land per 100 Acres ...	82	65¾
Average Number of Tractors per 100 Acres	1.3	1.2
Average Hours worked per Tractor annually	826	795

Perhaps the main reason why tractor numbers seem rather high on some of the co-operating farms was the existence of what farmers termed spare tractors. Spares were invariably old models, still in working order, which were used occasionally for odd jobs and for field work at rush periods. These machines had a very low market value and provided maintenance costs were not excessive, the generally held opinion was that it paid to retain them on the farm. Specialised tractors were rarer. The great majority of the tractors found were the common models of the general purpose medium size wheeled machines.

All this suggests rather a fortuitious element in the numbers of tractors kept per farm. Consequently the figures given in Table XXXIV should not be interpreted as illustrating comparative conditions prevailing on different systems of farming.

(1) For 1950 average figures see "A Study of Farm Machinery found in Different Farming Systems in Yorkshire."
Farmers' Report 103. Department of Agriculture, Leeds University, 1951.

Details of the number of tractor hours worked annually per 100 acres together with the subdivision among the three headings crops, stock and other work, are given in Table XXXVA. Information about the type of jobs done is contained in Table XXXVB. The two tables are not comparable since they relate to different periods of time. The figures given, however, are very similar.

Table XXXV.

TWO TYPE OF FARMING GROUPS.

Tractor Hours Worked Annually and the Type of Work Done.

(a) **Tractor Hours Worked per 100 Acres** Average, 1951/1952

	Vale of York Arable		Holderness Mixed with Milk	
	Hours	Percentage	Hours	Percentage
Crops	854	80	737	86
Stock	73	7	11	1
Other Work	143	13	111	13
Total	1,070	100	859	100

(b) **Percentage Breakdown of Tractor Work.** 1952. (1)

Type of Work	Vale of York Arable	Holderness Mixed with Milk
Ploughing	18	34
Other Field Cultivations	29	27
Hay and Silage Making...	6	9
Corn Harvesting	10	13
Root Harvesting	14	0
Stock Work	6	3
Carting Farm Yard Manure	10	7
All Other Work	7	7
Total	100	100

Perhaps the point brought out most in the table is the concentration of tractor work on crop production. By comparison, work with stock is unimportant, while other work makes only modest demands on the services of tractors. The concentration on crops explains

(1) 1951 figures not available.

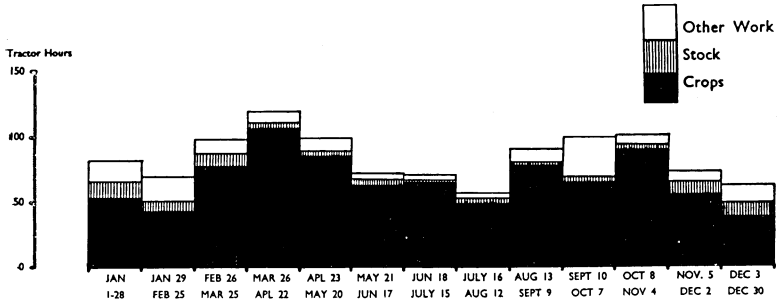
the seasonal fluctuations in tractor work—see Histograms N1 and N2. For many days at a time the tractors stood idle while at rush periods every tractor on the farm was put into use. This point is brought out in Chapter V where details are given of the number of days a year tractors were used.

Histogram N(1).

VALE OF YORK — ARABLE GROUP.

Seasonal Distribution of Total Tractor Work on Crops, Stock and Other Work.

Tractor hours per 100 acres.

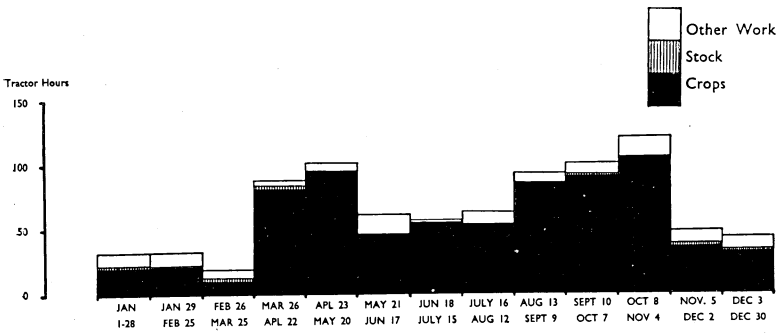


Histogram N(2).

HOLDERNESS — MIXED WITH MILK GROUP.

Seasonal Distribution of Total Tractor Work on Crops, Stock and Other Work.

Tractor hours per 100 acres.



Crop work can be divided into two broad headings, field cultivations and harvesting. Of the two groups, field cultivations involved the greater amount of tractor work. Ploughing was the most important single task. Tractors were used exclusively for the job, no horse ploughing being recorded on the sample farms.

On the Vale of York group the yearly peak of tractor work came with the spring cultivations. A secondary peak occurred in the late summer and early autumn with corn and potato harvesting, leading farm yard manure and autumn ploughing. In contrast the slackest time of the year was between hay time and corn harvest. The seasonal distribution of the Holderness group is different. The input of tractor work was much less even from month to month. Winter was a very slack period. The first spurt of activity came with the spring cultivations. The early summer was quiet. After that, however, work requirements climbed up to their annual peak in early autumn. This rather distinctive seasonal pattern arose partly from the special cultivation practices demanded by clay soils, where ploughing should be done as early as possible, and the land left alone in the winter.

THE PATTERN OF HORSE USE.

Work horses were found on all eleven farms; numbers varied from farm to farm, some farmers possessing a team, others only a solitary horse. A point of interest is the low level of annual working time per head returned by the solitary horses. In contrast, farmers who had a team tended to work them far harder.

Details of the number of horse hours worked annually per 100 acres and their subdivision among the headings of crops, stock, and other work, are given in Table XXXVIA. Further information about the type of jobs for which horses were used is shown in Table XXXVIB. Seasonal distributionsof horse work are illustrated in Histograms O1 and O2.

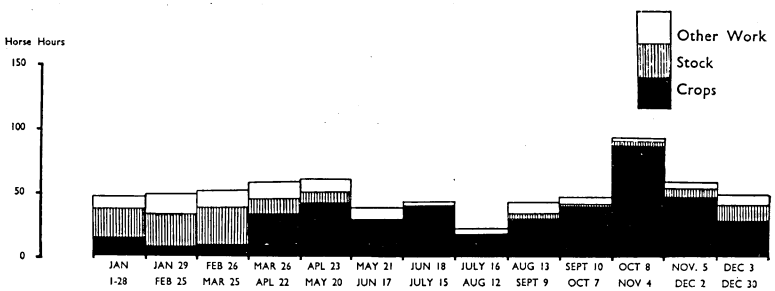
On the Vale of York farms the most important type of work done by horses was carting at root harvest. Next came general light

Histogram O(1).

VALE OF YORK — ARABLE GROUP.

Seasonal Distribution of Total Horse Work on Crops, Stock and Other Work.

Horse hours per 100 acres.



cultivations such as sowing seed and artificials, harrowing, and inter-row cultivations. Carting farm yard manure and fetching fodder and water for stock were other jobs for which horses were used. Farmers, however, tended to favour tractors for carting work at the hay and corn harvests. Histogram N1 illustrates the seasonal distribution of total horse hours worked. The marked seasonal peak for potato harvesting is shown. The demands made on horses by the sugar beet and fodder root harvests were more modest and spread over a longer period. The bulk of horse carting for the stock came in the winter months.

Table XXXVI.

TWO TYPE OF FARMING GROUPS.

Horse Hours Worked Annually and the Type of Work Done.

(a) **Horse Hours Worked per 100 Acres.** Average, 1951/1952.

	Vale of York Arable		Holderness Mixed with Milk	
	Hours	Per-centage	Hours	Per-centage
Crops	409	65	209	39
Stock	124	20	147	28
Other Work	99	15	175	33
Total	632	100	531	100
Number of hours worked annually per horse ...	507		356	

(b) **Percentage Breakdown of Horse Work.** 1952.

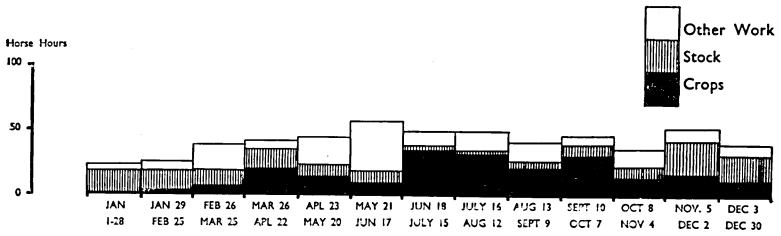
Type of Work	Vale of York Arable	Holderness Mixed with Milk
Ploughing	0	0
Other Field Cultivations	20	10
Hay and Silage Making...	4	7
Corn Harvesting	4	10
Root Harvesting	45	2
Stock Work	15	38
Carting Farm Yard Manure	6	20
All Other Work	6	13
Total	100	100

Histogram O(2).

HOLDERNESS — MIXED WITH MILK GROUP.

Seasonal Distribution of Total Horse Work on Crops, Stock and Other Work.

Horse hours per 100 acres.



On the Holderness farms, there was much less demand for horse work in connection with root harvesting and field cultivations. Instead the bulk of work done by horses consisted of carting fodder and water to stock and leading farm yard manure. Horses were worked in connection with stock all the year round, although winter was the busiest period. In late spring and early summer, muck leading was their main occupation. From mid-June to the end of September crop work became important. The first half of this period was mainly taken up with hay making and fodder root hoeing, the second with corn harvest.

At the present time the horse seems to be vanishing from the farming scene. The tractor is generally held to be superior both on technical and economic grounds. In 1951 and 1952, however, the farmers co-operating in the Diary Investigation were not fully convinced of the superior merits of tractors over horses for all types of farm work. Some were loath to part with old servants, especially if the merits of the usurper were not entirely proven. But it is significant that horses were used for jobs in which their speed of work and manual labour requirements were not at a disadvantage with those for tractors. The farmer used his horses for light carting but not for autumn ploughing.

On the farms studied the bulk of the motive power required went on crop production—the usual situation in mixed farming systems. Crop production is essentially seasonal in its demands on manual labour and motive power. Consequently, during slack periods in field work these factors are faced with under-employment unless they can be absorbed in other branches of the farm. Livestock enterprises provide alternative outlets for manual work, but the opportunities they afford for the use of motive power is rather limited. Jobs associated with the heading other work, too, make greater demands on labour than on power. Therefore it is not surprising that there are many days when tractors and horses are standing idle—the price paid for the possession of sufficient resources to cope with peak periods of field work.

CHAPTER V.

A STUDY OF TRACTORS AND HORSES.

By J. B. D. Radford

One of the most interesting features of the Farm Diary investigation was the information which it supplied with regard to tractor and horse labour. The farmers co-operating in the scheme provided details of the work done both by horses and by individual tractors, and this section of the Study is the result of the analysis of the records of an identical sample of nineteen farms for the two years 1951 and 1952.

Table XXXVII shows the total horse and tractor hours and the number of tractors per farm for both 1951 and 1952. Tractors which were purchased or sold during the years have been entered according to the number of four-week periods when they were actually available for use. They have been divided into two categories—those which were in use during most of the possible working time and others which were used either mainly for row-crop work or were regarded as reserves for use at busy times. Although the 1952 figures show a decline in horse hours and a rise in tractor hours when compared with the previous year, and two farmers dispensed altogether with horses in 1952, horse labour remained a fairly important factor on most farms. For in spite of the fact that it is usually reckoned that a tractor is capable of undertaking the work of between three and four horses (1), it is also true to say that the average tractor seldom develops more than two-thirds of its power when engaged in cultivating operations and still less when it is used for carting (2), which was where the horse came into his own. However, there was a feeling amongst some farmers that diesel tractors were cheaper to run and that these would eventually make possible the economic replacement of horse labour on farms. As it was, several farmers replaced other tractors by diesels during the two years under investigation.

Tables XXXVIIIA and B are attempts to show for how much of the total possible working time the nineteen farmers in this investigation employed their tractors. For example, on Farm No. 2, which consisted of 113½ arable acres in 1951 and 130 arable acres in 1952, two tractors were kept, one of which was in use " full-time " and one which was regarded as a spare for use at busy times. In 1951 neither was in use during 41% of the possible working days whilst one was in use for 50% of the time and both for only 9% of the time (Table XXXVIIIA). Table XXXVIIIB shows that there was little variation in these percentages in 1952 when neither was in use for 43% of the time, one was employed for 48% of the working days and again for only 9% of the time were both in use.

(1) Dudman, R. A., " Of Horses and Tractors," Farm Economist, Vol. VI., No. 7, 1950, p. 187.
(2) Wright, S. J., " The Mechanisation of the 200 Acre Farm," in " Modern Farming," June, 1946.

Table XXXVII.

HORSE AND TRACTOR HOURS PER FARM, 1951 AND 1952.

Farm	1951				1952			
	Total Horse Hours	Total Tractor Hours	Number of Tractors		Total Horse Hours	Total Tractor Hours	Number of Tractors	
			"Full-Time"	Row-Crop and Spare			"Full-Time"	Row-Crop and Spare
1	1,920	5,570	$4\frac{5}{13}$	—	1,948	6,102	5	—
2	1,811	1,157	1	1	1,403	1,104	1	1
3	1,132	2,631	2	1 (1)	996	2,737	2	1 (1)
4	312	1,362	1	1	168	1,388	1	1
5	1,390	1,031	1	1 (1)	1,408	1,112	1	1 (1)
6	2,209	6,867	4	1 (1)	1,203	8,210	$4\frac{10}{13}$	1 (1)
7	300	2,235	2	—	288	2,233	2	—
8	2,155	2,584	3	—	1,728	2,747	3	—
9	517	1,717	2	1	294	1,633	$1\frac{10}{13}$	$1\frac{5}{13}$ (1)
10	2,582	3,029	3	1 (1)	1,602	3,178	3	1 (1)
11	159	2,316	2	—	176	2,320	2	—
12	138	1,136	2	—	145	1,349	$1\frac{11}{13}$	1
13	228	2,120	2	—	—	1,992	2	—
14	145	4,176	3	—	76	2,788	2	1
15	440	1,454	$2\frac{4}{13}$	—	476	1,741	2	1
16	852	910	1	—	1,012	932	1	—
17	1,418	1,244	2	—	1,162	1,555	2	—
18	308	3,739	4	1	—	3,761	3	2
19	1,125	2,466	2	—	883	2,864	2	—
Total	19,141	47,744	$43\frac{9}{13}$	8	14,968	49,746	$42\frac{5}{13}$	$12\frac{5}{13}$
Average	1,007	2,513	2.3	0.4	881(2)	2,618	2.2	0.7

Note:—The records were analysed in thirteen four-week periods and fractional figures in the table refer to the number of four-week periods when a tractor was available for use on a farm.

On approximately 25% of the possible working days in each year no tractors were in use on this group of farms. The percentage naturally varies from farm to farm, those with the most tractors generally showing the lowest percentage of working days when no

(1) Row-crop tractor.
(2) Average horse labour hours on seventeen farms.

Table XXXVIIIA.

THE USE OF TRACTORS, 1951.

Farm	Arable Acreage	Notes on Tractors, 1951	Total Tractors	Tractors in Use per Farm						
				0	1	2	3	4	5	
				Working Days						
	Acres			%	%	%	%	%	%	%
1	530	New tractor, September ...	$4\frac{5}{13}$	7	15	25	27	24	2	100
2	$113\frac{1}{2}$	1 spare	2	41	50	9				100
3	162	1 row crop ...	3	14	46	39	1			100
4	81	1 spare	2	31	54	15				100
5	93	1 row crop ...	2	48	46	6				100
6	$558\frac{1}{4}$	1 row crop, 1 replaced ...	5	5	10	21	28	27	9	100
7	$104\frac{1}{2}$		2	15	44	41				100
8	243		3	27	29	29	15			100
9	128	1 spare	3	10	31	52	7			100
10	$224\frac{3}{4}$	1 row crop ...	4	32	22	24	19	3		100
11	144		2	25	39	36				100
12	180		2	20	55	25				100
13	$152\frac{1}{2}$		2	20	41	39				100
14	238		3	15	27	29	29			100
15	98	New tractor, September ...	$2\frac{4}{13}$	42	40	17	1			100
16	61		1	57	43					100
17	$113\frac{1}{2}$		2	40	38	22				100
18	$194\frac{1}{2}$	1 spare	5	17	28	27	16	10	2	100
19	147		2	19	44	37				100

tractors were in use. Spare tractors have three main uses, as auxiliaries to the tractor team at busy periods when plenty of power is needed, as alternatives for use in case of the breakdowns of other tractors and for use with machines such as manure-loaders and hedge-cutters, when the possession of a spare tractor to which such implements may be permanently attached saves a great deal of time which would otherwise have to be spent in removing and refitting these machines. Most of the spare tractors kept by the farmers in this investigation were old tractors whose second-hand values were so low that they were not worth trading in when new ones were purchased, but whose upkeep was considered justified for the work that they did at times when power was most in demand. An investigation of the work done by spare tractors showed that, on an average, for 83% of the total hours worked in 1951 and 87% in 1952 the spares were working at the same time as other tractors.

Table XXXVIIIB.

THE USE OF TRACTORS, 1952.

Farm	Arable Acreage	Notes on Tractors 1952	Total Tractors	Tractors in use per Farm: 0	1	2	3	4	5	6	
	Acres			Working Days: %	%	%	%	%	%	%	%
1	538		5	6	15	17	19	26	17		100
2	130	1 spare ...	2	43	48	9					100
3	161	1 row crop	3	13	41	42	4				100
4	81	1 spare ...	2	22	66	12					100
5	101	1 row crop	2	48	45	7					100
6	503	1 row crop, 1 new, March	$5\frac{10}{13}$	1	2	8	28	34	23	4	100
7	$103\frac{1}{2}$		2	15	46	39					100
8	$272\frac{1}{2}$		3	33	30	23	14				100
9	129	2 spares, 1 new, March	$3\frac{2}{13}$	7	25	55	11	2			100
10	220	1 row crop	4	25	29	33	13	—			100
11	123		2	24	41	35					100
12	180	1 spare, 1 new, February	$2\frac{11}{13}$	31	38	22	9				100
13	152		2	21	45	34					100
14	241	1 spare ...	3	30	42	21	7				100
15	108	1 spare ...	3	30	45	22	3				100
16	$61\frac{3}{4}$		1	61	39						100
17	$128\frac{1}{2}$		2	29	39	32					100
18	212	2 spares ...	5	18	27	27	18	8	2		100
19	$139\frac{1}{2}$		2	10	48	42					100

Table XXXIX. gives details of horse labour on seventeen of the nineteen farms in the investigation in 1952. (Two farmers ceased to use horses in the second year under review.) Horse numbers averaged 2.2 per farm and in addition all these farms ran tractors. The table shows that in 1952 horse labour averaged 881 hours per farm or 405 horse hours per horse, 74% of which were spent on haulage. Forty-three per cent. of the total horse labour was employed on harvest operations, one-third of these concerning the harvesting of root crops which takes place in the autumn and early winter when the state of the land is often too wet for the successful use of tractors.

The operations carried out by full-time tractors on nineteen farms in 1951 and 1952 are shown in Table XL. In the first year each farm averaged 2.3 full-time tractors; each tractor working on

Table XXXIX.

HORSE LABOUR ON FARMS WITH TRACTORS, 1952.

Seventeen Farms, 37 horses (2.2 horses per farm.)([1])

Operations	Hours		
	Per Farm	Per Horse	Per Cent.
Cultivations:			
Ploughing	3	1	
Cultivating, rolling and ridging ...	9	4	
Harrowing	34	16	
Drilling tillage	57	26	
Drilling corn, root and grass seeds ...	23	10	
Planting potatoes	9	4	
Hoeing and scruffling	34	16	
Cutting nettles	2	1	
Spraying weeds and drilling beetle dust	2	1	
Total Cultivations	173	79	20
Harvesting (excluding haulage):			
Hay and silage making	21	10	
Corn harvest	15	7	
Ploughing up sugar beet	3	1	
Topping sugar beet	15	7	
Clearing potato tops	2	1	
Total Harvest	56	26	6
Haulage (Crops):			
Hay and silage harvest	6	3	1
Corn harvest	27	13	3
Potatoes	204	94	23
Sugar beet	41	18	4
Other root crops (not to stock) ...	48	22	6
Total Haulage (Crops)	326	150	37
Other Haulage:			
Stock feed and other stock work ...	182	84	21
Carting and spreading farm yard manure	80	37	9
Miscellaneous haulage	64	29	7
Total Other Haulage	326	150	37
Total Horse Labour	881	405	100

(1) Two of the nineteen farms whose records are analysed in this section did not use horse labour.

Table XL.

ANALYSIS OF WORK DONE BY "FULL-TIME" TRACTORS.

Nineteen Farms, 1951 and 1952.

Operations	Hours			
	Per Tractor		Per Cent.	
	1951	1952	1951	1952
Cultivations:				
Ploughing	216	197	21	18
Cultivating and harrowing ...	139	154	14	14
Rolling	21	18	2	2
Drilling seed, tillage and planting potatoes...	54	59	5	6
Rowing and ridging	21	22	2	2
Weeding and spraying ...	5	6	1	1
Hoeing and scruffling	34	34	3	3
Total Cultivations ...	490	490	48	46
Harvesting (excluding haulage):				
Hay and silage harvest ...	68	59	7	5
Combine harvesting	8	9	1	1
Bindering, etc.	28	29	3	3
Threshing and baling straw ...	16	23	1	2
Root lifting	49	63	5	6
Total Harvest	169	183	17	17
Haulage (crops):				
Hay and silage harvest ...	42	33	4	3
Corn harvest	67	67	7	6
Potatoes	14	10	1	1
Sugar beet	24	36	2	3
Other root crops (not to stock)	15	17	2	2
Total Haulage (Crops) ...	162	163	16	15
Other Tractor Work:				
Miscellaneous haulage ...	26	43	2	4
Leading and spreading farm yard manure	89	105	9	10
Haulage and grinding for stock	59	76	6	7
Miscellaneous tractor work ...	23	15	2	1
Total Other Tractor Work	197	239	19	22
Total Tractor Hours ...	1,018	1,075	100	100

Table XL (*continued*)

		Total	Per Farm
Number of "full-time" tractors	1951	$43\frac{9}{15}$	2.3
	1952	$42\frac{5}{15}$	2.2
Number of horses ...	1951	44	2.3
	1952	37(1)	2.2(1)

average 1,018 hours. There was a very slight decrease in the number of full-time tractors in 1952, but these averaged 1,075 hours work per tractor or 57 hours per tractor more than during the previous year. The hours per cent for each operation showed very little difference during these two years. Nearly 50 per cent of the working time was spent on cultivations and approximately 30 per cent on haulage operations, half of which concerned the harvesting of crops.

On the nineteen farms under review only four in 1951 and seven in 1952 kept spare tractors. Table XLI shows a decrease of 33 hours per tractor in the work done by spares in 1952 compared with the previous year, although there was a slight rise in the number of spares per farm. There were noticeable differences in the hours spent on the various operations, cultivations increasing by 23 per cent and haulage decreasing by 20 per cent in 1952. A comparison with Table XL. shows that in these two years spare tractors were only in use for approximately one-third of the time worked by full-time tractors.

Tractors which were used mainly for row-crop work were kept on four of the farms in the investigation. These tractors averaged 484 hours each in 1951 and 425 hours each in the following year, and details of the operations for which they were used are given in Table XLII.

(1) Seventeen farms.

Table XLI.

ANALYSIS OF WORK DONE BY SPARE TRACTORS, 1951 and 1952.

Operations	Hours			
	Per Tractor		Per Cent.	
	1951	1952	1951	1952
Cultivations:				
Ploughing	35	68	11	23
Cultivating and harrowing ...	47	82	15	28
Rolling	19	16	6	6
Drilling seed, tillage and planting potatoes	30	15	9	5
Weeding and spraying ...	—	2	—	1
Hoeing and scruffling	—	2	—	1
Total Cultivations ...	131	185	41	64
Harvesting (excluding haulage):				
Hay and silage harvest ...	11	9	3	3
Bindering, etc.	2	2	1	1
Threshing and baling straw ...	—	1	—	—
Root lifting	18	8	6	3
Total Harvest	31	20	10	7
Haulage (Crops):				
Hay and silage harvest ...	15	—	5	—
Corn harvest	11	7	3	2
Potatoes	7	1	2	1
Sugar beet	3	—	1	
Other root crops (not to stock)	17	1	5	
Total Haulage (Crops) ...	53	9	16	3
Other Tractor Work:				
Miscellaneous haulage ...	17	9	5	3
Leading and spreading farm yard manure	40	47	12	16
Haulage and grinding for stock	49	17	15	6
Miscellaneous tractor work ...	2	3	1	1
Total Other Tractor Work	108	76	33	26
Total Tractor Hours ...	323	290	100	100

	1951	1952
Number of farms with spare tractors	4	7
Number of spare tractors ...	4	$8\frac{5}{13}$

Table XLII.

ANALYSIS OF WORK DONE BY ROW-CROP TRACTORS, 1951 and 1952.

Operations	Hours			
	Per Tractor		Per Cent.	
	1951	1952	1951	1952
Cultivations:				
Ploughing	3	2	1	1
Cultivating and harrowing ...	90	50	18	11
Rolling	3	14	1	3
Rowing and Ridging	28	16	6	4
Drilling seed, tillage and planting potatoes	53	33	11	8
Weeding and spraying ...	7	4	1	1
Hoeing and scruffling	148	161	31	38
Total Cultivations ...	332	280	69	66
Harvesting (excluding haulage):				
Hay and silage harvest ...	14	—	3	—
Root lifting	114	93	24	22
Total Harvest	128	93	27	22
Haulage (Crops):				
Hay and silage harvest ...	1	—	—	—
Corn harvest	1	—	—	—
Potatoes	9	—	2	—
Total Haulage (Crops) ...	11	—	2	—
Other Tractor Work:				
Miscellaneous haulage ...	6	19	1	4
Leading and spreading farm yard manure	—	22	—	5
Haulage and grinding for stock	—	7	—	2
Miscellaneous tractor work ...	7	4	1	1
Total Other Tractor Work	13	52	2	12
Total Tractor Hours ...	484	425	100	100
Number of farms with row-crop tractors	**1952** 4		**1952** 4	
Number of row-crop tractors ...	4		4	

Appendix A.

DETAILS OF THE TYPE OF DATA USED.

1. **Chapter I.** Manual Labour and Tractor Work Requirements for Crops.

Investigation	Harvest Years Covered	Number of Records Consulted (1)
Farm Diary	1951, 1952	49
Enterprise Cost Studies: ...		
Wheat	1950, 1951	91
Barley	1953	98
Potatoes	1951, 1952	79
Sugar Beet	1948, 1949, 1954	219
Crop Costs of the Milk Costs Investigation:		
Oats	1948-1951	115
Beans	1948-1951	45
Mangolds	1948-1951	70
Swedes	1948-1950	46
Kale	1948-1951	74
Arable Silage	1948-1951	18
Ley Establishment (direct seeding) ...	1948-1951	45
Seeds Hay	1948-1951	105
Meadow Hay	1948-1951	102
Grass Silage	1948-1951	60
Grazing	1948-1951	211
Grand Total ...		1,427

2. **Chapter II.** Manual Labour Requirements for Livestock.

	Years Covered	Number of Records Consulted (1)
Enterprise Cost Studies:		
Cattle rearing and finishing	1948-1954	263
Sheep	1951-1953	88
Milk Costs Investigation:		
Milk Production Costs...	1948-1954	259
Grand Total ...		610

(1) The number of records consulted is not necessarily synonymous with the total number of records actually collected in the course of the investigations listed above.

3. **Chapter III. Manual Labour Requirements for Other Work.**
Forty-nine records for the years 1951 and 1952 from the Farm Diary investigation.

4. **Chapter IV. The Pattern of Manual Labour, Tractor and Horse Use on Two Type of Farming Groups.**
1951 and 1952 records from the Farm Diary investigation relating to an identical sample of eleven farms.

5. **Chapter V. A Study of Tractors and Horses.**
1951 and 1952 records from the Farm Diary investigation relating to an identical sample of nineteen farms.

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