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Benchmarking Labour Input on Irish Dairy Farms with Use of a Smartphone App

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Traditionally, the average herd size for Irish farms has been relatively small with an average size of 68 cows in 2015, and could be managed by the farmer and family members. However, it is projected that the Irish dairy sector will grow by up to 50 % by 2020. Thus, it is important that labour efficiency be increased, both in terms of a low availability of labour sources and also a high cost of labour. Labour has been identified as one of the highest costs on dairy farms, thus optimizing labour efficiency is an important influencing factor in increasing farm profitability. The objective of this study was to quantify levels of labour input on spring-calving Irish dairy farms relating to a range of dairy farm tasks over a 1-year period. Between 2015 and 2016, 38 farms from across the country participated in the project. Labour input was recorded through an app on a smart phone and a monthly online survey. Data was recorded for 3 consecutive days each month and were sent directly to the cloud server. Herd sizes ranged from 79 cows to 534 cows and were grouped into one of three herd size categories for analysis. Herd size category (HSC) 1 were farms with < 150 cows, HSC 2 were farms with 150-249 cows, and HSC 3 were farms with 250+ cows. Average total farm labour input was 4,017 hours per year with an average herd size of 193 cows. Average farm labour efficiency was 21.7 h/cow/y with HSC 1 and 2 being similar, but farms in HSC 3 were significantly more labour efficient, with an average efficiency of 17.5 h/cow/y. A seasonal pattern to labour demand on farm was witnessed with the highest labour input in the spring (February, March, April) at 1,777 hours, dropping slightly during the summer (May, June, and July) to 1,663 hours, again during the autumn (August, September, and October) at 1,412 hours and tapering off during the winter (November, December, and January) to 885 hours. While there was no significant difference in hours worked by the main farm operator across herd size categories, the proportion of the farm's total work conducted by that person varied with the farmer doing 76 %, 56 %, and 37 % of the total farm labour in HSCs 1, 2, and 3, respectively. There were significant differences between hours worked by hired labour across HSC with HSC 3 utilising the highest amount of hired labour. Thus, optimising labour efficiency on Irish dairy farms is important on both the smaller family farms where the work-life balance needs to be maintained and equally on the larger farms where that same balance is required in addition to reducing costs of hired labour.

Introduction

Dairy farming is the main enterprise for more than 16,000 farm households in Ireland and it continues to represent the most profitable Irish farm business (NFS, 2015). Traditionally, the average herd size for Irish farms has been relatively small with an average size of 68 cows in 2015 (NFS, 2015), and could be managed by the farmer and family members. However, with the EU milk quota abolition in 2015, it has been expected that the Irish dairy sector will grow by up to 50 % by 2020 (DAFM, 2014). Second to feed costs, labour has been identified as one of the highest costs on dairy farms (Hemme et al., 2014) and compared to other EU countries, Ireland has historically had low milk production per labour unit (Donnellan et al., 2011), thus optimizing labour efficiency is an important influencing factor in increasing farm profitability. Intensive research on Irish dairy farm labour efficiency was last conducted in the early 2000s and under the constraints of the European milk quota regime (O'Donovan et al., 2008). That study, recorded a labour input of 41.4

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hours/cow/year. That level of labour input per cow is not sustainable as herd size increases. It is expected that cow numbers will have increased to 1,450,000 by 2020, i.e. an extra 250,000 cows compared to the current number of approx. 1,200,000. This presents a challenging scenario for labour supply on farms, (i) if the farm owner maximizes the work conducted by him/herself, an increased likelihood of a poor work/life balance will prevail and this may have a negative impact on inducing a successor for the farm in future years, (ii) alternatively, the cost of employed labour to conduct the work will make dairy farming much less profitable for the farm owner. Additionally, farmers frequently experience a difficulty in securing skilled labour for specific tasks. Thus, an examination of the labour issue on-farm is required to identify the factors affecting both the absolute labour input required and also the efficiency of labour use, together with the influence of facilities and practices on farms The objective of this study was to quantify levels of labour input on spring-calving Irish dairy farms, operating a grass based milk production system, relating to a range of dairy farm tasks over a 1-year period.

Materials and Methods

Farm selection

Farms were selected for the study based on the criteria of being a spring-calving dairy farm with a herd size ranging from 50 to 80 cows or greater than 150 cows, being highly labour efficient (as described by Teagasc advisory personnel), the farmer being an owner and user of a smartphone, and participants in discussion groups working with Teagasc (The Irish Agriculture and Food Development Authority), thus having an appreciation of data collection. Thirty-eight farms were finally chosen for the study from a number suggested by Teagasc Advisory.

Data collection

An app was developed to allow farmers to record labour data in real-time by starting and stopping the app's stopwatch recording for designated tasks on-farm. Farmers were asked to record their labour data for three consecutive days (the last Tuesday, Wednesday, and Thursday) of each month for 12-15 months. There were twenty-nine tasks listed in alphabetical order on the app that the farmers could choose from at any given time. The list was as follows: Advisory, AI (artificial insemination), breaks, calf care/feeding, calving tasks, cleaning yards, cubicle cleaning, driving jeep/car, drying off, feeding cows and heifers, fertiliser spreading, grass measurement, heat observation, herding post-milking, herding pre-milking, land and building maintenance, machinery maintenance, milking, office/business, other dairy tasks, other enterprise tasks, silage pit management, slurry spreading, soiled water spreading, strip fencing, topping, trading stock, veterinary, and washing post-milking. When the farmer wanted to start a task they would select the task in the app and press a 'Start' button at which point the timer would start recording. The farmer pressed the 'Stop' button when the task was finished. As farmers entered their task data throughout the collection periods, data was automatically sent to the cloud database.

A short online survey was also developed and applied to the farmer group on a monthly basis. The purpose of this questionnaire was to capture the other factors contributing to labour data on farm, e.g. labour input by part-time and full-time employees that did not use the phone app, stock numbers on the farm and hours of machinery work conducted on-farm during each month. The machinery tasks included among others, winter feeding, fertiliser spreading, topping, slurry spreading, baled silage. Additionally, a once-off phone survey was conducted with each farmer on their farm facilities and practices.

Data collection was completed in August 2016 and the monthly data from the app and the monthly survey data were compiled and prepared for analysis. This procedure also involved removing time spent at 'breaks' and 'other enterprise tasks' from the dataset. Average monthly labour input was calculated by firstly getting the average daily duration for each task during the three days of data collection. The daily average duration for all tasks was then summed and multiplied by the number of days, minus number of Sundays in that calendar month. This calculation is based on farmers working five full week-days and two half days at weekends. Labour efficiency was measured as hours per cow per year. The hours worked was calculated by summing the hours worked by each individual on the farm and the hours of contractor work carried out during each month. Cow numbers were recorded via the online monthly survey and a yearly average was calculated.

Analysis

Herd sizes ranged from 79 cows to 534 cows and were grouped into one of three herd size categories for analysis. Herd size category (HSC) 1 were farms with < 150 cows, HSC 2 were farms with 150-249 cows, and HSC 3 were farms with ≥ 250 cows. Herd Size Category 1 was designated as those farms that were operated by just the main farm operator and a small amount of family and part time hired labour. Herd Size Category 2

was designated as farms that frequently had two full time people working on-farm (including the main farm operator). Herd Size Category 3 included farms that always had at least two full time people operating the farm (including the main farm operator); these farms represent a small but potentially growing proportion of dairy farms in Ireland. The study data was summarized using descriptive analysis with the most efficient farms being identified in terms of hours worked per cow per year. Statistical analyses were conducted using SAS software (SAS Institute Inc., Cary, NC). Least squares means among categories were calculated for variables using the PROC MIXED procedure of SAS. Tukey's test for multiple comparisons was used and statistical differences were considered significant using a 0.05 significance level. Residual checks were made to ensure the assumptions of the analysis were met.

Results and Discussion

Average total farm labour input was 4,017 hours per year across herd size categories, with an average herd size of 193 cows. Average total labour input per year was 2,974 hours, 4,566 hours and 5,692 hours in HSC 1, HSC 2 and HSC 3, respectively (Table 1). The increase in labour input associated with increased farm scale was not unexpected, and was in agreement with previous studies (O'Donovan et al., 2008). Average farm labour efficiency was 21.7 h/cow/y which was considerably higher than that observed in the O'Donovan et al. (2008) study (41.3 h/cow/y). This may be due to the earlier study having examined a farm group representative of all farms (rather than a group 'considered' to be efficient in the current study). Additionally, facilities and practices may have become more efficient on farms. Labour efficiency was similar for HSCs 1 (23.7 h/cow/y) and 2 (23.6 h/cow/y). Alternatively, HSC 3 was significantly more labour efficient (17.5 h/cow/y) than both HSC 1 (P= 0.03) and 2 (P= 0.04) (Table 2). This trend also observed by O'Donovan et al. (2008), with a greater efficiency and adoption of labour-efficient technologies observed in larger herds (O'Brien et al., 2007).

Table 1: Total labour input (hours/year) on farms of increasing herd size

Herd size category 1	Herd size category 2	Herd size category 3
2,974	4,566	5,692

Table 2: Labour efficiency (hours/cow per year) on farms of increasing herd size

Herd size category 1	Herd size category 2	Herd size category 3
23.7	23.6	17.5

The labour contributed by different people sources is shown in Figure 1.

There were significant differences between hours worked by hired labour across HSC with HSC 3 utilising the highest amount of hired labour. While labour input contributed by the farmer him/herself was similar across HSCs, the farmer performed 76%, 56% and 37% of the total work in HSC 1, HSC 2 and HSC 3, respectively. This highlights the importance of having very competent hired labour on farms, since in the case of larger farms hired labour is responsible for more than 60% of the operation. The farmer's labour efficiency improved with HSC, with farmers working 19.7 h/cow/y in HSC 1, 13.6 h/cow/y in HSC 2, and 6.6 h/cow/y in HSC 3. Hours worked by the family or the contractors were similar across HSC. Since 2012, an extra 250,000 cows are being milked on Irish dairy farms (CSO, 2016). Significant further expansion is envisaged with another 250,000 cows expected to be milked on such farms by 2025 (Teagasc Report, 2017).

Thus, it is crucial that there is an adequate supply of a highly skilled people to manage and work on such farms in the future and that the industry can deliver a good standard of living to those workers.

Total farm hours worked followed a seasonal trend across HSC, with an average of 1,777 hours worked in the spring, 1,663 hours in the summer, 1,412 hours in the autumn, and 885 hours in the winter (Figure 2). Day start times varied across HSC (P<0.0001), with farmers in HSC 1 starting their day at 07:33, HSC 2 at 07:16, and HSC 3 at 06:40. Average start times of the day during the springtime months (February, March and April) were 07:01, 06:55, and 06:04 for HSC 1, 2, and 3 respectively. There was no significant difference between the average farmer finish times of the day between HSC 1 and 2, both of which finished at 17:54. However,

HSC 3 had a significantly (P<0.0001) earlier finish time of 15:30 (Figure 3). Generally, the morning and evening milkings influence the length of the working day on a dairy farm when milking is conducted by the farmer/main operator. In the current study, the presence of hired labour allowed the farmer in HSC 3 to complete his/her day earlier, on average over the year. In the springtime months, HSC 1 finished at 18:42, HSC 2 finished at 18:25, and HSC 3 at 17:50.

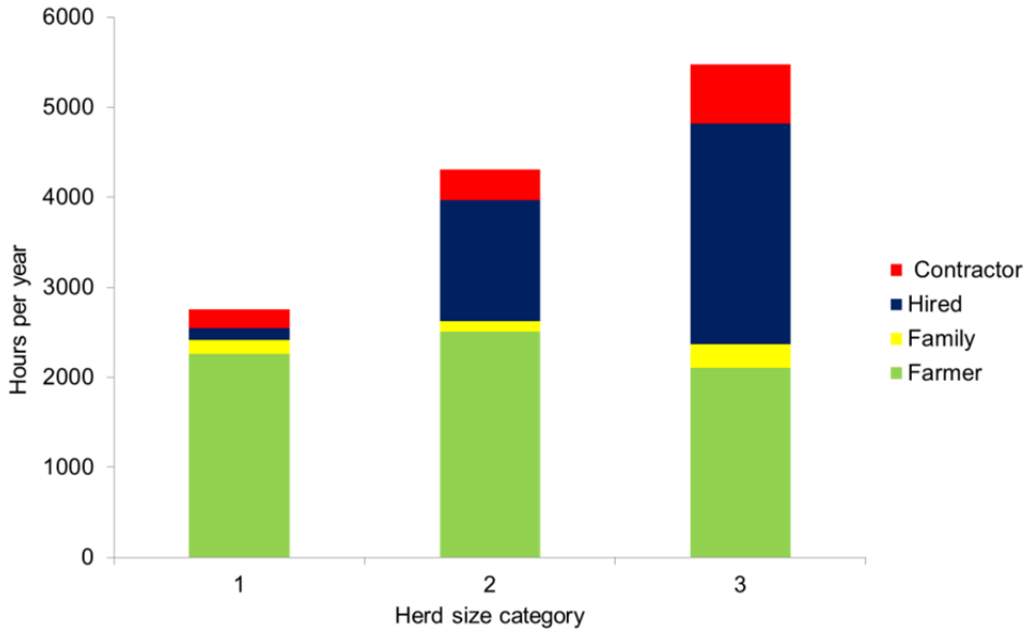

Figure 1. Labour contributed by different sources on farm

The length of the working day for the farmer (excluding breaks and other enterprise tasks) was 7.3 hours for HSC 1, 8.1 hours for HSC 2, and 6.8 hours in HSC 3, on average over the year. There was a significant difference (P= 0.009) between HSC 1 and 2 and HSC 2 and 3 (P= 0.0004) but no difference was observed between HSC 1 and 3 (P= 0.24). During the springtime, farmers were working 8.8 hours per day in both HSC 1 and 3 and 9.0 hours in HSC 2. Seasonal variation in the length of the work week for the farmer was observed across HSC with an average of 56 hours/week in Spring (February, March, and April), 45 hours/week in Summer (May, June, and July), 44 hours/week in Autumn (August, September, and October), and 35 hours/week in Winter (November, December, and January). The tasks that contribute most to the increased labour demand in springtime include calf care, milking and grassland management. The most effective way of managing this labour demand is by updating facilities and including automated technology around these tasks. The importance of good facilities was highlighted by Bewley et al. (2001a) when they showed that Wisconsin dairy producers observed higher production, greater efficiency and satisfaction with measures of profitability and quality of life when the dairy operations were modernized. Bewley et al. (2001b) also showed that labour efficiency increased with larger herd sizes and fewer people involved in the milking process. A further way of managing the springtime labour demand is through increased use of casual labour and contractors together with available family labour.

The annual hours per cow recorded in this study convert into 76, 76, 103 cows per labour unit (LU) in HSC 1, 2 and 3 farms, respectively, (assuming that 1800h/year equates to one LU or one full-time farm operator [NFS, 2015]). It is considered that a herd of 100 cows (at a minimum) will be required to generate a sufficient family income in the future Irish context (Hennessey and Thorne, 2006). Thus, a target of increasing labour efficiency on all farms to the level currently observed in the HSC 3 farms must be considered. .

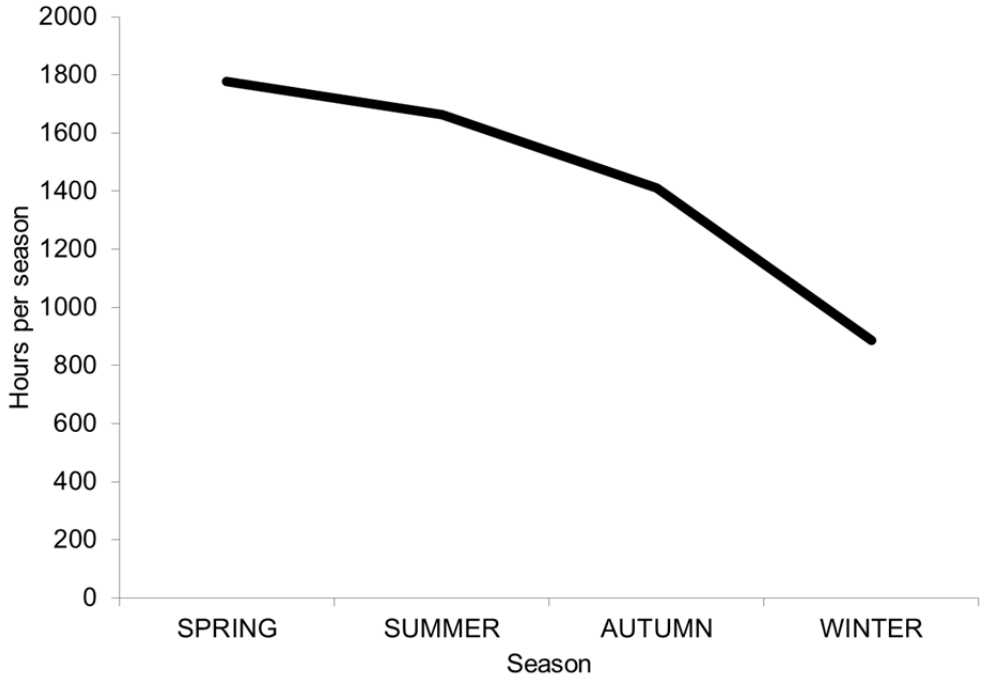

Figure 2. Seasonal variation in labour input to farm operations across HSC

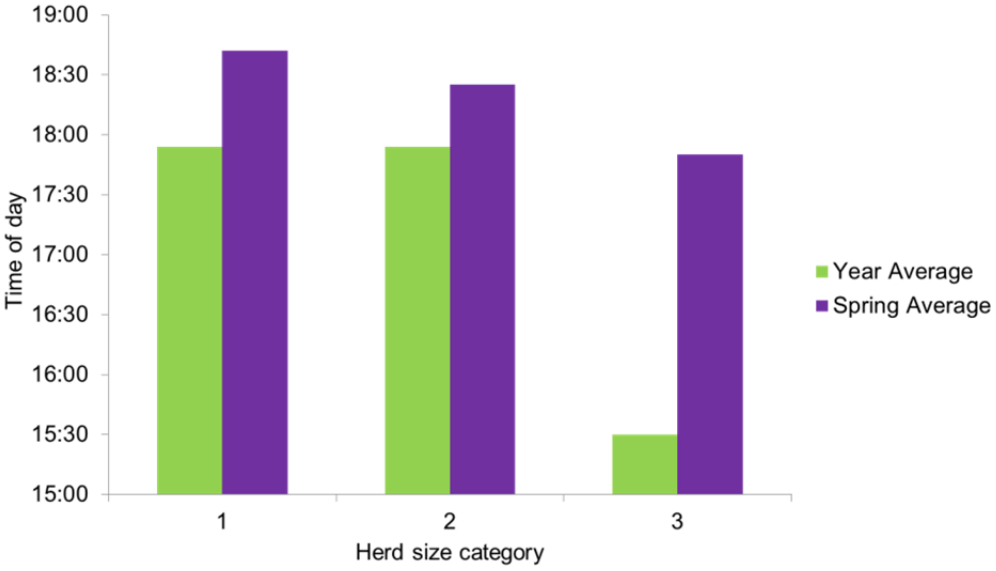

Figure 3. Average daily time at which labour input by the farmer/main operator ceases on farm

Conclusions

It is commonly known that labour issues are present on farms, and the issues differ depending on farm size. However, it was necessary to measure some labour parameters on farms in order to address the problems. It is only when the problem is defined that it is possible to identify solutions. The current study showed that labour input was high and labour efficiency low for the farms < 250 cows. The main operator was working up to 33 % longer than the average industrial worker (assuming an 1,800 h work year), and this is not sustainable. Thus facilities, such as those used for milking and feeding should be updated and work practices improved to enable a labour person to complete more duties in a satisfactory manner compared to that completed in a similar timeframe previously. But particularly, a solution involving a part-time work structure

where local people are trained and available when required is needed. Labour demand was also high on farms of > 250 cows, with each employing a number of hired staff alongside the main operator, but efficiency was also high at 17.5 h/cow/y on these farms. The facilities on these farms and the manner of conducting work tasks were generally good, but the predominant labour issue here was the availability of skilled labour people, identification, selection and retention of such labour sources by the farm owner or main operator. This is critically important, as the results also showed that the work/life balance of the main operator can be very much improved on the larger farms when sufficient hired labour was in place. The seasonal nature of milk production and associated high labour demand in springtime in a grass based milk production system is unavoidable. But it may be accommodated more easily if automated and updated facilities are in place for the predominant tasks at this time of year, e.g. calf feeding.

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