End of Project Report

A Study of Time and Labour Use on Irish Suckler Beef Farms

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Contents

Page

Summary

Labour is one of the four factors of production and an increasingly costly and scarce input on farms. The attractiveness of non-farming employment, the nature of farm work and the price received for farm outputs are resulting in falling levels of hired and family labour.

A study was undertaken to quantify labour use and efficiency issues on suckler beef farms and to identify on-farm factors which influenced labour use.

The study was carried out over a 12 month period on 115 participating farmers (proportionately 0.75 farmed full-time and 0.25 farmed part-time). The main findings were

- The average labour input was 9.90 hours per farm per day.
- The average labour input on farms peaked in March, at 11.45 hours per farm per day, as calving and lambing coincided, and was lowest in December at 8.32 hours per farm per day.
- Animal husbandry tasks consumed most time over the 12 months recording period, averaging almost 2.6 hours per farm per day. Other farm enterprises and grassland management tasks were also time consuming, averaging 1.7 and 1.5 hours per farm per day, respectively.
- The average labour input per farm per day required to operate the average full-time farm in the study was 11.24 hours per farm per day, while the average labour input per farm per day required to operate a part-time farm in the study was 5.40 hours per farm per day.
- Approximately 97% of the farmers surveyed used the services of a contractor on the farm. The number of jobs carried out by agricultural contractors varied and was highest in summer and early autumn, as a result of silage harvesting, sheep shearing and cereal harvesting.
- Contractors were most popularly employed for silage harvesting and slurry and manure spreading, and as these tasks require substantial labour and machinery

investment, it usually proves more economical for the farmer to hire in such a service.

- The majority of farmers surveyed expressed the view that agricultural contractors were playing an increasingly important role and were being used to replace permanent labour on farms.
- On-farm factors which has a positive relationship with labour employed included farm size, herd size, farm and herd fragmentation, herd health problems, farmers age, condition of farm buildings, mechanisation levels on farm and record keeping.
- The majority of the farmers considered stock checking and monitoring as the most important and enjoyable task on suckler beef farms with potential benefits for improvement in stock quality.
- The most disliked task on farms was office work. Only one in five farmers identified this task as the most important task on the farm.
- Case studies were carried out on 10 suckler beef farms**,** all of whom had already taken part in the 12 month labour study. The case studies were focussed on a range of factors such as individual farm backgrounds, farm facilities and practices, tasks on farms which demanded a significant amount of time and the reasons why such time was demanded, together with future plans to address labour efficiency on the farm.
- The importance of family labour on suckler beef farms was highlighted in the case studies. Springtime was identified as the most labour demanding time of year. Grouping cows according to calving date, using a calving observation camera, operating night feeding on farm, and an observer rota when observing cows at night for signs of calving, were all identified as good labour-saving practices over the spring period.
- Farmers involved in sheep and suckler beef enterprises were well aware of the peak labour requirement in spring, and many had attempted to smoothed out this peak, somewhat by moving the lambing season to early spring and changing the calving season to later spring in order to ease the overall workload and to get cows out to grass soon after calving.

- Slatted sheds were deemed to be more labour efficient as regards cleaning, and quad bikes were recommended for herding by farmers who had severely fragmented farms.
- A principal component factor analysis identified three factors namely farm size, farm fragmentation and farm intensity. Labour efficiency had a positive relationship with farm size and farm intensity, and a negative relationship with farm fragmentation.

Introduction

Relative to many E.U. countries, Irish beef farms are small in size and family farm incomes are low (Department of Agriculture, Food and Rural Development, 2002c). The most recent National Farm Survey (2000) data compiled and presented by Connolly *et al.* (2001) shows that up to 60% of beef farm units have a second income source and in many cases it is the farm holder who earns the off-farm income. On larger units, income is often insufficient to competitively pay hired labour. Through examination of the Central Statistics Office (C.S.O.) Agricultural Labour Input data over various years (1992 and 1998) it is clear that the labour input on farms is provided primarily by the farm operator, with declining contributions by other family members.

Proportionately more farms in the small size category have an off-farm income. Indeed Commins (2001) identified that one of the long-term structural trends in the agricultural sector is the growing incidence of part-time farming together with an outflow of labour on a permanent basis from the farm sector.

Although employment on farms will continue to decline, off-farm employment is likely to continue to increase in rural areas, as the Irish economy continues to grow, even if lower rates of economic growth prevail than those encountered in 1994-1998 (Frawley, 2000).

Taking the above facts into account it is clear that the labour available to undertake routine farm tasks is and will continue to be limited. Thus, the approach taken and time spent in undertaking farm tasks have major significance in the efficient use of farm labour. The identification of obstacles to the more efficient completion of tasks, how farm facilities, layouts, level of management skill and approaches, influence the outcome, are of major importance. A more efficient use of labour will free up time and the adoption of such efficiencies on other part-time and full-time farms will generate opportunity for the potential participation in off-farm employment.

Objectives

The objectives of the study, which related to suckler beef farms (farms where the beef cow herd is a major component were to:

1. measure the time spent undertaking predefined tasks,
2. document the role of the agricultural contractor,
3. identify factors influencing labour use,
4. gain an in-depth knowledge into labour use and the attitudes associated it,
5. design a simple model to predict labour use and
6. examine the number of variables used in the study and explore correlations among variables considered to be most closely related to labour use.

Methodology

Data were collected from 115 predominantly spring-calving suckler beef farms who were clients of the Teagasc advisory services and were distributed evenly across the east and west of the country. Thirty farmers were part-time and 85 were full-time. Each farmer was randomly assigned to 1 of 4 groups for data collection. Each group was allocated a different week per month during which they recorded on timesheets the time they spent undertaking predefined tasks. Starting and finishing time for each farm task was recorded over 3 consecutive (incl. one weekend day) days. Task duration, length of working day, as well as discretionary time, was measured.

Use of a contractor relieves farmers of the burdens associated with direct employment and seasonal tasks of short duration. As contractors provide specialised knowledge and equipment, it was decided to explore the employment of contractors on farms. This was done for essentially two reasons: firstly to document the agricultural contractors importance as a labour source, and secondly to give a more meaningful measurement to total farm labour input. All tasks carried out by the contractor over the course of the 4 weeks were recorded in the contractor timesheet.

A short questionnaire was compiled each month by the 115 farmers participating in the labour use study. These questionnaires were used to gain additional information on each farm and on the practices being operated. The main aim of these questionnaires was to

identify labour efficient and deficient practices. The questionnaires were made as user-friendly as possible, while also aiming to gather the highest quality of data. The questionnaires consisted predominantly of closed questions, which were easily answered, and were also easily coded for analysis. Checks were built into questionnaires to insure that data were obtained to the highest standard of accuracy. The questionnaires were designed to address topics of interest to the time of year, thus aiming to get the respondent interested in the survey from the very beginning.

Farmers attitudes and practices, as well as farm details, were assessed mainly within the detailed farm questionnaires administered each month. However, detailed case studies were also carried out on 10 of the 115 suckler farms to obtain in-depth information on labour use on suckler beef farms. These case studies complimented the information gathered in the 12 month survey, and helped to identify an individual farmers areas of success with regard to labour efficiency and how the farmer had come to have this success. It was also possible to obtain the farmers attitude to labour use on-farm, and how the issue would be addressed in future.

This phase of the project was focused around an attempt to design a simple model with would predict labour use. This was done using the concept of multiple stepwise linear regression. The dependent or outcome interval variable was labour hours per cattle livestock unit per farm per annum. The independent variables or predictor variables were selected from the farm-based questionnaires. Independent variables were selected if they had been previously seen to have an association with labour hours per livestock unit per annum on farm.

The final phase of the project attempted to identify the most important variables. To complete this exercise effectively, it was important to explore correlations among the main variables which were considered to be most closely related to labour use.

The sample used for the suckler beef labour study were Teagasc clients.
The nominated farms were to meet the following criteria:

1. they would be predominantly spring calving suckler-beef systems i.e. at least 50% of the suckler beef herd identified as calving between the months of January and May, and
2. herdsize would be set at a 20 cow (cows plus in calf heifers) minimum, with no maximum.

It is recommended in the literature that weekends be incorporated into time studies such as these (Abeyasekera and Lawson-McDowall, 2001), mainly because

1. family labour would most likely be more active at the weekend, and
2. part-time* farmers might carry out most of their farming tasks over the weekend.

* Part-time farmers were defined as those farmers who were involved in off-farm activities and earned a substantial portion of income from out-side farming (Paudel and Wang, 2002).

Targeting the selected population for the suckler beef labour study

436 farmers nominated from the ten counties received letters from Teagasc personnel, and were invited to take part in the major 12 month suckler beef labour study.

The 436 farmers were divided on a per county basis. The study was targeted to begin in late February - early March 2002. The majority of the targeted population received 2 letters, one from the Beef Research Centre, Teagasc Grange from where the study was to be conducted. The second letter was from the local county C.A.O. or drystock advisor, to give the study a sense of "local ownership", in an attempt to increase interest and improve response rate.

A user-friendly method of response to the study was used where the farmer returned a coded postcard, which was stamped addressed to the Grange Research Centre.

By the 15th February a population size of 136 was established (a response rate of almost 32%).

Meanwhile, due to the analysis carried out on the pilot study, a population size of 100 farmers was deemed suitable, but it was decided to incorporate all 136 suckler farms into the study to cater for any fall off over the twelve months of the study. The pilot study also indicated that 3 days recording per week was sufficient. It was decided then that the recording days would be Thursday, Friday, and Saturday of each week. All 136 farmers were assigned randomly to one of four groups, using the random assignment function in Microsoft Excel for Windows 97. Group 1, consisted of 33 farms, and were responsible for recording on Thursday, Friday and Saturday of week 1 of each month over the 12 month period. Group 2, consisted of 34 farms, recorded on Thursday, Friday and Saturday of week 2 of each month over the 12 month period. Group 3, consisted of 33 farms, recorded on Thursday, Friday and Saturday of week 3 of each month over the 12 month period. Group 4, consisted of 36 farms recorded on Thursday, Friday and Saturday of week 4 of each month over the 12 month period.

Commencement of recording

Recording began in early March 2002. In the first recording period farmers received the whole labour recording pack for month 1, and were given an outline of what would be required of them over the 12 month period. Farmers were told this so that those farmers who did not feel they would be able to successfully meet the necessary commitment involved could drop out immediately, and this it was hoped would mean a higher retention rate of the remaining farmers over the 12 month period of the study. A total of 21 farmers dropped out leaving 115 farmers returning data each month.

Profiling each farm

The remaining 115 farmers were initially sent a single farm profile questionnaire to establish some basic facts on the sample farming population. Information was sought on farming status (full-time or part-time farmer), the percentage of the herd that was spring calving, a breakdown of the numbers in the cattle herd and beef cow numbers, additional farm labour both family and hired, and whether the farmer was employed full-time or part-time. The farmer was asked whether or not a contractor was employed on the farm

over the course of the farming year, and if so, what were the main tasks for which the contractor was employed. Information on other enterprises operated was sought together with the winter animal housing arrangements for cattle.

Of the 115 farmers participating in the study, proportionately 0.90, 0.07, and 0.03 of these farms had spring, spring and autumn (mixed) and autumn calving herds, respectively. The farms ranged in herd size from 21 to 195 cows and in bovine herd size from 30 to 440 livestock units, with an average of 93 livestock units.

It is important to note that the population of farms selected for the study was not entirely representative of the typical Irish farm. The average herd size of the Irish suckler beef farm is 15 cows (Department of Agriculture, Food and Rural Development, 2002c) while the average cow herd size of suckler beef farm in this study was 54 cows.

Data collection

Data collection was over a one-year period beginning in March 2002 and concluding in February 2003. All farm operators (farmers and hired/family part-time/full-time staff) were requested to record the starting and finishing time for each farm task they performed throughout the day over the three day recording duration each month over a total 12 month period.

Timesheets

Time data was collected using a timesheet. Collecting information qualitatively using timesheets meant that the cost of data collection was low relative to similar studies involving direct independent observation (Suphanchaimat, 1994).

Each individual farm worker completed a timesheet. Each individual timesheet incorporated a total of 27 farm tasks organised under 7 task category headings. Task duration, length of the working day, as well as discretionary time during the day were measured. The timesheet was accompanied by a full set of task definitions, the task definitions incorporating all 27 farm tasks under the 7 task category headings.

The contractors time allocation was designed to take into account the contractors' involvement in farm activities. The farm profile showed that 97% of respondents said that they used a contractor at least once during the farming year. Therefore, it was decided to measure the extent of the contractor use on farms, so as to accurately measure total labour input.

The contractors time allocation was sent out with the labour package each month, the farmer was requested to keep the contractor time allocation for 4 weeks duration, and was to complete and return the timesheet with the following months farmers timesheets. All tasks carried out by the contractor over the course of the 4 weeks were to be recorded onto the contractor time allocation.

Farming practices questionnaires

It was decided to use a short questionnaire each month with the farmer to obtain additional information on farm set up and practices.

The main purposes of these questionnaires were to:

1. allow the researcher to build up a limited picture of farm size, layout, and quality, and
2. identify labour efficient and deficient practices on each farm.

These questionnaires covered the following topics: spring-time calving process on the farm; grassland management; animal health and breeding; farm fragmentation; a herd size; socio-economic issues; farm business issues throughout the year; agricultural contractors and winter housing; winter housing and feeding; labour issues on farm; time management and attitudes to farm tasks.

Each questionnaire was limited to 2 pages. The questionnaires were designed to address topics of interest to the time of year, and thus aiming to get the respondent interested in the survey from the very beginning. Questions were grouped in sections and given a logical order.

Statistical data analysis

Data checking and uni-variate and bi-variate analysis were carried out using Microsoft Excel version for Windows 97 and S.P.S.S. version 8.0. The scientific software package

S.P.S.S. (version 8.0) subprogram FREQUENCIES was used to obtain one-way frequency distribution table and descriptive statistics for each variable. Following this, relationships between two or more variables were examined. Cross-tabulated statistical analysis procedures were used to determine whether relationships were significant or not between the relevant set of variables. The Pearson Chi-square value was the significance test most commonly used. All 115 suckler farms were used in analysis. Complete records were eventually obtained for all 115 participant farms.

Multiple linear regression was carried out using S.P.S.S. version 8.0 for Windows. Principle component factor analysis was carried out using the SAS FACTOR procedure. It was hoped that by using this procedure the information contained in many variables could be epitomised into a smaller set of factors with the lowest possible loss of information.

Results

Labour input for farm tasks

The average (mean) labour input over a 12 month period (115 farms for which data was available for all months) was 9.9 hrs/day. The average total bovine and cow herd size of 93 and 54 livestock units, respectively. Labour input per day peaked at 11.5 hours (standard deviation (s.d.) 4.3) in March, and was lowest in December at 8.3 hours (s.d. 3.6). When time associated with enterprises other than suckler beef was excluded, the average labour input peaked in July at 9.6 hours (s.d. 5.4) per farm per day, and was at its lowest in January at 7.0 hours (s.d. 3.5) per farm per day. Over the 12 month period, the average labour input on suckler beef farms was attributed to; feeding - 1.13 hours (11%), cleaning - 0.78 hours (8%), animal husbandry - 2.58 hours (27%), farm maintenance - 1.41 hours (14%), grassland management - 1.51 hours (15%), farm management - 0.82 hours (8%), and other farm enterprises - 1.68 hours (17%). (Figure 3.2).

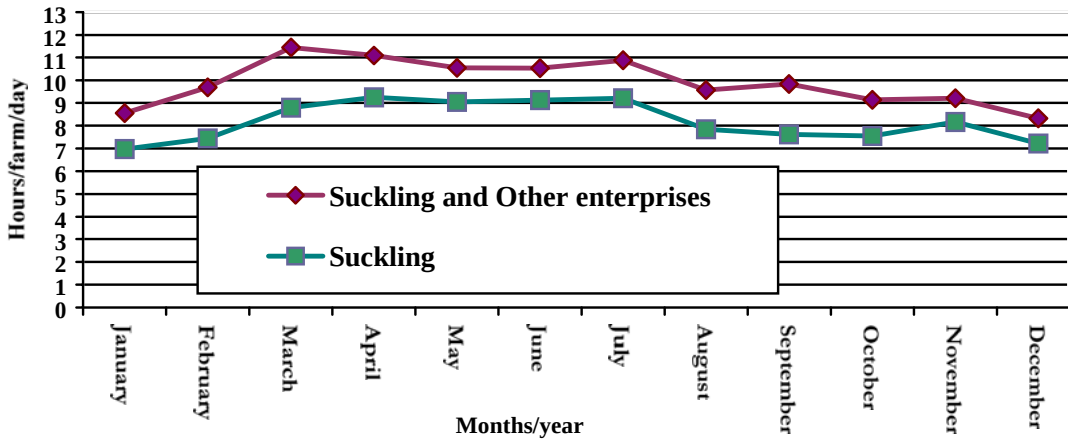


Figure 1: Average labour input for tasks per day over 12 months for 115 suckler beef farms.

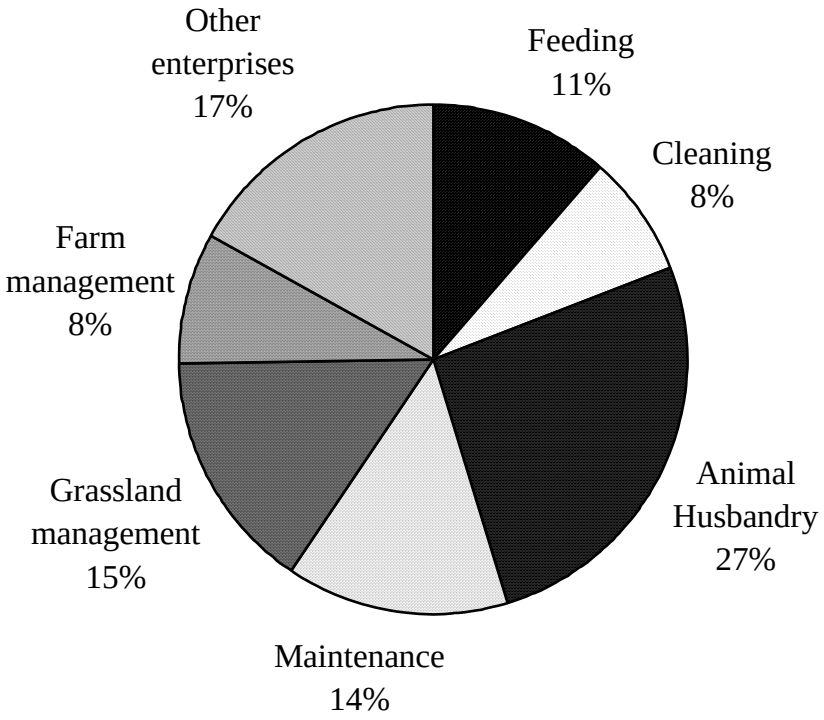


Figure 2: Labour associated with predefined tasks as averaged over 12 months for 115 suckler beef farms.

While net labour associated with many of these individual tasks did not constitute a high demand on total net labour (most tasks took less than 15% of total net labour), they created labour peaks at various periods of the year as illustrated in Figure 3.

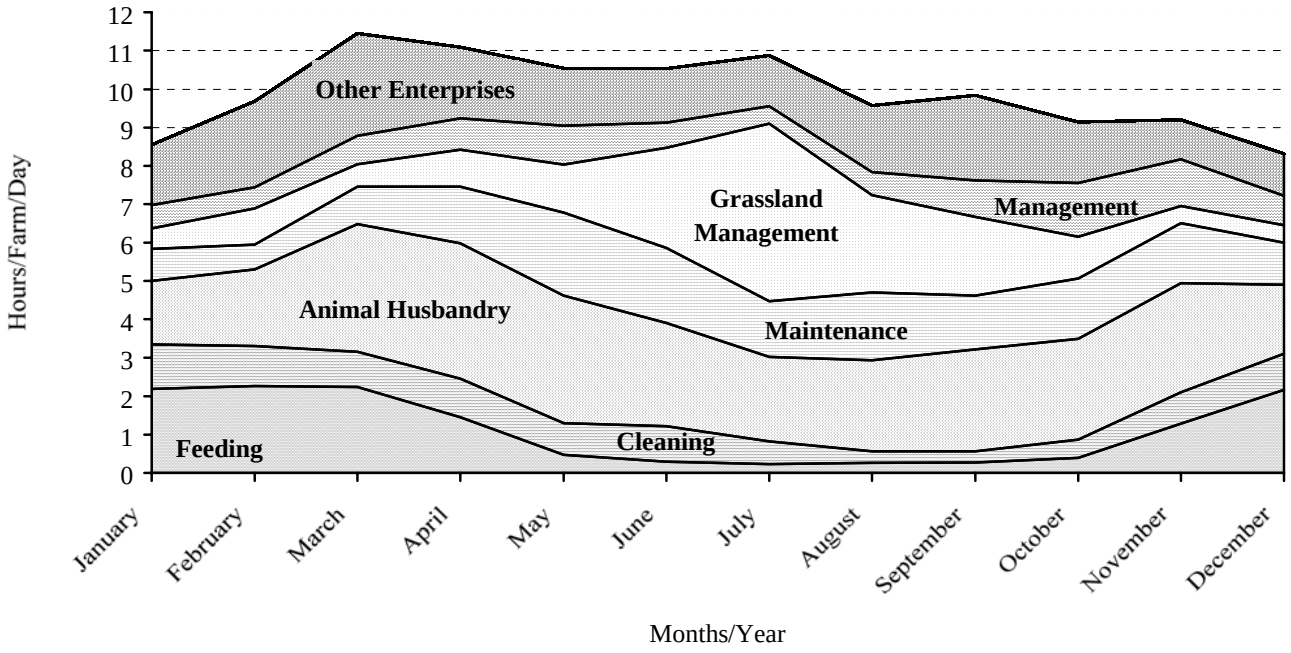


Figure 3: Labour input (hours per farm per day) required to carry out predefined tasks on 115 suckler beef farms. (average cow herd size of 54 cows (s.d. 30) an average total bovine herd size of 93 livestock units (s.d. 62) and average farm size was 72 hectares (s.d. 53)).

Feeding of livestock

Time associated with feeding silage and concentrates was highest in the winter months when stock were housed (Figure 4 below). Time devoted to feeding increased in November, accounting for 1.3 hours (s.d. 1.0) per farm per day as cattle were taken off the grass, it increased further in December and January to 2.2 (s.d. 1.23) and 2.2 hours (s.d. 1.2), per farm per day respectively. Time associated with feeding was highest in February, and March at 2.3 (s.d. 1.4) and 2.2 hours (s.d. 1.0) respectively, as the majority of cattle remained indoors.

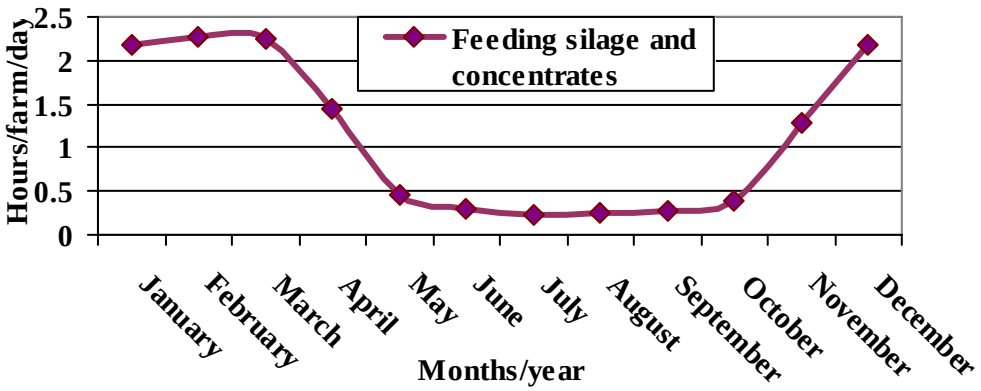


Figure 4: Average labour input for the feeding task per farm per day over 12 months.

Animal husbandry

Animal husbandry tasks were lowest in January at 1.65 hours (s.d. 1.383) per farm per day, increasing in February to 1.99 hours (s.d. 1.676) per farm per day, and were highest in March, April and May, at 3.32 (s.d. 2.093), 3.52 (s.d. 2.706), and 3.32 hours (s.d. 1.951) per farm per day respectively, and averaging 3.37 hours (s.d. 2.064) per farm per day over the 3 months (Figure 5). Time devoted to animal husbandry tasks reached a peak in April, coinciding with the peak calving season. Although time associated with animal husbandry tasks decreased after April, they were still high in May as the breeding season got underway.

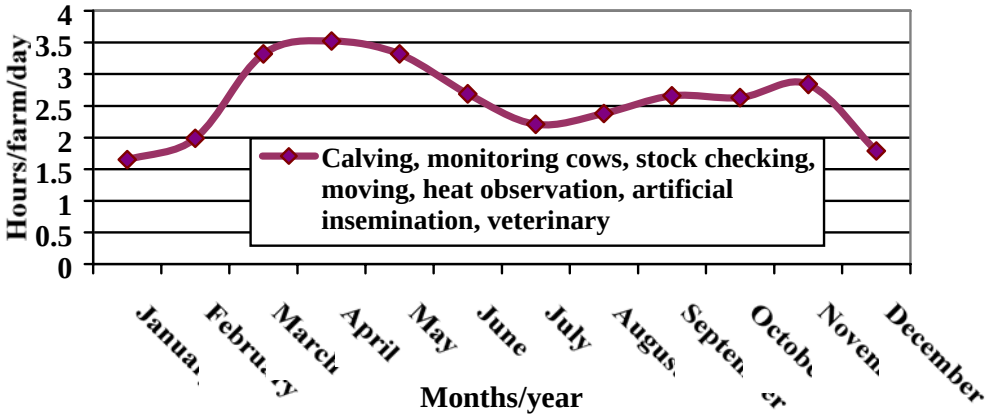


Figure 5. Average labour input for the animal husbandry task per farm per day over 12 months.

Grassland management

Time devoted to grassland management increased in April, May and June, to 0.96 (s.d. 1.357), 1.25 (s.d. 2.151), and 2.61 hours (s.d. 3.974) per day, respectively, reflecting the grass growing season. (Figure 6).

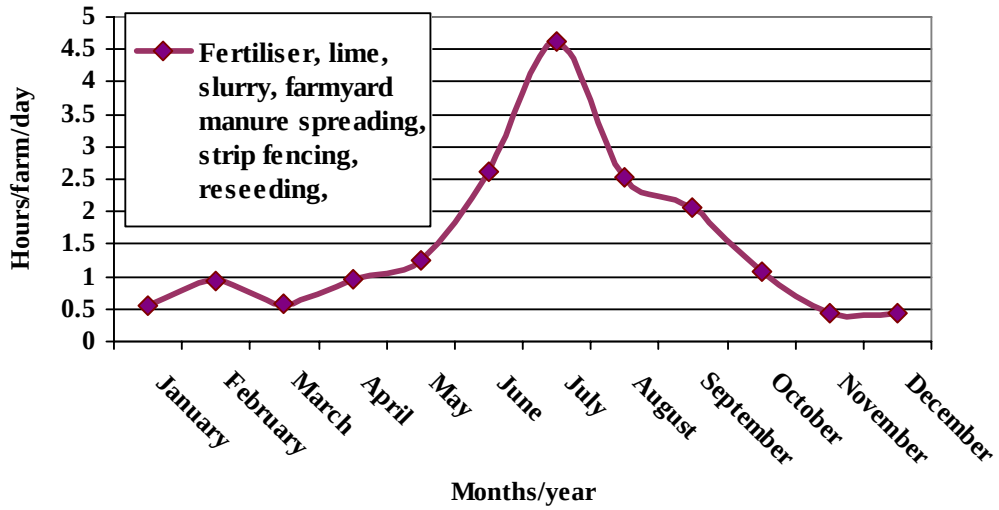


Figure 6. Average labour input for the grassland management task per farm per day over 12 months.

Grassland management activities averaged 1.51 (s.d. 0.921) hours per farm per day over the 12 month recording period, and averaged 2.40 hours (s.d. 0.354) between April and August inclusive.

Farm management

Farm management tasks were fairly even throughout the farm year (Figure 7). Time devoted to farm management was 0.61 (s.d. 0.823) and 0.55 (s.d. 0.788) in January, and February, respectively. It increased during the spring months of March, April and May, at 0.75 (s.d. 0.782), 0.82 (s.d. 1.178), and 1.02 hours (s.d. 1.321) per day respectively, as area aid applications, and farm accounts fell due, calves were registered, and some stock were traded. Time spent on the farm management tasks declined slightly in June, July and August, at 0.66 (s.d. 0.933), 0.46 (s.d. 0.671) and 0.60 hours (s.d. 1.011) per day respectively, as most time on the farm was devoted to outside work.

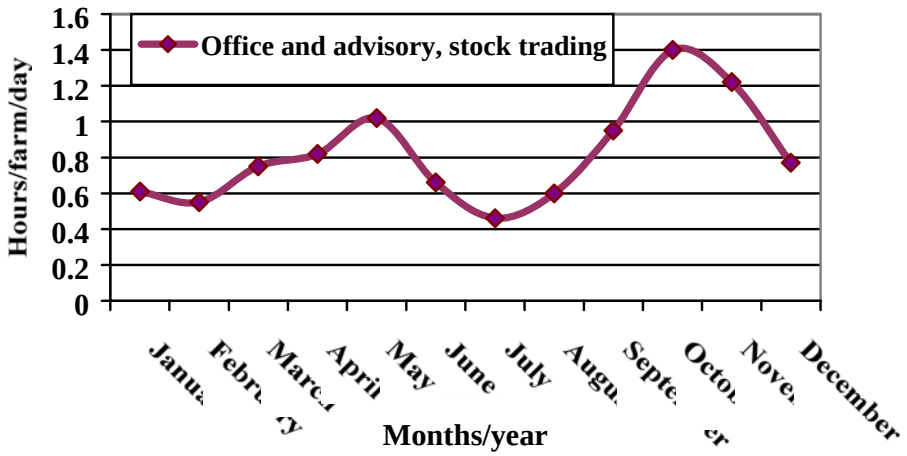


Figure 7. Average labour input for the farm management task per farm per day over 12 months.

Farm time devoted to the farm management tasks increased in September, October and November, at 0.95 (s.d. 1.403), 1.40 (s.d. 1.706), and 1.22 hours (s.d. 1.824) per day, respectively, as there was an increase in the time associated with buying and selling

stock. Farm management tasks decreased in December accounting for 0.77 hours (s.d. 0.817) per day on average. Farm management tasks averaged 0.82 hours (s.d. 0.725) per farm per day over the 12 month recording period.

Animal husbandry accounted for the most time over the 12 month recording period, averaging 2.58 hours (s.d.1.202) per farm per day (Table 1). Other enterprises and grassland management activities were also time consuming taking up 1.68 (s.d. 1.812) and 1.51 (s.d. 0.921) hours per farm per day, respectively.

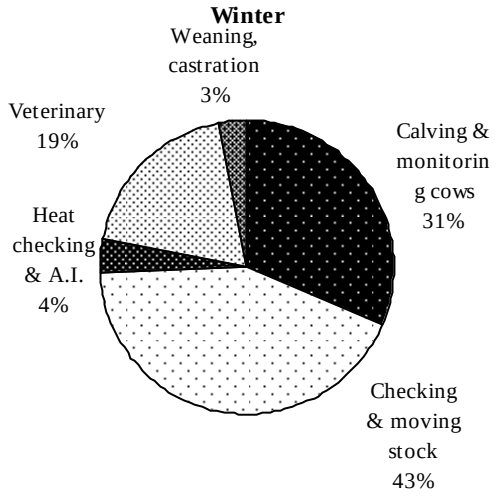
Table 1: Hours per day spent on 115 suckler beef farms averaged over 12 months.

Task	Minimum	Maximum	Average (Mean)	Standard deviation
Feeding	0.23	2.26	1.13	0.591
Cleaning	0.29	1.16	0.78	0.461
Animal husbandry	1.65	3.52	2.58	1.202
Farm maintenance	0.65	2.16	1.41	0.916
Grassland management	0.44	4.63	1.51	0.921
Farm management	0.46	0.82	0.82	0.725
Other enterprises	1.03	2.66	1.68	1.812

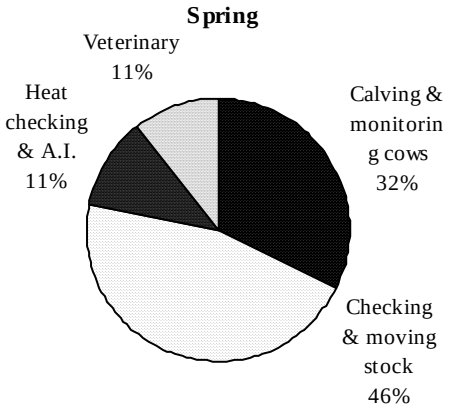
Focus on animal husbandry and feeding

Farmers were spending many hours a day devoted to animal husbandry tasks all year round, and were spending a substantial amount of time devoted to feeding tasks over the winter season.

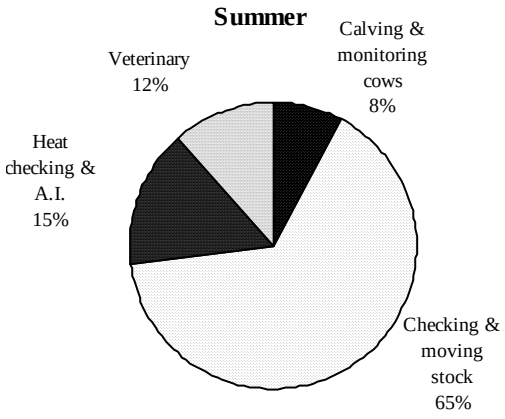
Animal husbandry tasks in the current study were taken to include activities such as calving and monitoring cows, checking and moving stock, heat observation and artificial insemination, weaning and castration as well as veterinary tasks. These tasks are illustrated below in Figure 8, showing the distribution of the animal husbandry components in the spring (March, April, May) summer (June, July, August) autumn (September, October, November) and winter (December, January, February).



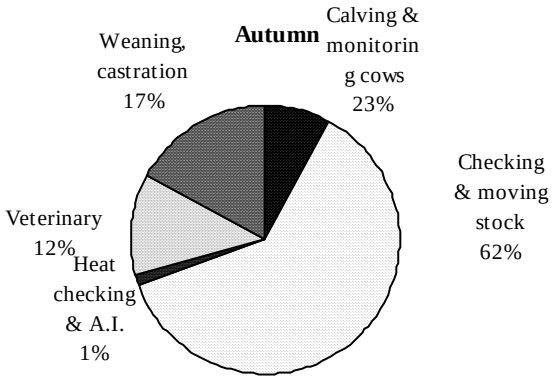
Average 1.91 hours
(s.d. 0.206) per farm per day in winter



Average 3.41 hours
(s.d. 0.113) per farm per day in spring



Average 2.66 hours
(s.d. 0.244) per farm per day in summer

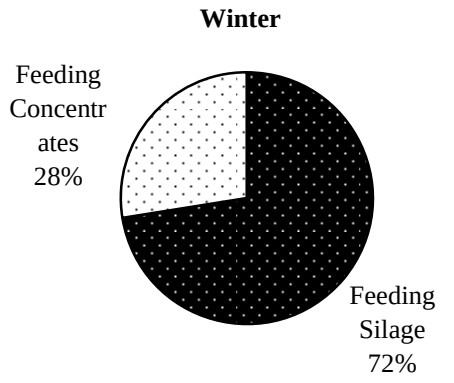


Average 2.95 hours
(s.d. 0.108) per farm per day in autumn

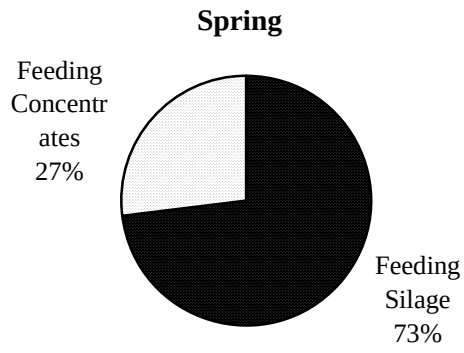
Figure 8: The average distribution of animal husbandry in the winter (December, January, February), spring (March, April, May), summer (June, July, August) and autumn (September, October, November) per farm per day.

Feeding

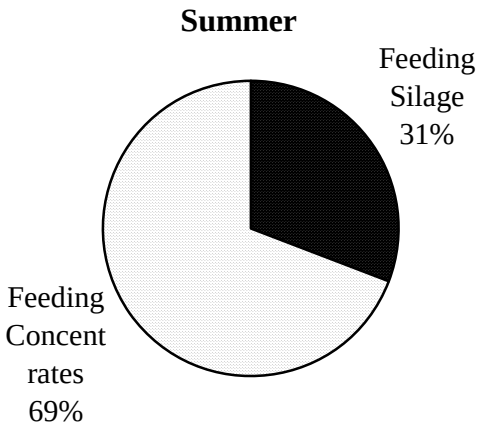
The task of feeding was also cited by farmers as a strenuous task. Feeding accounts for an average of 2.02 hours (s.d. 0.421) per farm per day over the winter and into early spring (approximately 5 months per annum, November - March). It may be worthwhile examining the labour hours devoted to animal husbandry tasks on farm, so to establish whether or not it is possible to improve labour efficiency (Figure 9). Feeding tasks are taken to include tasks such as feeding silage and feeding concentrates to suckler stock. Figure 9 shows the distribution of feeding tasks over each season.



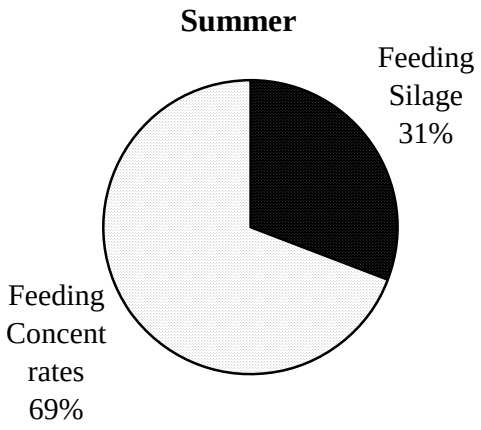
Average 2.21 hours
(s.d. 0.053) per farm per day in winter



Average 1.38 hours
(s.d. 0.892) per farm per day in spring



Average 0.26 hours
(s.d. 0.025) per farm per day in summer



Average 0.65 hours
(s.d. 0.552) per farm per day in autumn

Figure 9: The average distribution of feeding in the winter (December, January, February), spring (March, April, May), summer (June, July, August) and autumn, in hours per farm per day.

There was a decline in time devoted to feeding tasks as the year progresses in Figure 10.

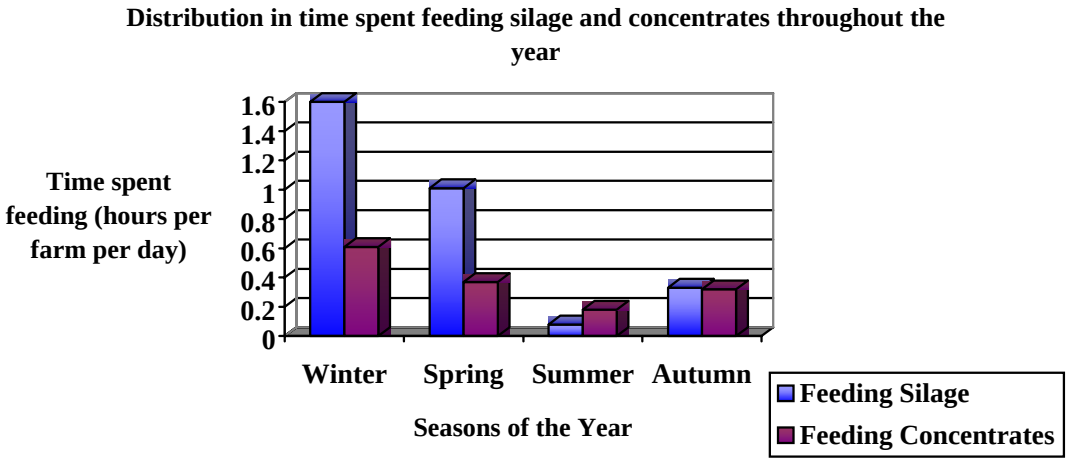


Figure 10: Change in time spent in feeding silage and concentrates as the seasons of the year change.

The feeding process for the winter season was examined further, and the herds were categorised according to total bovine herd size (measured in livestock units). As was the case in analysis of the animal husbandry tasks there were 4 groups: 30 to 50 livestock units (24 herds), 51 to 70 livestock units (28 herds), 71 to 100 livestock units (31 herds) and 101 to 440 livestock units (32 herds).

Time spent at tasks associated with animal husbandry as a proportion of the labour input per day, for different herd categories, is shown in the Table 2. Herds within the study ranged from 30 to 100 livestock units spent between 1.65 (s.d. 0.800) and 2.00 hours (s.d. 0.990) devoted to feeding tasks, which represented between 29 to 32% of the labour input per day. Herds of category 101 to 440 livestock units spent 2.87 hours (s.d. 1.419) devoted to feeding tasks, representing 30% of the labour input per day.

Table 2: Feeding tasks as a proportion of the labour input per day, for different herd size categories over the winter months of December, January, February (n=115*).

Herd size category (Livestock units)	Average labour input devoted to suckler beef per day (hours) over winter	Average labour input devoted to feeding tasks per day (hours) over winter	Average labour input devoted to feeding tasks per day over winter as a percentage (%) of average total net labour input
30 - 50	5.70	1.65	29
51 - 70	6.39	2.03	32
71 - 100	6.25	2.00	32
101 - 440	9.72	2.87	30
Average	7.01	2.14	30

* = number of farms sampled.

Full-time farmers

Data was examined for the 85 full-time farmers over the 12 month recording period. The 85 full-time farmers had an average cow herd size of 58 cows (s.d. 33) and an average total bovine herd size of 101 livestock units (s.d. 68). The average farm size was 81 hectares (s.d. 57). Figure 11 illustrates total labour input (hours per farm per day) required to carry out predefined tasks for the 85 full time suckler beef farmers.

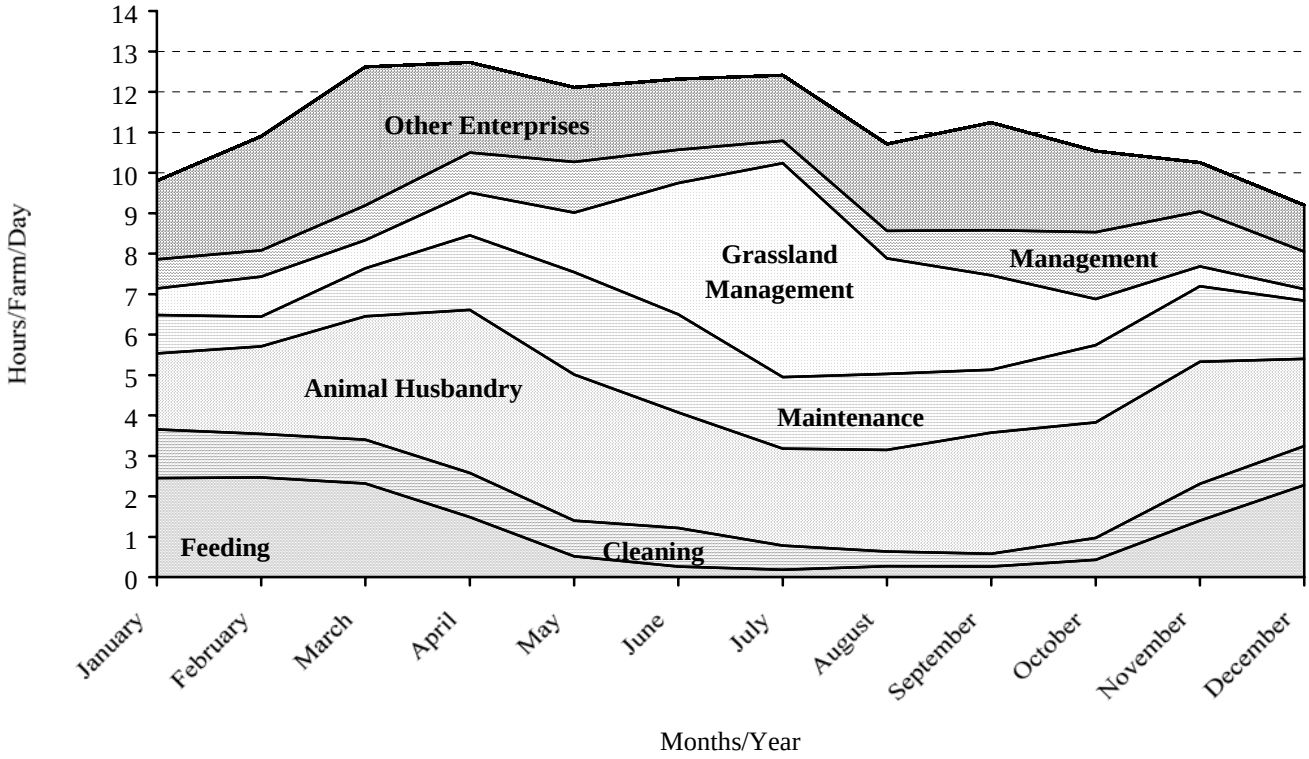


Figure 11: Total labour input (hours per farm per day) required to carry out predefined tasks for a sample of 85 full-time suckler beef farmers.

Part-time farms

Data was examined for the 30 part-time farms over the 12 month recording period. Farms had an average cow herd size of 46 cows (s.d. 19), total bovine herd size of 70 livestock units (s.d. 31) and farm size was 45 hectares (s.d. 24). Figure 12 illustrates total labour input (hours per farm per day) required to carry out predefined tasks on the 30 part time suckler farms.

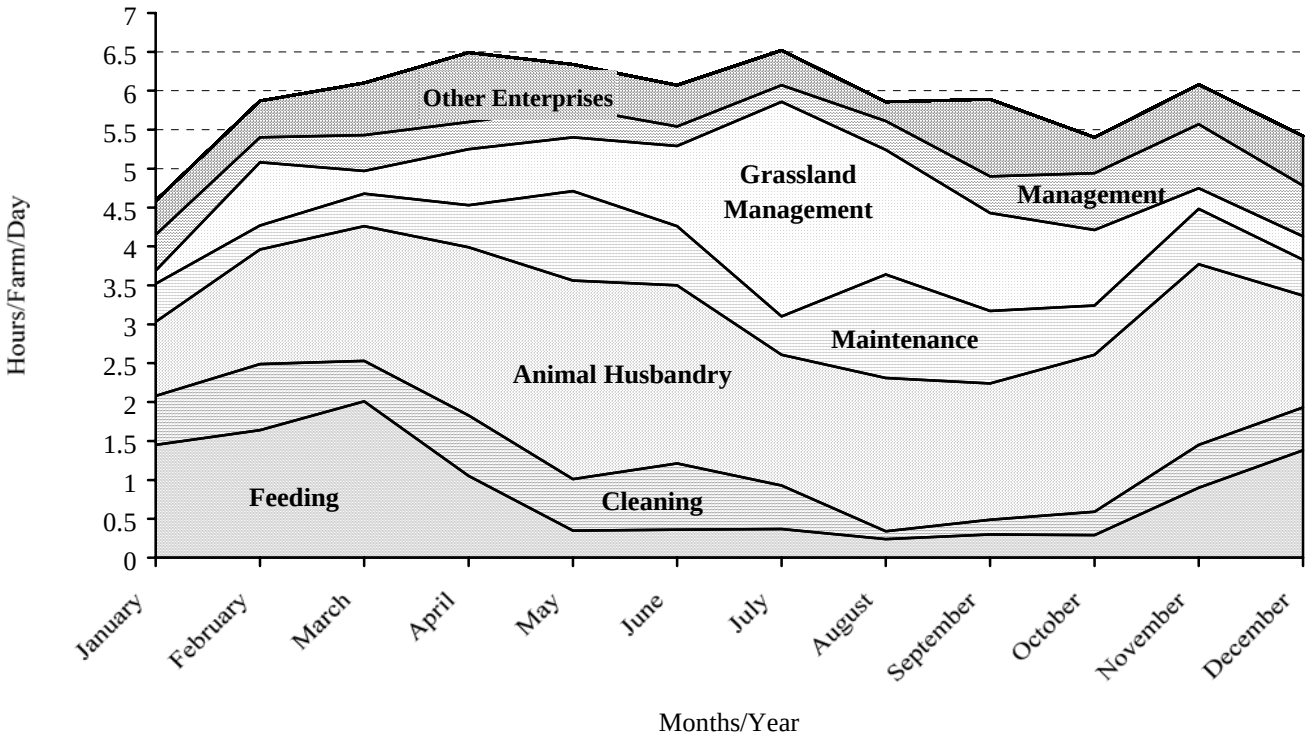


Figure 12: Total labour input (hours per farm per day) required to carry out predefined tasks on the of 30 part-time suckler farms.

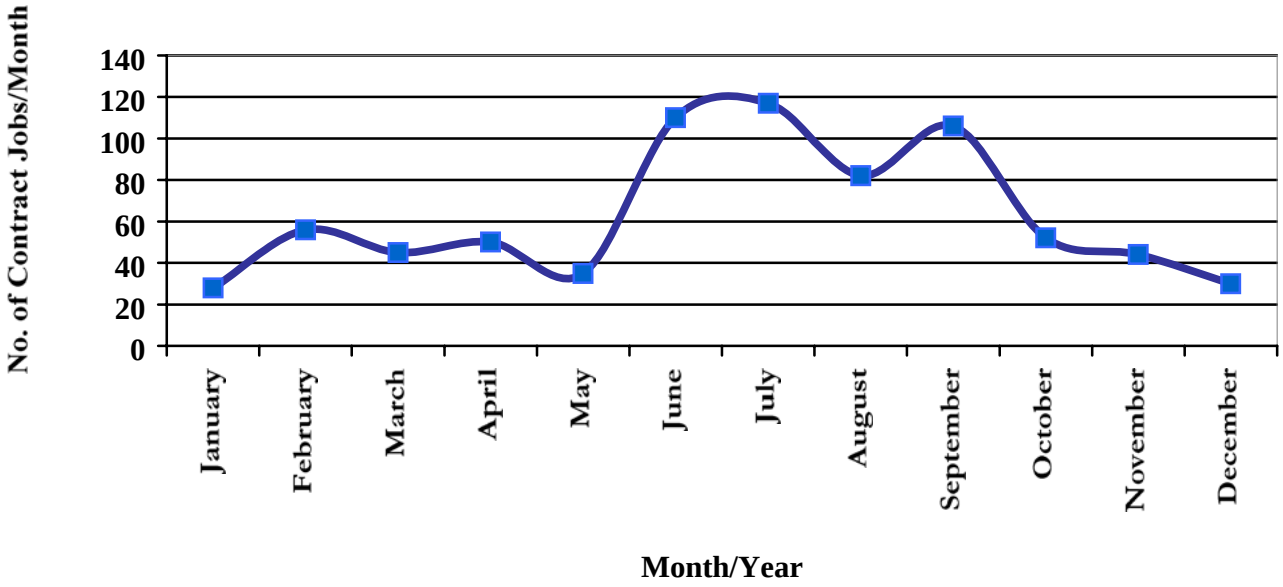
Full and part-time faming compared

The total labour input (hours per farm per day) required to carry out predefined tasks for both part-time and full-time farmers, has a similar pattern of distribution over the farming year. What differs is the actual time assigned to tasks for the average part-time and full-time farmer. A higher proportion of part-time farmers have their cow herd split into autumn and spring calving and so the part-time farm tends to devote more time to animal husbandry tasks in the autumn. Part-time farmers also tended to assign more time to maintenance tasks in the period immediately before the pressures of grassland management began, and later as the pressures of grassland management eased off. There were also a smaller amount of other farm enterprises being operated by part-time farmers, due to the off-farm employment commitment, also where other enterprises were operated by part-time farmers, the majority were small sheep enterprises, or cereal enterprises where the time required for operation was minimal.

Agricultural contractor use on suckler beef farms

The role of the agricultural contractor is becoming increasingly important. Figure 13 shows that in January the number of jobs carried out per month was lowest in winter and highest in summer on the sample of 115 suckler beef farms. The main jobs which contractors were employed to undertake included feeding, cleaning, land and building maintenance, and slurry, farmyard manure and fertiliser spreading tasks.

Monthly Fluctuations in the Recorded use of Agricultural Contractors for all Tasks



The following section examines the contract jobs carried out on the 115 suckler farms for the month of January, April, July and October.

In January, 28 contract jobs were recorded on the total of 115 farms. This was the lowest number of contract jobs per month over the 12 month recording period. The distribution of tasks is presented in Figure 14.

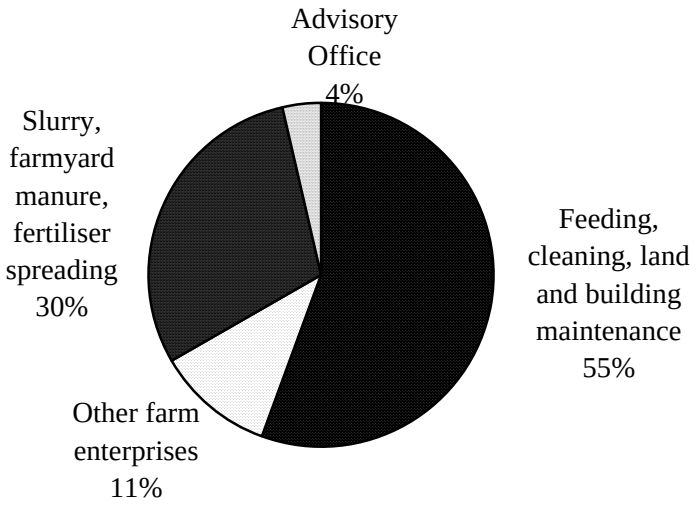


Figure 14: Distribution of tasks by job number undertaken in month of January 2003, by contractors employed by 115 suckler beef farms.

In the month of April the majority of jobs that contractors were employed to undertake in were concerned with slurry, farmyard manure and fertiliser spreading (36% of jobs). Feeding, cleaning, land and building maintenance were also undertaken on many farms in the month of April by contractors (30% of jobs) while animal husbandry, grassland and other enterprise accounted for the minority of jobs for which contractors were employed in the month of April (4%, 18%, 10% respectively). (Figure 15).

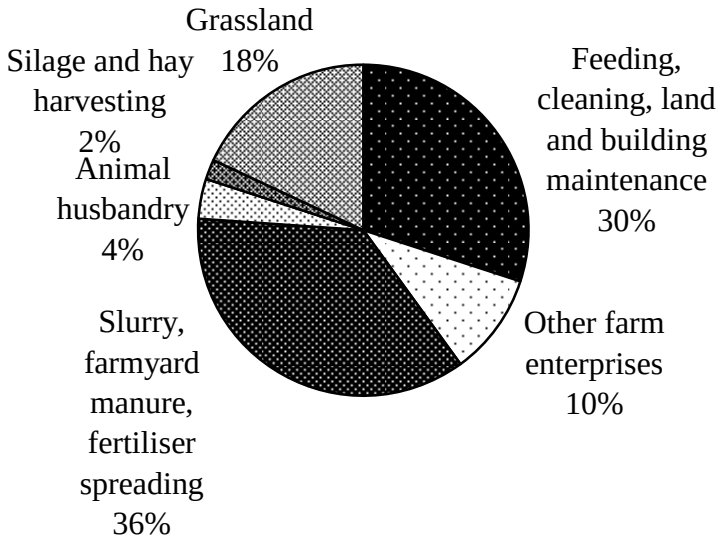


Figure 15: Distribution of tasks by job number undertaken in month of April 2002, by contractors employed by 115 suckler beef farms.

In July a peak of 117 jobs were performed on the sample of 115 suckler beef farms by agricultural contractors. (Figure 16).

In the month of July the majority of jobs that contractors were employed to undertake were concerned with silage and hay harvesting (67% of jobs) and tasks concerned with slurry, farmyard manure and fertiliser spreading (16% of jobs) while other farm enterprises, animal husbandry and feeding, cleaning, and land and building maintenance accounted for the minority of jobs for which contractors were employed in the month of

July (10%, 4% and 3% respectively). It should be noted that farmers have to take whatever weather comes their way. The year 2002 was a particularly bad year weatherwise. Farming endured the worst May and June since records began. The beginning of July was little better, and the weather began to improve in Mid July (Lynch, 2002).

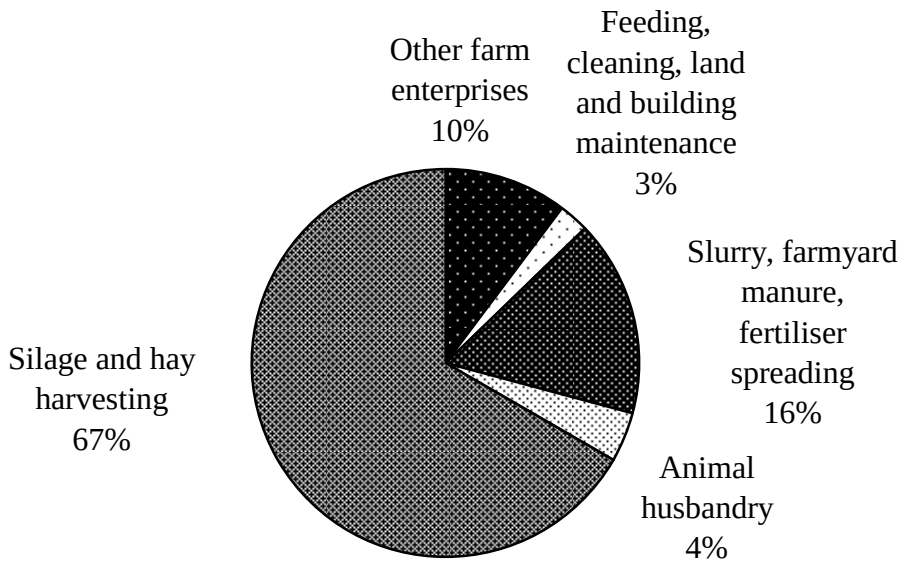


Figure 16: Distribution of tasks by job number undertaken in month of July 2002, by contractors employed by 115 suckler beef farms.

In October 52 jobs were performed on the sample of 115 suckler beef farms by agricultural contractors. (Figure 17). In the month of October the majority of jobs that contractors were employed to undertake were concerned with feeding, cleaning and land and building maintenance (45% of jobs) and slurry, farmyard manure and fertiliser spreading tasks (23% of jobs). The minority of jobs completed by contractors in October were concerned with animal husbandry, other farm enterprises, silage and hay harvesting and grassland activities (10%, 10%, 6% and 6% respectively).

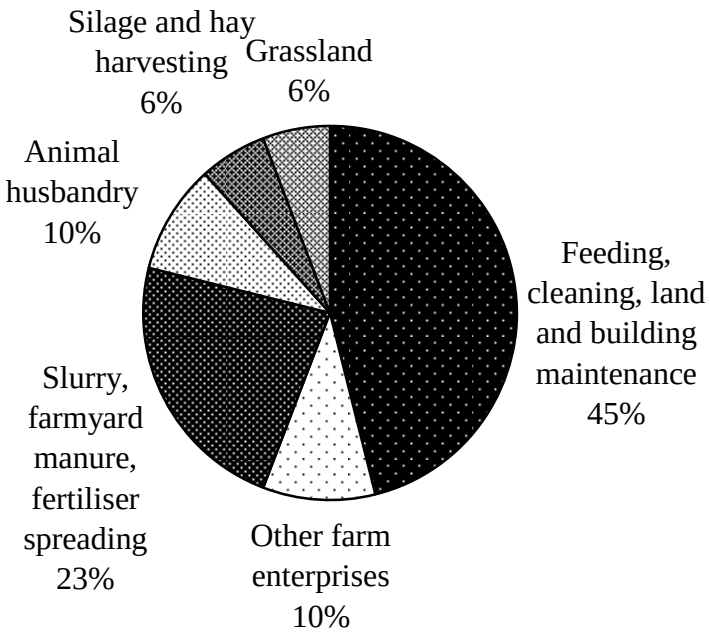


Figure 17: Distribution of tasks by job number undertaken in month of October 2002, by contractors employed by 115 suckler beef farms.

The number of contract jobs per month assigned to slurry, farmyard manure and fertiliser spreading tasks was highest in February and March. It declined then in April and May, only to increase again in the summer as silage was cut.

Labour efficiency on suckler beef farms

It was decided to examine in detail the labour efficiency levels on the farms which participated in the study, so that the range of values as well as an average value could be obtained. For the purposes of this study labour efficiency was measured as the labour input per cattle livestock unit per annum on farm Figure 18 shows the variation in labour efficiency on the farms. The X-axis containes the 115 sample farms used in the study, while the Y-axis measures the labour input in hours, per livestock unit, per annum.

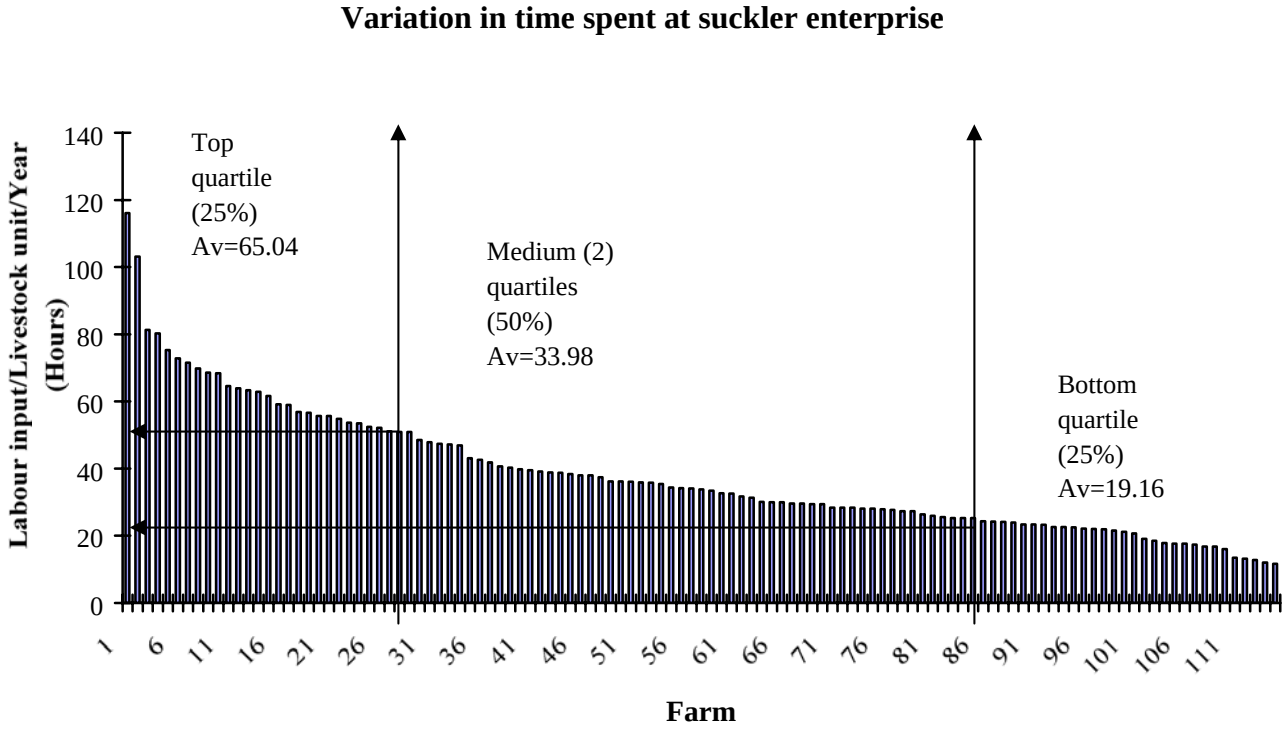


Figure 18: Variation in time spent by 115 sample farms at suckler beef per farm as measured in Labour input hours per livestock unit per year.

Figure 18 shows a large variation in time spent per annum devoted to the suckler enterprise on the farm. The farms were split into quartiles for ease of explanation.

The top quartile (0.25 of the sample) group spend an average of 65 (s.d. 15) hours per livestock unit per year on the farm and ranged from 116 to 51 hours per livestock unit per year. The medium quartiles combined (middle 0.50 of the sample) groups spend an average of 34 (s.d. 7) hours per livestock unit per year on the farm, and ranged from 49 to 24 hours per livestock unit per year. The bottom quartile (0.25 of the sample) spend an average of 19 (s.d. 4) hours per livestock unit per year on the farm, and ranged from 26 to 12 hours per livestock unit per year on the farm.

There was large variation in labour efficiency levels amongst the farms used for study, as evident from the range 116 to 12 hours per livestock unit per year on farm.

As the average labour input per livestock unit per farm per year was 32 hours there is considerable scope for improving labour efficiency on suckler beef farms.

Variation in labour efficiency on full-time and part-time farmers

There was a large variation in the level of labour efficiency on full-time and part-time farms. Figure 19 details the variation in time spent by the 85 full-time farms at the suckler beef enterprise on farm as measured in labour input hours per livestock unit per year.

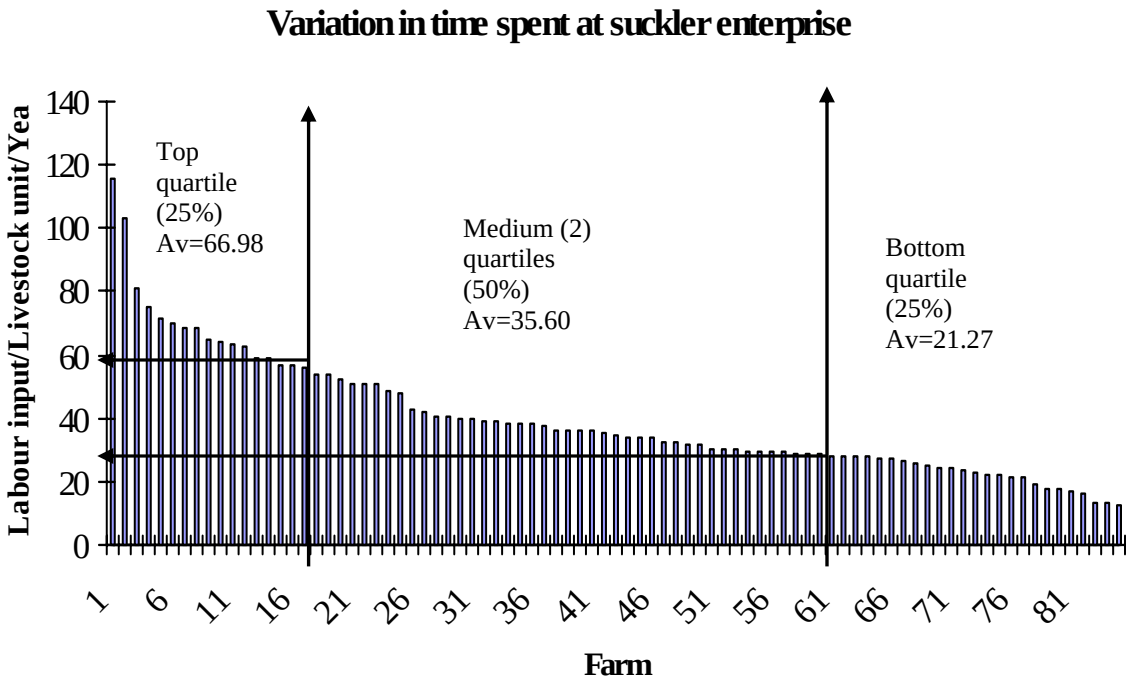


Figure 19: Variation in time spent by 85 full-time sample farmers at suckler/beef enterprise per farm as measured in labour input per livestock unit per year.

The top quartile on the graph (0.25 of the sample), spend an average of 67 hours (s.d. 16) per livestock unit per year on the farm and 116 hours to 51hours per livestock unit per year. In the medium quartile (0.50 of the sample) group spent on average of 36 hours (s.d. 6) per livestock unit per year on the farm and ranged from 51 hours to 36 hours per livestock unit per year on the farm. At the bottom (0.25 of the group) spent an average of 21 hours (s.d. 5) per livestock unit per year on the farm and ranged from 28 hours to 13 hours per livestock unit per year on the farm. The least efficient full-time farm spends 116 hours per livestock unit per year on the farm, while the most efficient full-time farm spends 13 hours per livestock unit per year on the farm.

Figure 20 details the variation in time spent by the 30 part-time farmers at the suckler beef enterprise on farm as measured in labour imputs per livestock unit per year.

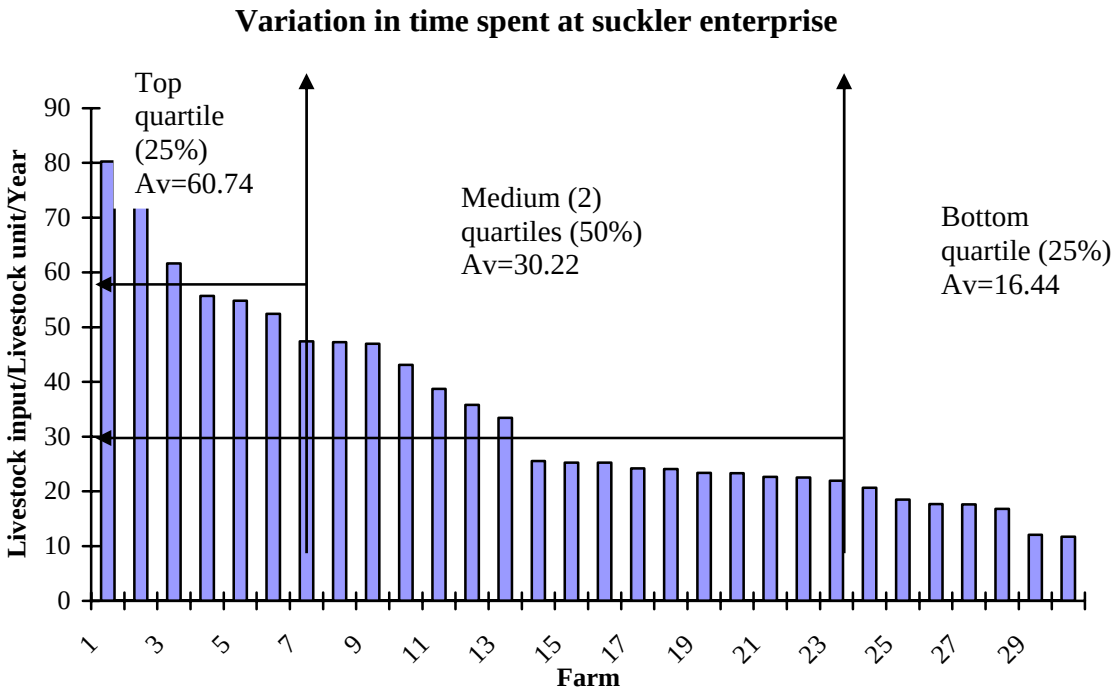


Figure 20: Variation in time spent by 30 part-time farmers at suckler beef enterprise per farm as measured in labour input hours per livestock unit per year.

The top quartile (0.25 of the sample) spent an average of 61 hours (s.d. 12) per livestock unit per year on the farm and ranged from 80 hours to 47 hours per livestock unit per year. The median quartiles (0.50 of the sample) spent an average of 30 hours (s.d. 8) per livestock unit on the farm and ranged from 47 hours per livestock unit to 22 hours per livestock unit per year. The bottom quartile (0.25 of the group) spent an average of 16 hours (s.d. 4) per livestock unit on the farm and ranged from 21 hours to 12 hours per livestock unit per year.

The average labour input per livestock unit over the 12 month recording period on full-time farms was 32 hours per livestock unit per year on farm, this compares with a lower value of 24 hours per livestock unit per year for part-time farmers and indicates that the part-time farmers uses labour more efficiently than the full-time farmers.

In comparing part-time and full-time farmers in each of the quartile the range of values is much greater in the sample of full-time farmers as compared to the sample of part-time farmers.

It could be concluded that the average part-time farmer is more labour efficient than the average full-time farmer, and the range of labour efficiency is much greater within the full-time sample than the part-time sample.

Factors affecting labour use on the suckler beef farm

The considerable variation in labour efficiency on suckler beef farm would indicate that many factors affect labour use on the farm. The main objectives of the monthly questionnaires which accompanied the farm timesheets was to gain an insight into farm practices and facilities, and to identify factors which influence labour use on the suckler beef farm.

The following is a summary from the questionnaires results showing that there are many farm factors which had a significant influence on labour use on the Irish suckler farm.

- Part-time farmers had a shorter farm work day than full-time farmers, this may be for a number of reasons. Part-time farmers are under increasing pressure for time, so they have to become efficient, to manage the farm and their off-farm employment. Part-time farmers are likely to have a smaller number of other enterprises on farm, or indeed smaller cattle herd numbers.

- Farm size (hectares and herd size) also affected labour use on farm. Larger farms required additional labour, but were also managed with a high level of labour efficiency. However, annual hours per farm worker also increased with farm size.

- As the number of enterprises increased on farm, the farm became increasingly diverse and required more labour. Many labour specialists recommend that when

addressing labour management that farm systems should be streamlined, so that work practices are simplified, labour demand can be predicted, and decision making is eased.

- Many factors affect labour use on farm in spring, when labour demand peaks. Farmyard fragmentation and calf health problems in spring hinders labour efficiency, while time saving equipment such as calving observation cameras ease the workload.

- Record keeping also helps to manage the workload. It is important over the spring period when labour demand is at its highest that the most effective and efficient labour practices are put in place to ease the workload associated with lambing and spring calving, while at the same time paying maximum attention to farm safety.

- Farmland fragmentation over the grazing season also affected farm labour use. Farmland fragmentation is a real constraint when trying to maximise labour efficiency on farm. In Ireland, the availability of land for rent or purchase is in short supply and farmers are often forced to buy or rent land away from their main farm in an effort to expand their business, labour efficiency can suffer in the process.

- Many socio-economic factors were identified as influencing labour use on farm. The farmers age as well as the number of years he/she had spent farming influenced labour efficiency in a negative way on farm, this may be due to a number of reasons, for example health problems or illness associated with old age including rheumatism and arthritis which constrain movement.

- Older farmers are more likely to be in a work routine and are less likely to take a step back and change the way they have been completing a certain task for the last 30 years.

- The proportion of young children on the farm (stage of family lifecycle) had a positive relationship with farm labour efficiency. Added family pressures especially when the spouse is engaged in off-farm employment forces the farmer to tighten up his/her labour use on farm.

- The level of the farmers education also had a positive relationship with labour efficiency on farm. The assumption here maybe that the more educated farmers look at the quickest most practical way of completing a task and are more innovative and open to change.

- The quality of farm facilities and farm buildings also had a positive relationship with farm efficiency. Easy accessible, well-designed housing and farm facilities are crucial to reducing labour use on farm. Easy access to a handling unit reduces labour used when treating or testing stock.

- The farm business can also be managed with labour efficiency in mind. Farms that experienced long work days were more likely to delegate responsibility for the farm office to another family member.

- A personal computer was also recognised as a very labour friendly device for keeping farm records up to date.

- Throughout the winter period, when stock were moved inside and the majority of tasks undertaken on farm occurred in the farmyard, farmyard fragmentation again influenced labour use. The level of mechanisation on farm for such tasks as cleaning and bedding and the feeding regime implemented on farm all influenced labour use.

- Putting silage in place at several day intervals can reduce the amount of labour used feeding silage. Early stock turnout also reduces labour use in late winter.

- Farm stress and time pressures were all evident on farm. Most farmers worked beyond a typical 8-hour day.

- A set finishing time gave farmers a focus and improved labour efficiency on farm,

- The most labour efficient farmers felt on top of their work. Time spent dealing with interruptions increased on inefficient farms, as did the time set aside for making positive changes.

- Regular time off and holidays increased on farms where the total work day decreased. Inefficient farmers were expanding farm tasks to fill the days and perhaps did not believe that they had time for or were worthy of a break.

- Organising work well in advance had a positive relationship with labour use on farm.

- Farm income also increased with labour efficiency, suggesting that the best financial managers are also the best time managers.

In summary there are many lessons to be learned here, if intending to improve time management on farm, capital expenditure on improving farm facilities and handling units as well as the farm business management system will all improve labour use on farm, however there are numerous cost effective ways of reducing labour use on farm as well. Constructing a simple weekly, monthly and daily work plan to achieve farm objectives and long term farm goals will give increased work satisfaction. A set work finish time will give the farmer a "focus", and something to work towards for the day. Taking a step back from work practices, with an open view to change and modify the way in which tasks are completed will yield rewards, as will keeping up to date with farm maintenance and repair work. Concentrate on doing one task at a time, and also seek to minimise interruptions. Keep all equipment and materials needed to complete a task close to the task site. By following these cost-effective steps labour efficiency on farm can be

improved, which in turn improves financial return and/or discretionary leisure time on farm.

Predicting labour hours per cattle livestock unit per year using multiple regression

This part of the study involved using the concept of multiple linear regression to predict labour hours per cattle livestock unit per year which was the dependent variable from several independent or predictor variables in order to explain the considerable variation between farms.

A stepwise multiple regression model was used for the purposes of this study. In this case the computer selects the variable that has the highest bi-variate correlation with the outcome and enters it into the equation. Then it examines the semipartial correlations (which removes the correlation with the first predictor variable and enters the variable with the highest semipartial correlation). After each step, variables already entered are examined to see if they still make a statistically significant contribution. If not they are removed. Then the procedure continues until the remaining variables no longer make a significant additional contribution to the multiple correlation (R). The main advantage of this method is that there is no issue with two related variables cancelling each other out.

The dependent or outcome interval variable was labour hours per cattle livestock unit per farm per annum. The independent variables or predictor variables were selected from the farm-based questionnaires. Independent variables were selected if they had been previously seen to have a significant association with labour hours per livestock unit per annum on farm.

The following independent or predictor factors were incorporated into the model:

- Farming status (farm full-time or part-time)
- Farm size (hectares)
- Farmers age on the farm
- Years spent farming by farmer
- Proportion of young children on farm
- Farmers level of education
- Cattle herd size on farm

- Cow herd size on farm

A total of 71 study participants were incorporated into the model out of a maximum study sample of 115, 44 farmers had missing data which was relevant to the variables used within the model and so were excluded from the model.

Equation derived from the model

The model identified, using the variables above, that 63% of the variation (Adjusted R Square of 0.597, in labour hours per livestock unit per farm per year can be predicted from the above independent variables. The predictor variables selected were: average livestock units on farm, whether or not the farmer had a young family on farm (stage of the family cycle), and average livestock units on farm squared, whether or not the holding was being farmed full-time, and the farmers age. The model summary is presented in Table 4:

Table 4: Summary of labour hours per farm per annum model.

Model	R	Predictors	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.527	A	0.277	0.267	16.8543
2	0.681	B	0.464	0.448	14.6201
3	0.733	C	0.537	0.516	13.6892
4	0.771	D	0.594	0.569	12.9244
5	0.792	E	0.626	0.597	12.4897

A = Average cattle livestock units on farm;

B = A, and Proportion of the farm household made up of children under the age of 12 years;

C = A + B and Average cattle livestock units on farm squared

D = A + B + C, Farming status;

E = A + B + C + D, Farmers age.

Table 4 shows that the first model accounts for 28% of the variation. The second model accounts for a 46% variation, the main predictor added to the original model which improved the variance was the proportion of young children on the farm. The third model

accounts for 54% of the variation and takes account of the average number of cattle livestock units on the farm squared, as well as the earlier predictor variables. From the Table 4 the fourth and fifth model add very little to the original model, improving the variation by under 10%.

In summary the model identified indicates that 63% of the variation in labour hours per livestock unit per farm per year can be predicted from the predictor variables selected.

Principal component factor analysis on factors affecting labour use

The objective of this exercise was to reduce the number of variables used in the study while retaining as much variation as possible, and exploring the correlations among variables considered to be most closely related to labour use efficiency.

There were 7 variables used in the analysis, selected from the farm-based questionnaires, and identified as having a significant influence on labour use on suckler farms over the farming year. These variables were also cited in the literature as influencing labour use on farm.

The 7 variables are listed as follows:

- Farm size (hectares)
- Cattle herd size on farm (livestock units)
- Cow herd size on farm (livestock units)
- No. of parcels farmed
- No. of fragments over which cow herd is fragmented
- No. of feed areas on farm
- Stocking rate on farm

The output of a factor analysis gives several useful elements which helps to determine the number of components or factors to be retained for further analysis (Table 5). A good rule of thumb for determining the number of factors is the "eigenvalue greater than 1"

criteria. This criteria means that any factors retained will account for at least the variance of one of the variables used in the analysis.

Table 5: Extraction of components/factors from 7 original variables.

Factors	Eigenvalue	% of variance	Cumulative % of variance
1	2.65	37.9	37.9
2	1.38	19.7	57.6
3	1.32	18.9	76.5
4	0.82	11.7	88.2
5	0.52	7.4	95.6
6	0.26	3.7	99.3
7	0.05	0.7	100.0
Total	7.00000000	100.0	

From Table 5 it is evident to exclude factors that account for less and less variance. From the eigenvalue column it is clear that the first three factors have values of >1, therefore, the final solution will only represent 76.5% of the variance in the data.

The next panel of factor analysis will look like the data presented in Table 6. The loadings listed under the "factor" headings represent a correlation between that item or variable and the overall factor. The correlations range from -1 to 1. From the Table 6 there appears to be high loadings between farm size as measured in hectares, cow herd size as measured in livestock units, and cattle herd size as measured in livestock units, and factor 1. There also appears to be high loadings between the two variables number of parcels farmed, and the number of fragments over which the herd was split and factor 2. Finally there appears to be high loadings between the variable concerned with stocking density on farm and factor 3.

Table 6: Unrotated factor matrix.

Variables	**Factor 1**	**Factor 2**	**Factor 3**
Farm size (hectares)	**0.86901**	0.00870	-0.31085
Cattle herd size on farm (livestock units)	**0.91107**	-0.30681	0.10696
Cow herd size on farm (livestock units)	**0.83256**	-0.26756	0.28251
No. of parcels farmed	0.35036	**0.75213**	0.22844
No. of fragments over which cow herd is fragmented	0.13783	**0.60334**	0.63181
No. of feed areas on farm	0.46805	0.18805	-0.29298
Stocking rate on farm	-0.11983	-0.50099	**0.77208**

Naming the factors

Now a highly interpretable solution has been computed, which represents almost 80% of the data. The next step is to name the factors. Past methodologies recommend that factor names should be brief, one or two words maximum, and communicate the nature of the underlying construct. It is useful to look for patterns of similarity between items that load on a factor. Names should communicate the conceptual structure of the factors to others. In addition, it may be useful to look at items that do not load on a factor, so to determine what that factor isn't. As is evident from the above table (figures in bold), the main items that seem to load on factor 1 are all concerned with farm size, these are namely land farmed, cattle livestock units on farm, and cow numbers (livestock units) on farm, in the case of factor 2 the main items that load here are concerned with farm fragmentation, namely the number of parcels farmed and the number of parcels over which the cattle herd is farmed. Finally, in the case of factor 3, stocking rate (farm intensity) seems to be the most important item.

From the data presented in Table 6 some variables are negatively correlated with certain factors. Herd size for example is negatively associated with factor 2, where the main items that load are concerned with farm fragmentation. This appears to suggest that farms that are more fragmented tend to be smaller in scale also. Farm intensity is negatively associated with factor 2, where the main items that load are concerned with farm

fragmentation. This appears to suggest that farms that are fragmented tend to have a smaller stocking density and are operating a less intensive farming system. Stocking density or farm intensity is negatively associated with factor 1, where the main items that load are concerned with farm size. This appears to suggest that as farm size increases stocking density increases also.

Figure 21 to 23 below illustrate further the relationship between each of the factors and labour efficiency on the sample of 115 suckler beef farms.

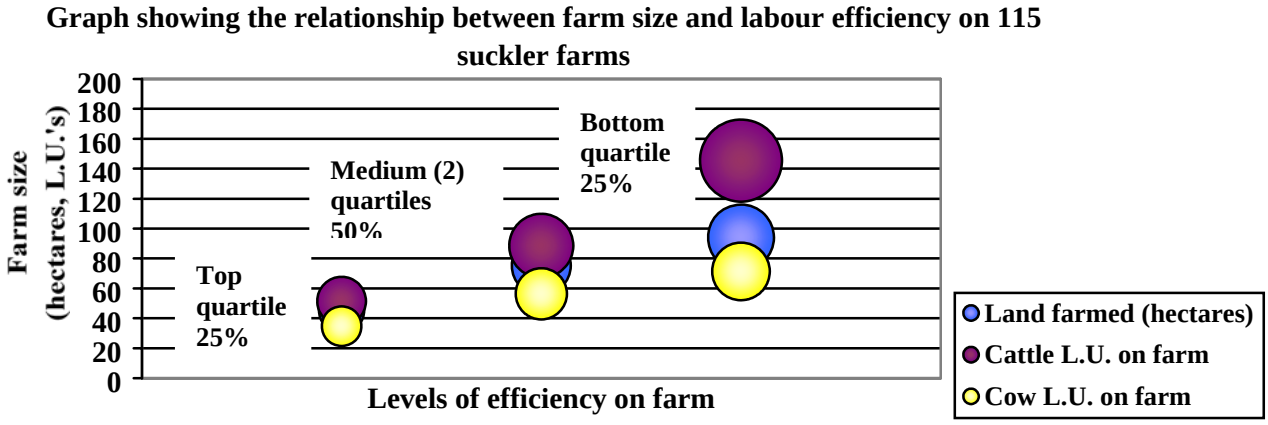


Figure 21: Graph showing the relationship between farm size and labour efficiency as measured in labour hours per livestock unit per year on a sample of 115 Irish suckler beef farms.

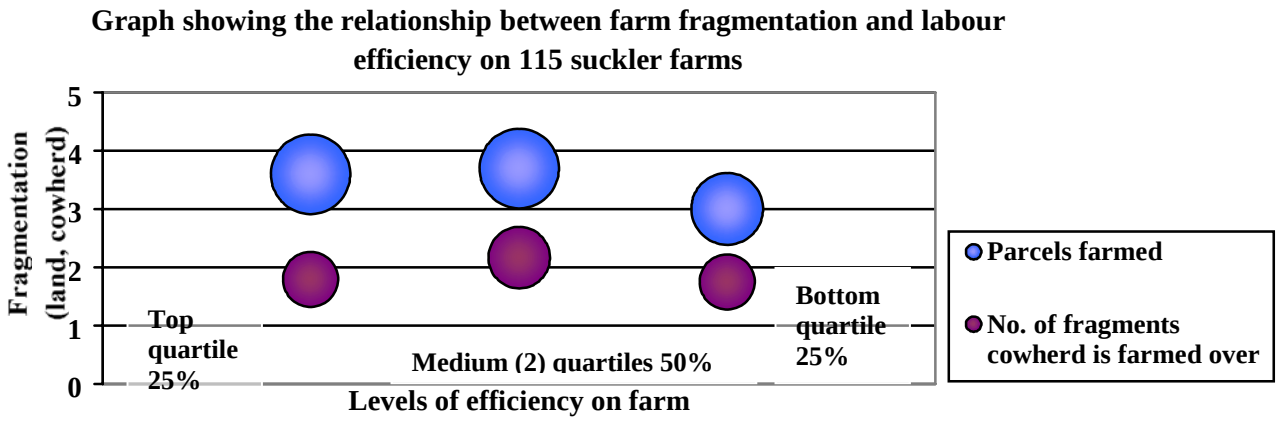


Figure 22: Graph showing the relationship between farm fragmentation and labour efficiency as measured in labour hours per livestock unit per year on a sample of 115 Irish suckler beef farms.

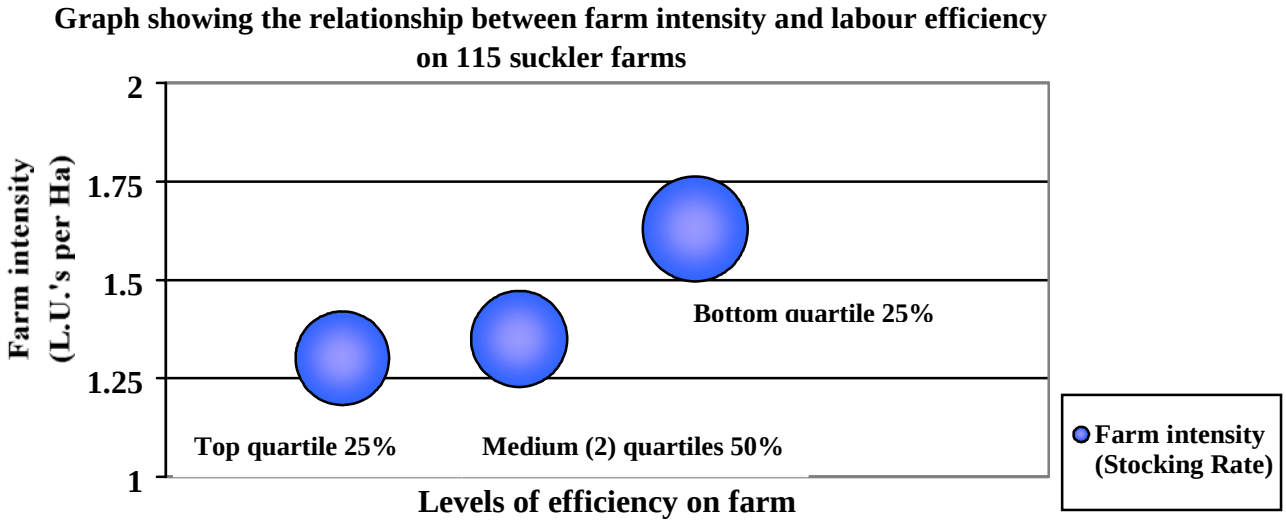


Figure 23: Graph showing the relationship between farm intensity and labour efficiency as measured in labour hours per livestock unit per year on a sample of 115 Irish suckler beef farms.

Figures 21 to 23 illustrate diagrammatically the relationship between the three computed factors namely farm size, farm fragmentation and farm intensity. Each figure shows clearly how each characteristic within the factors changes as labour efficiency on farm changes, and whether this change is positive or negative.

From simple statistical analysis carried out on the factor analysis, it seems that as labour efficiency has a positive relationship with farm size. Farm fragmentation has a negative relationship with labour efficiency, while stocking density has a positive relationship with labour efficiency.

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