Labor and wages, Agricultural O.S.

NORTH OF SCOTLAND COLLEGE OF AGRICULTURE.

AGRICULTURAL ECONOMICS DEPARTMENT.

ECONOMIC REPORT. NO. 4.

AGRICULTURAL LABOUR IN NORTH-EAST SCOTLAND.

by

G. G. HAYES.

PART I.

THE EFFICIENCY OF LABOUR UTILISATION.

Albert D. Imper, M.B.E., B.Sc.(Agr.), M.S.(Econ.), Ph.D., N.D.A.
Senior Agricultural Economist.

G. G. Hayes, B.Sc.(Econ.), N.D.A.
Agricultural Economist.

J. Clark, B.Sc.(Agr.), N.D.A.) Assistants.
R. B. Reid, B.Sc.(Agr.), N.D.A.)

May, 1946.

THE EFFICIENCY OF LABOUR UTILISATION IN NORTH-EAST SCOTLAND.

1. Introduction.

For some time it has been evident that one of the major problems facing farmers, has been the supply of, and efficient organisation of labour. This problem is becoming of increasing importance, due to the combined operation of a number of factors. The supply of permanent, whole-time employees has, of late years, become less, while the mobility of agricultural labour has been curtailed during the war by government control. Wage rates have risen, while hours of work are now suffering some reduction. These factors have increased the relative importance of labour on the farm, particularly in certain fields of agricultural production. Changes in the quantity and conditions of supply of labour may be counteracted in two ways. The farmer may either change his type of farming, or he may improve the efficiency of his organisation. The former change is physically possible, but is subject to some external control. The latter is a matter over which the farmer has a great degree of control. It is this latter point which is the subject of the present investigation, which is directed towards measuring the efficiency of farm labour organisation, and to determining the factors governing the efficient utilisation of such labour. Part I of this Report will be concerned primarily with a statement of the problem, and with an explanation of the means whereby the efficiency of labour organisation can be measured. Part II to be issued later will be concerned with the factors governing such utilisation, and with recommendations relative to the improvement of labour organisation.

2. Magnitude of the Problem.

The importance of expenditure on labour may be gathered from the following table, which shows labour costs as a percentage of total expenditure, the data being obtained from the farm accounts examined by the Economics Department of the North of Scotland College of Agriculture over the past five years. Three groups of farms are included - (1) those which feed cattle mainly purchased as advanced stores, (2) those which breed, rear, and feed cattle and/or purchase cattle at an early age to rear and feed them, and (3) dairy farms.

Table I./

Table I. Labour Cost as % of total expenditure.

Year	Group 1	Group 2	Group 3	All Groups.
1935-36	15.9	20.9	23.4	20.0
1936-37	13.2	21.1	22.8	18.6
1937-38	13.7	19.2	23.6	18.6
1938-39	17.4	23.7	24.9	22.0
1939-40	15.8	22.3	22.7	20.2
1940-41	17.1	24.3	23.6	21.5
1941-42	19.6	26.2	24.7	23.4
1942-43	19.7	29.5	27.1	25.1
1943-44	20.4	28.3	27.0	25.2

It is evident from the foregoing figures that expenditure on labour has become of increasing importance, and now takes a larger proportion of the total expenditure than at any time in the past. This increase is not limited to any one type of farming, but is common to all.

The story is made plain by reference to the minimum rates of wages as fixed by the Scottish Agricultural Wages Board. The following figures refer to certain wage rates laid down by the Wages Orders relating to District 3 - Banff, Aberdeen and Kincardine. Space does not permit the giving of full details of these orders. Only certain classes are therefore listed. The rates are in shillings per week for a normal working week, and refer to male workers, 20 years of age and over.

Order No:	Date of Operation	Class of Worker - Stockman	Horseman	Orraman*
1	18. 7.38	35/6	35/6	33/-
2.	28. 5.39	35/6	35/6	33/-
3.	18. 3.40	40/6	40/6	38/-
4.	22. 7.40	51/-	51/-	48/-
5.	28.11.40	52/-	52/-	48/-
6.	19. 1.42	65/-	65/-	60/-
7.	15. 5.44	71/-	71/-	65/-
8.	16. 4.45	76/-	76/-	70/-

* Unclassified male workers in the agricultural wages orders.

Since/

Since the summer of 1938 the financial attraction of farm work has considerably improved. From the employer's point of view the increase in Wage rates - an increase of the order of 100% - has been masked by increased receipts. Should the price level of agricultural commodities weaken substantially, and should this drop be unaccompanied by a corresponding fall in wage rates, then the farmer will begin to feel the full impact of the higher wage level. Uninspired prophecy is perhaps an idle occupation, but it seems likely that in the not too distant future the general price level will fall, and that this fall will be unaccompanied by a corresponding drop in the wage level. Should this be the case, then it will be necessary for the farmer to give the organisation of his labour force much more consideration than has been evident in the past.

From the supply point of view, the farmer is also faced with some difficulties. The following table shows the number of persons employed in agriculture in the three counties of Banff, Aberdeen, and Kincardine from 4th June, 1935 onwards.

	Aberdeen - shire			Banff - shire			Kincardine - shire		
Year	Regular	Casual	Total	Regular	Casual	Total	Regular	Casual	Total
1935	13,040	1,202	14,242	3,201	299	3,500	2,468	220	2,688
1936	12,704	1,002	13,706	3,153	231	3,384	2,394	143	2,537
1937	12,561	1,058	13,619	3,060	227	3,287	2,367	190	2,557
1938	12,054	989	13,043	2,879	244	3,123	2,269	198	2,467
1939	11,648	1,090	12,738	2,838	241	3,079	2,212	219	2,431
1940	11,287	1,266	12,553	2,744	269	3,013	2,169	262	2,431
1941	12,399	1,229	13,628	3,023	238	3,261	2,244	226	2,470
1942	12,554	1,166	13,720	2,978	217	3,195	2,224	228	2,452
1943	12,473	1,611	14,084	3,159	381	3,540	2,427	357	2,784
1944	12,282	1,616	13,898	(i)	435	(i)	2,496	414	2,910
1945	11,342	1,622	12,964	2,740	359	3,099	2,329	363	2,692

(i) Reliable figures not available.

The table shows for Aberdeenshire, a steady decline in the magnitude of the labour force from 1935 onwards, arrested temporarily in 1941/

1941, 1942, and 1943. For Banff-shire much the same story may be told, but for Kincardineshire an upward movement may be observed from 1941 to 1944 following a fall from 1935. For this county, however, 1945 showed a return to the downward trend, which is likely to be continued.

These figures, in themselves, are not sufficient to cause grave concern. In normal conditions, the declining labour force could be met by an increase in mechanisation, and possibly in an increase in the amount of land laid down to grass. It is where ploughing quotas above the normal are imposed on farmers and where mechanisation is difficult owing to a short supply of new equipment, that difficulties arise. Farmers have had to increase the area of tillage considerably under difficult conditions of labour supply. In these circumstances the efficiency with which a farmer organises his labour force becomes of paramount importance.

3. Objects of Investigation.

"Efficiency of labour utilisation" may refer solely to the number of acres of crops, and the number of head of livestock which a given labour force can handle. Giving the phrase this connotation does not take into account the quality of the work done, that is, in the production of high-grade crops, livestock, and livestock products, nor that work undertaken for the permanent improvement of the holding. For the purpose of this investigation the narrower definition is to be preferred, since the wider meaning introduces factors other than labour. The production of high grade crops, stock, and livestock products is dependent more upon the wishes and plans of the farmer than upon the ability of his men. For example, a good byreman cannot produce a high yield of milk per cow when working with poor-grade stock, nor can he introduce high-yielding stock unless his employer desires it. Further, it is not possible to assess the improvements which are the results of a high grade labour staff, other than the readily observable ones such as roads, fences, buildings, etc., unless that particular farm is under constant observation for a number of years. Hence, for the purposes of this investigation it seems preferable to limit the/

the meaning of the phrase "efficiency of labour utilisation" to the more easily measurable number of acres of crops, and the number of head of livestock which a given labour force can handle.

One final point in these introductory remarks should be stressed. This investigation is concerned with the efficiency of labour utilisation and not with the efficiency of labour. Hence, any characteristics pertaining to individual members of the labour force are not considered as being within the scope of this investigation. Its prime purpose is to measure, as far as possible, the efficiency with which a given labour force is used, and to determine the factors leading to that particular utilisation. The investigation should be able to provide the answer to such questions as: What labour force is required on a given farm? What type of labour is required? What is the optimum combination of crop and livestock enterprises to enable a given labour staff to be fully employed in their proper functions?

A number of factors are involved in the efficient utilisation of labour. An important factor is the size of enterprise. "Size of enterprise" is used in preference to "size of farm" since the latter conjures up a vision of so many acres, while the term "enterprise" is used to convey the idea of a combination of crops and stock. Any such combination is possible, varying from all crops and no stock to all stock and no crops. In actual practice neither extreme has been encountered.

A second factor involved is the number of men employed. For every size of enterprise there exists a certain optimum number of workers. If the labour force is above or below the optimum level, the maximum efficiency of organisation cannot be obtained. In this connection, the labour force must be regarded as a combination of permanent and casual workers, allowance also being made for any hired service, such as ploughing, harvesting, threshing, etc.

The amount and type of equipment employed will also affect the efficiency with which the existing labour force is employed. For instance, it is generally held that the employment of a milking machine enables the staff of byremen to be reduced or, alternatively, the number of cows in milk which the existing staff can handle to be increased. Similarly the

employment/

employment of a tractor enables the existing staff to handle more tillage acres or, alternatively, the number of men so employed may be reduced. The examples given above are sufficient to show the importance of the quantity and type of equipment employed. It does not seem desirable to introduce money values into this question of equipment. To do so brings in factors other than the actual type and volume of equipment employed - factors such as the relative scarcity of a particular implement, variations in new and second hand prices, age, etc. Provided the machine is working satisfactorily, none of these factors has much influence on the efficient utilisation of a labour force, and little is achieved by complicating the investigation with their introduction.

Dealing with the cropping side of the enterprise and the implements required for the cultivation of such tillage area, the shape and size of field will have an effect on the utilisation of labour. This is of particular importance where a tractor is employed. For example, in ploughing a certain acreage the fewer the turns at the end of the furrow, the smaller the amount of time wasted in such turning. Hence the ideal field for a tractor would be large and rectangular. It will be necessary in this investigation to obtain some information regarding the suitability of fields for tractor operations.

A further very important factor governing the efficient utilisation of labour is the standard of organising ability exercised by the farmer or farm manager. This ability to organise should show itself not only in connection with the labour staff but also in regard to the type of crops and stock handled. In connection with labour, efficient organisation will see that all employees are fully occupied, and, a point of some importance, that each employee is fully occupied in his proper sphere. For instance, a byreman should, in order to be working efficiently, be fully employed with his cows. This means, of course, that in order to extract the maximum from the employment of a byreman, the size of herd must be sufficient to occupy all his time. If the herd is less than this required size, it means that the byreman must undertake other work, with a consequent loss of efficiency. In addition, the farmer should so plan the type of his enterprise that peak periods of work on one type

of/

of crop do not coincide with similar periods on other crops. This is not always possible, but in planning his cropping, a farmer should bear this in mind, as well as the availability of casual labour.

Bearing in mind the foregoing factors which appear to have some influence on the efficiency of labour organisation, the survey has been designed to show the following points:-

1. Stocking and Cropping.
2. Type of labour staff.
3. Condition of labour.
4. Major Equipment.
5. Extent of contract work.

The following notes discuss in some detail the information which has been obtained, in order to supply answers to the above points.

The labour staff has been divided into the two main categories - whole time permanent, and casual. For the permanent employees, the information obtained showed the class of worker (horseman, shepherd, cattleman, etc.) the age of each worker, his wage rate, and any perquisites allowed. The age of the worker is required since all workers have been reduced to a common denominator, and, for reasons given in a subsequent paragraph, "man units" have been selected. Casual labour may or may not be employed in gangs. If it is, then the number of persons in the gang has been determined to enable the gang to be reduced to terms of man units. The number of days the gang was at work and the work done was also noted.

In the belief that the conditions under which the labour staff exist have, in the long run, some considerable influence on the efficiency with which they work, information about such conditions is of particular importance. Particulars regarding the number and condition of cottages, presence or absence of electricity and water, distance from schools, shops, etc., have been obtained. To what extent the conditions under which the labour staff lives has any bearing on the efficiency of the farm organisation is uncertain, but will be examined in the second part of this study.

Particulars were obtained of the major equipment, in particular, tractors/

tractors and tractor equipment. For the reasons already given, no note was made of the cash value of such equipment. It is sufficient to know what equipment is available.

Information was obtained regarding the extent and nature of contract work, whether undertaken by the A.E.C. or by a private contractor, including in this latter term, the neighbouring farmers if they undertake any considerable amount of work. This information is necessary since the more a farmer employs contract work the less the demands he makes on his own farm staff. The information obtained here relates to the nature of the operation and the length of time involved. It was then possible to reduce the contract work to man units, and add it to the man units of regular and casual labour.

4. Measurement of Efficiency.

The investigation of the efficiency of labour utilisation cannot remain at the stage to which it has now arrived - merely a factual statement embodying the results of the survey. An attempt had to be made to reduce all farms to a common denominator, thus enabling some comparison to be made between different farms, and the weak points in labour utilisation to be determined for the farm on which such a weakness obviously exists. For this purpose some form of standard is required.

One form which such a standard could take is the £1 value of labour. By this method all labour would be quoted in money terms, including both regular and casual labour. This method has the great advantage of simplicity, but the simplicity covers a number of erroneous assumptions. In the first place, an underlying assumption is that the money value of labour measures its efficiency. Two objections can be raised against this assumption. The first objection is that the £1 does not, under existing conditions, measure the efficiency of an individual. Under a perfectly free market for labour, where supply is only slightly above or below demand and where labour is mobile, then the wage offered would measure in some degree the efficiency of labour. But such a measure could only be applied to similar types of labour. Much would depend upon the agricultural/

agricultural community's eagerness to undertake certain types of farming. No comparison between the efficiency of byremen and shepherds, for example, would be possible. Under existing conditions, when a scarcity of labour exists, and where mobility of the labour force is severely reduced by government control, the £1 cannot measure efficiency. Under such conditions, a farmer would be prepared to pay freely for any labour, if he could get it, and also more for a good man than for an inferior worker, again if he could get one. But since mobility is practically non-existent, such factors cannot operate. Finally, where a minimum wage is fixed, as in the case of agricultural workers, there exists a tendency for all wages to be at or near a common level, no premium being placed on a more than average efficiency, nor is inefficiency penalised. The second is that the survey is not concerned with the efficiency of labour, but with the efficiency of the organisation of such labour. Hence any attempt to measure the efficiency of individual workers is unnecessary, and would merely serve to complicate an already intricate subject.

In order to build up from the basic farms to which reference is made below, an estimated labour requirement, an allocation of labour has to be made between the various classes of livestock and crops. This can only be done by reference to the number of hours worked and no purpose seems to be served by converting these hour figures to money terms. For the purpose of this survey, the time involved in undertaking the various operations is of more importance than the money cost. Further, any contract work, embodying, as it does, an element of profit to the supplier, if introduced in terms of cash into the study, brings with it a further factor - the profit just mentioned. In order to avoid this complication, it appears more satisfactory to determine the value of this contract work in terms of hours rather than in money terms.

The position therefore seems to be that the disadvantages of using the £1 as the unit outweigh the advantages. The unit here suggested is the man hour. By this means all labour is reduced to terms of man-hours, whether the labour be regular, casual, or contract. The number of man-hours involved in various operations is the only relatively stable factor,/

factor, and for this reason alone has much to recommend it as the standard which should be adopted. Money terms are relative only, whereas man hours are absolute, unaffected by changes in wage rates, and can form a satisfactory basis for the evolution of a standard. The employment of a man-hour standard is of course, complicated by the differing age and sex of the workers. Arbitrary figures have been adopted for the conversion of all workers into terms of man-hours. It has sometimes been difficult to calculate casual and contract work in terms of man-hours, while the measurement of overtime presented further difficulties, but none of these difficulties have proved insuperable, and a method of overcoming them, and of developing a reasonably satisfactory standard is given below.

It is held, therefore, that, not only is a standard of labour efficiency desirable as a measure of the relative efficiencies of various enterprises, but that such a standard can be devised which will work with a fair degree of reliability. The following notes describe the source from which the standard has been built up and the method of determining such a standard. While the universal applicability of the standard is not postulated, it is believed that the method of obtaining such a standard is capable of adoption anywhere.

The evolution of a Standard of Efficiency is based on an examination of the labour records of certain farms in the North-East of Scotland for the years 1936-37 to 1944-45. The first step was to determine for each year the number of hours of man labour spent on each crop, and on each class of livestock. A refinement was introduced whereby the total number of hours spent on each crop was determined. This has sometimes involved an examination of three years' time sheets in order to determine the number of hours of man labour on one year's crop. Thus, if the cost account closed in November, 1940, labour on the oat crop was recorded before November 1939, and after November 1940. This meant an examination of the labour sheets of the year 1938-39; 1939-40; and 1940-41. Such an examination gave the total number of hours spent on the 1940 oat crop, and also enabled the proportion of the total hours spent in 1939-40 to be calculated.

The calculation of the labour requirements of crops is a straight-forward matter./

matter. The data required are simply the acres grown and the number of hours worked on each crop. By dividing the acreage into the hours, a figure of hours per acre is obtained which can be reagrded as the initial step towards the determination of a standard for that crop. Livestock present certain other problems. It is necessary to make allowances for different age groups in each class of livestock, as adults will require more man labour than younger animals. Hence it seems desirable that all classes of livestock be reduced to a common denominator. A different one could be devised for each class of livestock. Thus, cattle could be dealt with in terms of cow units, sheep in terms of sheep units, and so forth. This appears to be an unnecessary complication, so that in the following calculations all livestock have been reduced to cow units. The calculation of the number of hours required per cow unit then becomes a simple arithmetic problem.

The unit system employed is as follows. One unit is represented by -

1	Working Horse
2	Young Horses
.1	Cow
1	Bull
1	Store Beast
2	Young Cattle
7	Breeding Sheep
14	Other Sheep
5	Pigs
100	Poultry

This system is possible open to some criticism, but the main requirement is not accuracy in the unit values assigned to each class of livestock, but to have some system which can be applied to all enterprises.

Before dealing with the calculations for each crop and each class of livestock, some notes on the basic data may be desirable. 35 separate cost account records have been examined, covering 278 workers, both regular and casual. The total number of hours of work involved was well over 500,000. The size of the sample is not insignificant, and it is reasonable/

reasonable to believe that the results obtained from an examination of the data will be satisfactory for the purpose in view. The general plan for the use of this data, adopted in the following paragraphs, is to calculate the fundamental coefficients, and then to adjust them for other factors as may be necessary.

Wheat, Barley, Oats.

The calculation of the fundamental coefficients is simple. The number of hours worked on each of these crops is divided by the acreage grown. Yet in this simple case an important decision had to be made before any such coefficients could be determined. In any one period of twelve months labour on any crop may include labour on the preceding season's crop, on that for the current year, and on that for the following year. It is obvious that, for the calculation of a coefficient, the number of hours worked must be related to a certain acreage. Hence the method adopted is to determine the total hours worked on a certain acreage, irrespective of whether or no the work on that acreage is spread over two or three year's farming operations. This method will be satisfactory as long as there are no substantial changes of acreage from one year to another, as any sharp increase or decrease in the acreage of a crop grown in the following year will affect the amount of labour required in the current year. The result of an examination of the hours of man labour required per acre are as follows:-

Fundamental Coefficients - Wheat 35 hours per acre
Barley 42 " " "
Oats 35 " " "

It is interesting to observe the degree of correspondence between the above fundamental coefficients and similar calculations made elsewhere. These are given below:-

Source	Hours man labour per Acre. Wheat	Barley	Oats
North of Scotland College of Agriculture	35	42	35
Seale-Hayne Agricultural College	42	41	42
Cambridge University	34	41	31 (winter) 44 (spring)

Owing to the significantly greater difference in the demand for labour/

labour by barley, it does not seem possible to produce one fundamental coefficient for cereals. Each crop has to be dealt with separately.

Potatoes and Roots:

The method of calculating the fundamental coefficients for these crops is similar to that for the cereals. The results of the examination of the available data are as follows:-

Fundamental Coefficients - Potatoes 129 hours per acre
Roots 104 " " "

Comparable figures may be obtained from other sources, and are given here.

Source	Potatoes	Roots
North of Scotland College of Agriculture	129	104
Seale-Hayne Agricultural College	229	83
Cambridge University	180	161 (mangolds)

These fundamental coefficients will need some adjustment under certain circumstances. Where seed potatoes are produced, the labour per acre increases considerably, and will be in the neighbourhood of 170 hours per acre. The roots figure here includes turnips, kale, and a small acreage of sugar beet. If the turnips and kale are fed off on the field, and not lifted, the hours per acre figure used should be reduced by 20 hours to a figure of 84 hours per acre. If any considerable acreage of sugar beet is grown, the hours per acre figure for this crop should be taken at 200.

Hay and Grazing.

In a manner similar to that adopted in the foregoing paragraphs, the fundamental coefficients for hay and grazing may be calculated.

Fundamental Coefficients - Hay 22 hours per acre
Grazing $1\frac{1}{2}$ " " "

Comparison may again be made between this figure and those obtained from the other two centres.

Source	Hay	Grazing
North of Scotland College of Agriculture	22	$1\frac{1}{2}$
Seale-Hayne Agricultural College	16	2 (temporary) 3 (Permanent)
Cambridge University	19	-

Judging/

Judging by the scanty references available, the figures obtained by the above calculations seem reasonably accurate.

The fundamental coefficients so far obtained, applying to the major crops, can now be summarised.

Wheat	35	hours per acre
Barley	42	" " "
Oats	35	" " "
Potatoes	129	" " "
Roots	104	" " "
Hay	22	" " "
Grazing	1½	" " "

These may not be the final efficiency factors, as under certain circumstances, to be discussed later, some adjustment may be necessary. Coefficients have not been calculated for every possible crop. It is suggested, therefore, that where a crop occurs for which a coefficient has not been determined, the factor applying to the most similar crop be used. Thus, while the roots factor has, in the main, been calculated on turnips, a similar coefficient could be used for mangolds without invalidating the results to any significant degree. The roots coefficient is not applicable to sugar beet. As already suggested, if a considerable acreage of this crop is grown, the coefficient should be taken as 200.

Attention must now be directed to livestock. Here one of the major problems is the method by which, and the extent to which, the livestock be reduced to some common factor. For reasons already given cow units have been employed. There is no intrinsic worth possessed by this system as compared with any other, for sheep units would be equally suitable. The actual values employed are given on page 11 of this memorandum.

Horses.

The figure for the fundamental coefficient is given below. It has been obtained by dividing the number of hours man labour by the average number at the time of the opening and closing valuations. No other adjustments has been made for purchases, sales, births or deaths.

Fundamental Coefficient - 20 hours per unit.

These/

These hours do not take into account stable time, harnessing horses, nor the attention required at the end of the day. The work scheduled under this heading is mostly confined to taking horses to the blacksmith, cleaning harness, and other small jobs done only when absolutely necessary.

Cattle.

The figures and remarks given in this section refer to store and feeding cattle only, and do not include dairy cows. This latter class is the subject of a later section.

The calculation of the number of livestock units attended to presents some difficulty. It is manifestly unsatisfactory to take as the stock carried the average of the number at the beginning and end of the financial year. Many farmers will carry a permanent herd of small size, but purchase considerable numbers during the year. It would thus be most inaccurate for present purposes to represent the stock attended to merely by reference to the numbers in the valuation. Some other method had thus to be devised.

The ideal method of determining the number of cattle carried would be by reference to the number on hand on every day of the year. This is out of the question, but monthly figures can be used. It is possible for a considerable number of farms to determine the number of beasts on hand at the end of every month. This figure makes due allowance for births, deaths, purchases and sales, and also transfers of beasts from one grade to another, e.g. from calf to yearling. The method adopted in calculating the number of livestock units carried on the farm is therefore to take the number in the opening valuation, and add the number on hand at the end of each of the subsequent twelve months, the total to be divided by 13. This gives a reasonably satisfactory estimate of the average carry of stock throughout the year. The resultant figure is then converted to livestock units, and when divided into the total number of hours worked during the year gives the number of hours per livestock unit.

Adopting this procedure, the following figure is obtained:-

Fundamental Coefficient - 43 hours per unit.

Sheep.

The/

The number of livestock units carried has been calculated in a manner similar to that for cattle, using, of course, the appropriate conversion factors - 7 for breeding sheep, 14 for other sheep. The appropriate sheep figure is given below:-

Fundamental Coefficient - 67 hours per unit.

Pigs.

The calculation of the pig coefficient is undertaken in a similar manner to cattle, but employing the appropriate conversion factor to turn the pig population into cow units.

Fundamental Coefficient - 157 hours per unit.

Poultry.

The method of calculating the livestock units for poultry is the same as that used for other classes of livestock.

Fundamental Coefficient - 78 hours per unit.

Dairy Cows.

As no information is available in the cost account records studied with regard to the number of hours of man labour per cow per annum, reference has been made to other sources. From an examination of reports issued by various centres the following figures are obtained:-

Seale-Hayne.....	211	hours per head
Cambridge.....	220	" " "
Aberystwyth.....	222	" " "

These figures suggest that the fundamental coefficient for dairy cows is in the neighbourhood of 220 hours per head per annum. These figures were, however, obtained some years ago. Information obtained for the Milk Costs Investigation now being carried out suggests that 180 hours would be a more reasonable figure. This figure is used in preference to the 220 given above.

Summary of Fundamental Coefficients.

It is now possible to summarise the foregoing paragraphs, and produce a tabular statement of the coefficients recommended. It cannot too strongly be emphasised that these coefficients are intended, not as absolute/

absolute but as relative figures for use in estimating the optimum labour requirement of farms. The entire study is comparative, hence the relative accuracy of the coefficients is of greater importance than the absolute accuracy. In fact, no absolute accuracy is claimed.

Enterprise	Fundamental Coefficients.
Wheat	35 hours per acre
Barley	42 " " "
Oats	35 " " "
*Potatoes	129 " " "
Roots	104 " " "
Hay	22 " " "
Grazing	1½ " " "
Horses	20 Hours per Livestock Unit
Cattle	43 " " " "
Dairy Cows	180 " " " "
Sheep	67 " " " "
Pigs	157 " " " "
Poultry	78 " " " "

* If rogueing is undertaken by the farm staff, add 40 hours per acre.

Adjustments to Fundamental Coefficients.

The foregoing "fundamental coefficients" will give, when multiplied by the appropriate acreage or number of livestock units, the basic requirements of labour on any farm. Certain adjustments of the basic figure have to be made, however, before any adequate labour force requirement can be determined. The purpose of this section is to examine these adjustments which have to be made, and suggest any changes which appear necessary.

The most important adjustment to be made is in connection with the amount of time spent on work not directly connected with crop production or the tending of livestock. These charges are in the main what are called establishment charges, and relate to the upkeep of hedges, ditches, fences, buildings, roads, and so forth. Examining the cost account records available, a reasonably consistent figure in the neighbourhood of 10% of the total man labour employed is obtained. Comparison with a

similar/

similar enquiry at Cambridge is rather difficult, since at that centre the work falling under this heading, called "other work" is quoted in hours per 10 arable acres. A figure of 210 hours per 10 arable acres is given for Cambridge. Converting the Scottish figures to a similar standard, a total of 64 hours is obtained - very much lower than the corresponding Cambridge figure. A survey carried out in Devon and Cornwall gave a figure of 25.40% of the total amount of labour as being spent on "unproductive" work. Too much importance should not be attached to this figure as according to the author of that report, "the survey method.... is of doubtful efficacy in measuring up the rather nebulous quantities which are characteristic of many of the items of 'unproductive' labour". In view of the uniformity shown by an examination of the cost accounts a figure of 10% is employed as the measure of the total labour spent in work not directly chargeable to stock or crops. The total labour requirements of crops and stock, after adjustment has been made for the employment of tractors, has thus to be increased by one-ninth to allow for this addition.

The demand for man labour may be eased considerably by the employment of outside sources in the shape of contract labour for such services as threshing, ditching, and draining, and for such operations as ploughing, drilling, and harvesting. The employment of contract labour for these latter operations have, of late, become much more in evidence. A further source is the casual labourer employed directly by the farmer and not via a contractor. The fundamental coefficients given above include such contract and casual work. It has thus been necessary, when surveying a farm, to obtain from the farmer details of the contract and casual work, such details to show the nature of the operations and the number of man hours involved.

A further problem which had to be solved relates to the effect the employment of a tractor and tractor equipment has upon the labour requirement of any particular farm. Emphasis is here laid upon the tractor and tractor equipment. It is evident from an analysis of the data available that, given an adequate supply of equipment, the physical volume of equipment has little effect on the amount of man labour required. It has been/

been found in practice that the existence of a tractor is sufficient for the purpose of making allowances for the existence of varying quantities of equipment. This being so, all that is necessary is to adjust the fundamental coefficients as given above for the presence or absence of a tractor. It should be emphasised that the farms examined included some where such specialised series of equipment as a potato ridger and planter, combine harvester, or elevator type potato digger which loads the tubers into a cart, have been employed. The use of these series of equipment should result in a very considerable saving of man-hours, and would reconciliate a further adjustment to the fundamental coefficients. While these machines are not very common today, they are likely to become of increasing importance, and have to be taken into account. Similarly, any fresh development in farm mechanisation will have to be examined in order to determine its effect on the labour requirement of a particular crop.

In this study, where the figures obtained for each individual farm are purely comparative, it is essential that all be brought down to a common level of motive power, either horse or tractor. There appears to be little to be gained by adopting one of these two bases in preference to the other. Because of the almost absolute universality of the horse, all farms have been converted to 100% horse-power holdings. This will involve an increase in the hours of work done by tractor in order to make such labour comparable with horse labour. From an examination of all the available data, it appears that generally speaking, a man using a tractor will undertake three times the amount of work done where horses form the motive power.

The number of hours of man labour per acre during which a tractor was used have been obtained from the same sources as provided the fundamental coefficients, and are as follows:-

Enterprise	Tractor Hours per acre	Hours as % of total man hours.
Wheat	6.91	19.74
Barley	10.06	23.95
Oats	6.83	19.51
Potatoes	16.84	13.13
Roots	8.78	8.44
Hay	4.44	20.18
Other Work	-	3.45

The/

The farms studied showed tractor hours on items other than those listed above, but the number of hours recorded was very small, and to avoid over-complication, have been omitted. As tractors appear to work at three times the pace of horses it has been necessary to add on to the basic number of hours of work, twice the number of hours given above for tractor work. For example, to calculate the number of hours of man labour per acre of oats on an all-horse farm the fundamental coefficient of 35 hours, based as it is on the employment of tractors, must be increased by 13.66 (6,83 x 2), giving a total of 48.66 hours.

Data are not available to enable the effect of a milking machine on the number of man hours spent in the byre to be examined. The presence of such a labour-saving device should show itself in a figure for total man hours on a farm lower than the estimated, and would serve as one reason for the relatively high position of a particular farm.

Practical Application.

The degree of reliability which may be placed on the calculation of the efficiency factor may be gathered from its application to those accounts for 1944-45 where full information regarding stocking and labour was available. The broad picture thus obtained is as follows:-

Actual labour supply as per cent of estimated requirements.	Profit per farm	Profit per 100 acres.
Up to 70%	-	-
71% to 90%	£1,443	£484
91% to 110%	733	312
111% to 130%	648	259
Over 130%	143	102

It is evident from the foregoing figures that, as the efficiency of labour organisation decreases, so the profit level falls, whether this profit be measured per farm or per 100 acres. Within the whole range of accounts examined there were, of course, many farms which did not fit in perfectly - in fact nothing more than a moderately good fit is claimed for the entire study. It is, however, possible to explain the majority of mis-fits. A few examples will suffice to make the position clear.

Farm/

Farm A was not particularly well organised. Its percentage figure was 107, but the profit was high. The main lines of production was seed potatoes and malting barley - two commodities sufficient to explain the high profit level.

Farm B, on the other hand, was well organised, 76%, but the profit level was low. Here again lines of production provided the explanation - ware potatoes and no malting barley.

Farm C is a dairy farm, very well managed, and with a high level of milk output. The farm was, however, somewhat hampered by a less efficient crop production. Its efficiency factor was just under 100%, but its profit level was fairly high.

Farm D is also a dairy farm, with a high efficiency factor, showing that the farm was well organised. Its profit level was low, however, due to an outbreak of abortion.

It seems evident, therefore, that it is possible to obtain reasonable explanations of why certain farms do not fit into the picture particularly well. Such exceptional cases merely serve to emphasise the accuracy of the general picture. If further proof is required, however, it may be had by reference to the average profits for all farms. If the efficiency coefficients are reliable, the group - 91% to 110% - should return a profit somewhere near the average for all farms. For 1944-45 the average profit per farm, including a charge for the farmer's own labour, was £644. If allowance be made for the value placed on the farmer's own labour, the figure becomes £718, a figure reasonably near the foregoing group figure of £733.

It is claimed, therefore, that it is possible to measure, with a fair degree of accuracy, the efficiency of the utilisation of labour on farms. It is not claimed that the coefficients employed in these calculations have any validity outside the North-East of Scotland, but the method is capable of application elsewhere. By this means it should be possible to solve some of the problems concerning the extraction of maximum profits from farms, particularly today when labour has become the most important single item of expenditure.