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LABOUR INPUT ON IRISH DAIRY FARMS AND THE EFFECT OF SCALE AND SEASONALITY

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The objective of this study was to quantify the labour input per cow for different herd sizes. Data was collected from 98 and 73 spring-calving farms in years 1 and 2, respectively. Average annual total dairy labour input per cow was 49.7 h, 42.2 h and 29.3 h for small (<50 cows), medium (50-80 cows) and large (>80 cows) herd-size farms, respectively. Maximum labour input levels were observed in March and April and minimum levels in December and January.

(Keywords; dairy, labour input, scale, seasonality).

Introduction

The Irish dairy industry is the main enterprise for 23,000 farm households and continues to represent the most profitable farm business. But dairy farm numbers are declining. There were 26,800 dairy cow herds in the Republic of Ireland in 2005, with an average herd size of 41.1 animals (CSO, 2005). Milk production in Ireland occurs within a grass based system. The current mean calving date (MCD) is 16th March (Shalloo and Horan, 2008) and the optimum MCD is influenced by the need to maximize the contribution of cheaper grazed grass to produce milk and thus, achieve a high profit/l. In the period 1991 to 2006, French et al. (2007) reported that the farm gate price of milk remained relatively constant at approximately €0.279 (cent)/l. Between 1990 and 2004, the average cost of production for specialist dairy farmers was 17.1 cent/l. This comprised 8.7 cent/l for direct costs and 8.4 cent/l for fixed costs (Dillon et al., 2006). In association with milk price, labour availability, skill and cost are currently considered to be among the greatest challenges to dairy farming of the future (Dillon et al., 2006).

In a previous study on Irish dairy farms, O'Shea et al. (1988) assessed labour use over a one-year period, on 37 farms and showed that labour input per cow per year was 99 h and 41 h for herds of < 40 cows and > 150 cows, respectively. Additionally, they showed that gross profit margins did not correspond well with labour input per cow. A further study by Ruane and Phelan (2001) suggested that upgrading of facilities on Irish dairy farms would improve farm labour efficiency. However, the industry has not yet developed a mechanism to predict, monitor or effectively manage the on-farm labour resource. But the farm labour issue is becoming increasingly urgent as alternative employment options continue to be available within the Irish economy (Competitiveness Report, 2005) and Juvancic (2002) has shown that favorable conditions in the non-farm labour market tend to increase the probability of off-farm employment. In the US, a large population of Hispanic workers who undertake a considerable portion of the manual labour on farms reduces the problem of low availability of labour resources for dairying. A similar and recent trend is occurring in Ireland, where some workers from

Eastern Europe engage in agricultural work. Reforms in the accession countries (Czech Republic, Estonia, Ukraine, Latvia) have strongly affected agricultural output and labour markets in those countries (Swinnen et al., 2005) and many workers from these countries are now taking up employment on farms in Ireland. However, due to the relatively high cost of labour in Ireland, the challenge for agriculture then becomes how to compete with other employers, e.g. construction or other service industries. Consequently, the minimization of labour input (while remaining within good dairy management guidelines) will have the greatest impact on maximizing profitability on dairy farms in the future.

The issue of labour efficiency at farm level is not unique to the Irish dairy industry. The international comparisons in labour efficiency shown in Table 1 indicate the wide variation in labour use that is achieved on pasture-based systems (IFCN, 2002).

Table 1. Labour efficiency (h / cow) measured on four pasture-based systems

	Herd size	labour efficiency (h / cow)
Waikato NZ	229	20
South Island NZ	447	19
Wisconsin US	70	106
Wisconsin US	600	61

Maintenance of a stable dairy industry is dependent on increased labour efficiency by addressing the double challenge of expansion of dairy herds in the presence of a deficit of good quality labour for the management of such herds. However, it is necessary to acquire current, reliable data on patterns of labour input and labour productivity to allow identification of dairy tasks where labour input could be reduced or strategies devised to improve labour efficiency. The objective of this research was to quantify the annual labour input per cow relating to a range of dairy farm tasks and to establish monthly patterns of labour utilisation over a two-year period across a range of herd sizes.

Materials and methods

Data

Farm selection. This study was conducted with full-time dairy farmers mainly in the Munster region of Ireland. This constituency accounts for 65% of the total manufacturing milk supply in the Republic of Ireland. The dairy farmers were defined as those with a business size of at least 135 x10^3 litres of milk quota per annum and predominantly with spring calving systems. A population of 360 dairy farms was selected initially from 20 established dairy farm discussion groups. This population represented an estimated 1.3% of Irish dairy farms and 3.2% of milk production in Ireland. The decision to

select members of discussion groups as study participants was justified by the interest required for the relatively long (two-year) data recording process.

Individual letters of invitation were sent to 360 farmers outlining the purpose of the study and seeking their co-operation. Of these, 143 farmers agreed to participate in the study in year 1 (February 2000 to January 2001). Proportionally 0.80, 0.18, and 0.02 of these farms had spring, mixed (spring and autumn) and autumn calving herds, respectively. The farms ranged in herd -size from 26 to 300 cows and in milk quota size from 139 $x10^3$ to 1,409 $x10^3$ litres. One hundred and twenty-two dairy farmers participated in the study in year 2 (February 2001 to January 2002). The number of participants in year 2 was reduced compared to year 1, since 21 dairy farmers requested to cease data recording. Proportionally 0.83, 0.15 and 0.02 of these farms had spring, mixed and autumn calving herds, respectively. These farms ranged in herd size from 26 to 300 cows and in milk quota size from 140 $x10^3$ to 1,409 $x10^3$ litres. The farms participating in the study in years 1 and 2 had an average herd-size of 84 and 85 cows and an average milk quota size of 447 $x10^3$ litres and 446 $x10^3$ litres, respectively.

Data collection. Labour data were collected over a two-year period between February, 2000 and January 2002. All farm operators (farmers and/or farm staff) recorded the duration of the different tasks that they performed throughout the day. Records were made on consecutive 3 or 5-day periods on one occasion per month (usually on the second or third week of the month). Data were not recorded on Saturdays and Sundays, as sufficient technical backup was not available.

Two data recording methods were used. The main recording method involved a timesheet on which the total time consumed by each of 29 different farm tasks was recorded (total time contributed by all operators to the specific task on individual farms), for each of 3 consecutive days on one occasion per month. One sheet was completed for each farm. The second method involved an electronic data logger that incorporated the Observer behavioural package (Noldus Information Technology). This method allowed a greater level of detailed recording on a subset of farms. All operators on individual farms recorded on the data logger, the total time consumed by the 29 different farm tasks for each of 5 consecutive days on one occasion per month. This method also recorded the actual time schedule of tasks and rest periods, and thus, supplied a detailed profile of the working day. The data was subsequently uploaded onto a personal computer. The data logger was used for 5 days (compared to 3 days for the timesheet) due to the higher risk of data being unavailable, as a consequence of the greater complexities of recording by this method. Ninety-eight and forty-five farms used the timesheet and data logger recording methods, respectively, in year 1. The allocation choice of timesheets or data loggers to farmers was at the request of individual farmers in year 1. All 122 farms recording data in year 2 used a timesheet, since animal disease prevention regulations prevented the collection of data loggers from the farms during the 'Foot and Mouth' alert in 2001.

Farm task definition. The 29 farm tasks for which time (labour input) was recorded were classified into 10 task categories. These task categories were

defined as follows: 'Milking' incorporated herding cows for milking, milking (clusters on/clusters off), washing up and herding cows after milking. 'Management' referred to advisory, office and business trading of stock. 'Maintenance' was the term used to describe the maintenance and upkeep of land, buildings and machinery. 'Grassland' was the term used to describe grassland management and incorporated grassland measurement, fertiliser spreading, strip fencing, pasture topping, soiled water spreading, slurry spreading and contract fertiliser spreading. 'Cow care' referred to checking and moving stock, feeding cows and silage pit management. 'Calf care' referred to calving and care of calves. 'Cleaning' incorporated cleaning of cubicles, beds, yards and houses. 'Veterinary' was the term used to describe tasks associated with animal health and incorporated veterinary management and treatment, heat observation and artificial insemination. 'Miscellaneous' referred to all other minor tasks conducted on-farm. 'Other enterprises' referred to tasks associated with enterprises other than dairying on the farm. General farm financial data was also captured from the participating farmers in the study.

Analysis

Data. Labour input data was analysed for 98 and 73 spring calving herds with complete record sets in years 1 and 2, respectively. Herds with an element of autumn calving were excluded from the study reported here, due to their diversity in terms of calving pattern and the potential effect that this could have on their input and pattern of labour-use. A set of time records from a particular farm was considered incomplete and consequently, excluded from the analysis if data for more than two consecutive months was absent at any period over the year. This consideration eliminated the risk of a farm's labour input profile being altered by missing data. The proportion of farms excluded from the analysis due to the presence of an element of autumn calving in their system and incomplete data records were 0.20 (28 farms) and 0.12 (17 farms) in year 1 and 0.17 (21 farms) and 0.23 (28 farms) in year 2, respectively.

The 98 and 73 herds were categorized into 3 herd-size groups for data analysis (Table 2). These groups comprised farms of small, intermediate and large herd-sizes. Studies of competitiveness in Irish agriculture considered farms with a herd size of less than 50 cows of insufficient scale to adequately remunerate owned labour (Boyle, 2002). Alternatively, (Downey, 1999) has predicted that herds with a milk quota of 450,000 litres (approximately 80 cows) will account for 60 % of dairy farms in Ireland by 2015. Thus, the small and large herd size groups were defined as those with herds of less than 50 cows and greater than 80 cows, respectively, while the medium herd size group represented dairy herds with between 50 and 80 cows.

Table 2. Characteristics of spring calving farms for which there were complete records across herd-size groups (n^1=98; year 1) (n=73; year 2)

	Herd size group		
	small	medium	large
Range	< 50 cows	50-80 cows	> 80 cows
Number of farms Year 1	29	45	24
Number of farms Year 2	22	33	18
Average herd-size Year1	44	62	145
Average herd-size Year 2	44	62	149

Statistical. The labour input data were analysed using a repeated measures model (PROC MIXED) described below and using the statistical procedures of SAS (SAS, 2002). Farm was included as a random effect while year, month, herd size group and milk sales per cow were included as fixed effects. The following model was used:

$$R_{ijkl} = \mu + M_i + Y_j + H_k + S_l + MY_{ij} + MH_{ik} + YH_{jk} + e_{ijkl.}$$

where R_{ijkl} = the labour input per cow of the farm in month *i* of year *j*, herd size *k* and milk sales per cow *l*, M_i = the effect of *i*th month (i = 1 to 12); Y_j = year (j = 1, 2), H_k = herd size (*k* = <50 cows, 50 to 80 cows, or >80 cows); S_l = the effect of the *l*th milk sales per cow (*l* = <4,600 litres, 4,600 to 5,200 litres, >5,200 litres), and e_{ijkl} = the residual error term.

Results

The average annual total farm labour input per cow was 46.1 h (SD±17.1) over the two years of the study. Average annual total dairy labour input per cow was 41.4 h (SD ±14.2) for an average herd size of 77.4 cows and a milk quota of 388 x10^3 litres (Table 3). The average annual labour input (h) per cow for a range of dairy task categories is shown in Table 3. Tasks for which the average annual labour input exceeded 4 h per cow included milking, maintenance, grassland, management and cow care. Labour associated with other enterprises accounted for 4.7 h (SD±5.9) per cow per year.

Labour tasks and scale of enterprise

Average annual dairy labour input (h) per cow for combined and specific dairy task categories on farms of three different herd-size groups is shown in Table 4. Annual dairy labour input per cow declined (P<0.001) with increasing herd-size group. Annual labour inputs per cow for milking, maintenance, management, grassland, cow care, calf care and cleaning were reduced to (P<0.05) with increasing herd-size group. No significant differences (P>0.05) were found between herd-size groups with regard to annual labour inputs per cow for veterinary and miscellaneous. Average annual dairy labour input per

Table 3. Average annual dairy labour input (h) per cow for combined and specific dairy task categories (n^1=171)[1]n = number of farms

	Mean	Std Dev	Minimun	Maximum
Total dairy labour	41.4	14.2	11.7	85.3
Milking	13.6	4.4	5.4	26.2
Maintenance	6.9	5.7	0.5	36.2
Grassland	5.0	2.5	0.6	12.7
Management	4.7	2.8	0.5	16.1
Cow care	4.3	2.2	0.8	15.5
Calf care	2.7	1.4	0.3	9.8
Cleaning	2.1	1.5	0.1	6.7
Veterinary	1.5	1.0	0.1	6.3
Miscellaneous	0.6	0.8	0.0	5.8

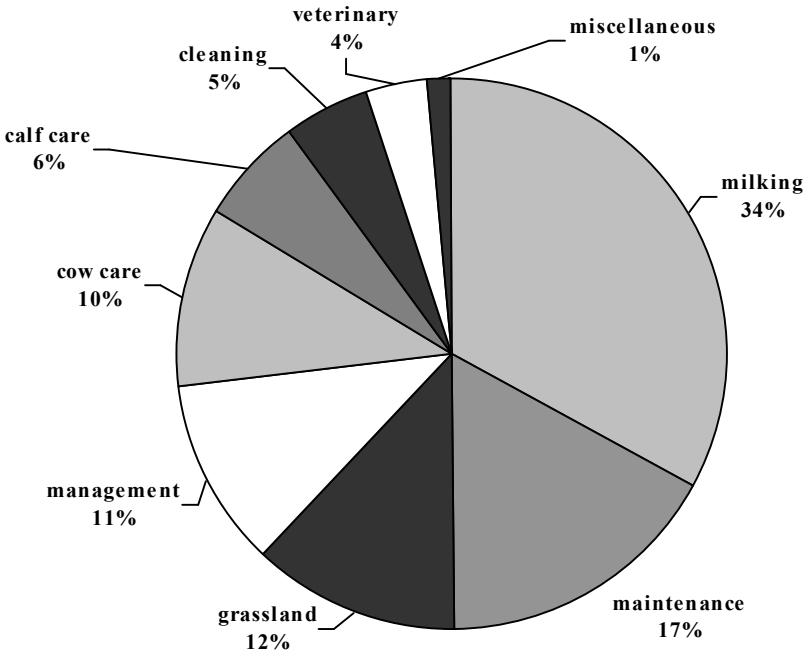
Table 4. Average annual dairy labour input (h) per cow for combined and specific dairy task categories on farms of three different herd-sizes

	Herd-size group				
	Small (n^1=51)	Medium (n=78)	Large (n=42)	SEM[2]	Significance
Total dairy labour	49.8[a]	42.2[b]	29.3[c]	1.64	***
Milking	17.4[a]	13.7[b]	8.9[c]	0.42	***
Maintenance	8.5[a]	6.8[ab]	5.3[b]	0.76	*
Grassland	6.3[a]	5.1[b]	3.2[c]	0.31	***
Management	5.0[a]	5.0[a]	3.5[b]	0.38	*
Cow care	4.5[a]	4.8[a]	3.2[b]	0.29	***
Calf care	3.1[a]	2.6[a]	2.1[b]	0.18	**
Cleaning	2.8[a]	2.1[b]	1.3[c]	0.19	***
Veterinary	1.7[a]	1.5[a]	1.2[a]	0.13	NS
Miscellaneous	0.5[a]	0.6[a]	0.6[a]	0.11	NS

[abc] Means within a row with different superscripts differ significantly * P<0.05; ** P<0.01; *** P<0.001; NS=non-significant.
[2]SEM = Standard error of the mean.

cow was lower (P<0.05) on medium farms than on small farms for the tasks of milking, grassland and cleaning. It was lower (P<0.05) on large farms than on small farms for all tasks except for veterinary and miscellaneous, and was lower (P<0.05) on large farms than on medium farms for all tasks except for maintenance, veterinary and miscellaneous. Average annual dairy labour input for different task categories is shown in Figure 1. The task of milking accounted for the largest proportion of labour input (0.34) on-farm, while the next most labour intensive task was maintenance (0.17).

Figure 1. Proportion of average annual dairy labour input associated with different task categories

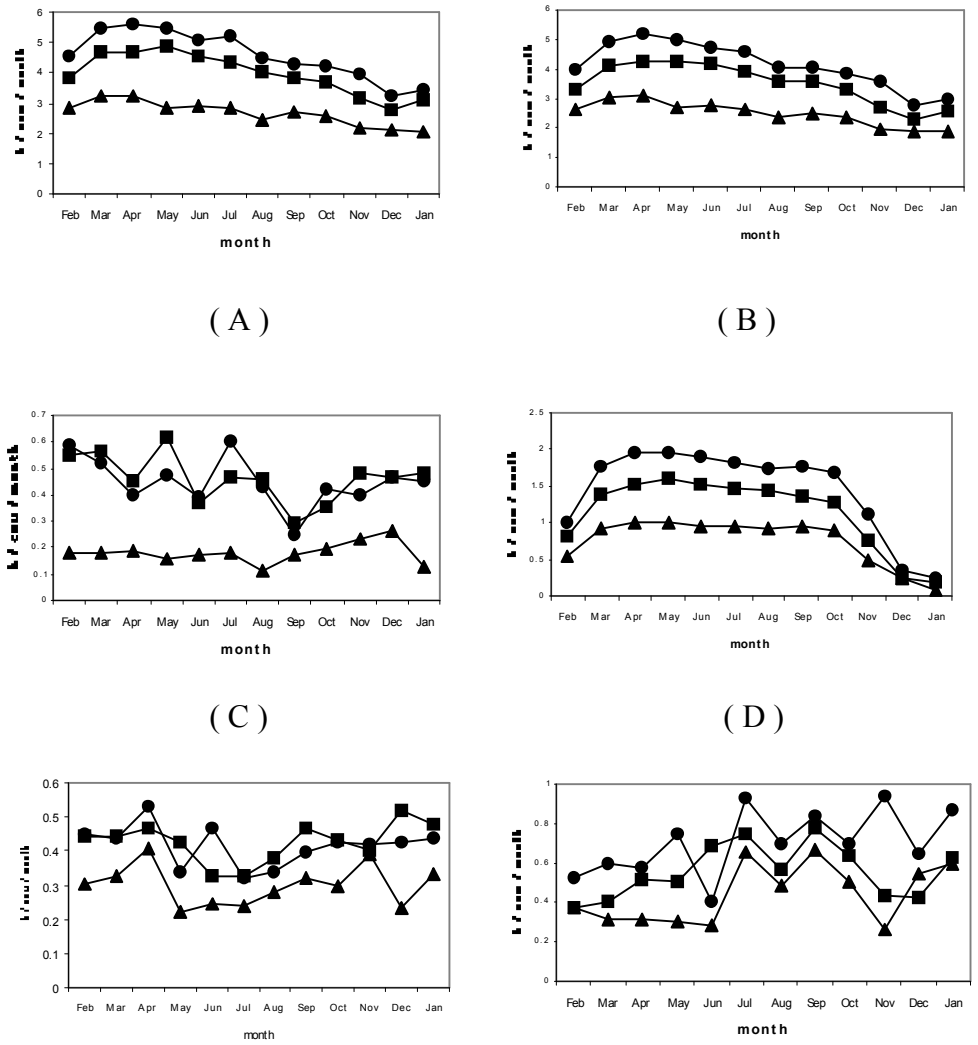


Seasonality

Average total farm labour input per cow per month, average total dairy labour input per cow per month and average labour input to other enterprises per cow per month over 12 months on farms within three herd-size groups is shown in Figure 2.1 in (a), (b) and (c), respectively. Average total farm labour input per cow per month attained the highest points in Spring and early Summer on all farms. A similar trend was observed for average total dairy labour input per cow per month. Average labour input per cow per month associated with milking, maintenance and management over 12 months on farms within three herd-size groups are shown in Figure 2.1 in (d), (e) and (f), respectively. Highest average milking labour input per cow per month was observed during April and May.

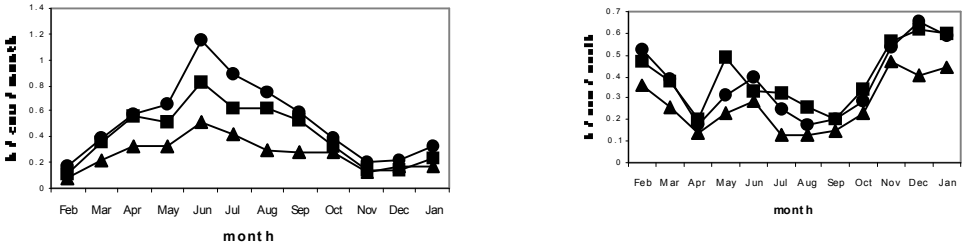
Average labour input per cow per month (h) associated with grassland, cow care and calf care over 12 months on farms within three herd-size groups is shown in Figure 2.2 in (a), (b) and (c), respectively. Average grassland labour input per cow per month was at a maximum in June for all farms.

Figure 2.1 Average labour input per cow per month (h) over 12 months associated with total (A), dairy (B), other enterprises (C), milking (D), maintenance (E) and management (F) tasks, showing small (—●—), medium (—■—) and large (—▲—) herd-size groups

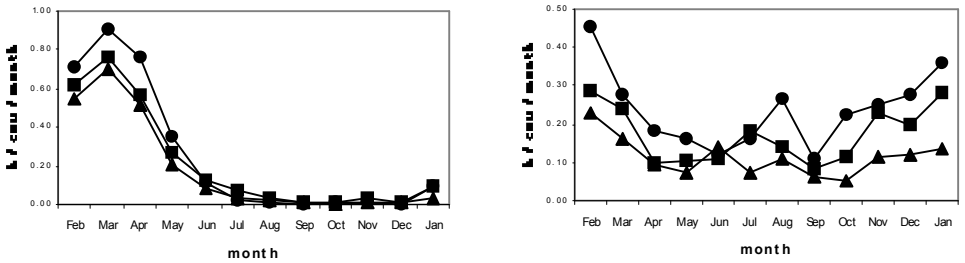


Average labour input per cow per month (h) associated with cleaning, veterinary and miscellaneous tasks over 12 months on farms within three herd-size groups is shown in Figure 2.2 in (d), (e) and (f), respectively. Maximum average cleaning labour input per cow per month was recorded in February for all farms.

Figure 2.2 Average labour input per cow per month (h) over 12 months associated with grassland (A), cow care (B), cleaning (C), calf care (D), veterinary (E) and miscellaneous (F) tasks, showing small (—●—), medium (—■—) and large (—▲—) herd-size groups



Farm financial data.



Average labour costs on farms for the three herd size groups are shown in

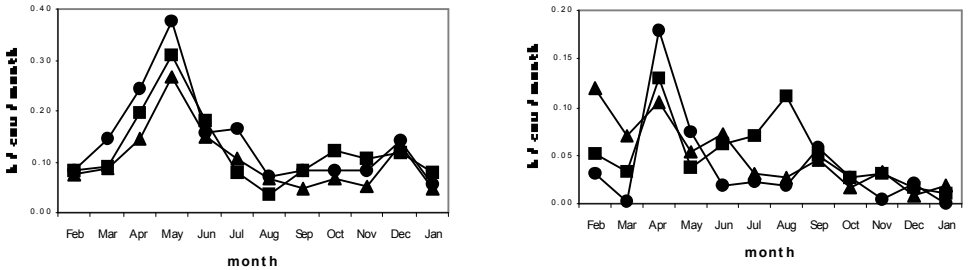


Table 5. The difference between small, medium and large farms is clearly reflected in terms of labour costs per litre and labour as a percentage of total costs. These figures include an imputed cost for family labour at an industrial wage rate, as used by Shalloo *et al.* (2004). Only the large farms reached a level which could be deemed competitive.

Table 5. Average labour costs on farms of three different herd size groups

	Herd size group		
	Small	Medium	Large
	<50 cows	50-80 cows	>80 cows
Quota (l)	236,000	296,000	745,000
Herd size	44	62	147
Milk sales per cow (l/cow)	5364	4774	5068
Milk to calves (l/cow)	300	300	300
Total milk yield (l/cow)	5664	5074	5368
h/cow/year	49.7	42.2	29.3
Labour cost (€/h)	11	11	11
Total labour cost (€/farm)	24055	28780	47378
Receipts€	85898	111036	275139
Variable costs €	17785	31580	102143
Fixed costs incl labour €	40090	47254	78206
Depreciation charges €	11885	13541	21412
Total costs €	69760	92375	201761
Interest earned €	187	181	398
Farm net profit €	16324	18842	73776
Labour % of total costs	34.5%	31.1%	23.5%
Labour cost (cents/l)	10.2	9.7	6.4

Discussion

The total dairy farm labour input in this study, measured at 41.4 h per cow for an average herd-size of 77.4 cows, compared favorably with the 53.8 h per cow recorded on Irish farms of a similar herd-size by O'Shea et al. (1988). The observed variation in labour input per cow when linked to size of herd (labour input per cow on farms of less than 50 cows was 1.7 times greater than

the labour input per cow on farms of over 80 cows) is consistent with the findings of an American study (Hadley et al., 2002) where increasing herd sizes resulted in improved labour efficiency. A related study by O'Brien et al. (2007) indicated a greater usage of labour efficient technologies on the larger farms, such as better facilities and less intensive work routines in milking and calf care and a trend away from the more traditional, labour-intensive methods. The superior facilities and practices found on large farms illustrated a greater ability on the part of large farms to invest capital, with less uncertainty surrounding their future in the industry. However, fragmentation of dairy farms represents a serious impediment to expansion, given the inaccessibility of the milking parlour in many cases and/or the labour associated with transfer of cows for milking.

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, fewer acres per cow and fewer people involved in the milking process.

The 20% most and 20% least efficient farms, in terms of labour input to the tasks of milking and calf care, which comprised a subset of the smaller farms in the current study, were reported on by O'Brien et al. (2006). These authors found that differences in labour input between most and least efficient farms at milking were mainly due to factors such as increased milking machine unit number and superior plant and yard design and paddock layout. Differences in labour input between most and least efficient farms at calf care were mainly due to factors such as mechanized transfer of milk from dairy to calf house and group as opposed to individual calf feeding. It is likely that such factors are relevant in improving labour efficiency at all herd sizes, however, reduced labour requirement due to economy of scale is mainly achieved with tasks such as milking, grassland and cleaning, while scale may be less relevant to tasks which require individual animal attention.

The task of milking was recorded as the most time-consuming task in this study, accounting for over one-third (34%) of total dairy labour input. This proportion of time was higher than the 29% recorded by Jagtenberg (1999) and the 30% observed by Ordolff (1986) and Sonck (1993) on dairy farms in The Netherlands. The current study also showed that total over-head activities (management and maintenance) accounted for 28% of total dairy labour input, which was higher than the 16% recorded by Turner and Fogerty (1995) on English dairy farms. This difference may be due to the relatively high level of labour input to management in this study (labour input to management as a proportion of total dairy labour input = 11%) compared to that in the study of Turner and Fogerty (1995) (labour input to management as a proportion of total dairy labour input = 3%). This substantiates a perception within the Irish dairy farming community that office work has a high labour requirement due to increased regulatory inputs.

The springtime calving season has long been perceived by Irish farmers to be a peak labour input period. Results of this study support this view as peak

dairy labour input was recorded during March and April for the three herd-size groups. The task categories that contributed most to this peak in labour input included milking, grassland, management and calf care. The calving season and consequently milking, had commenced in early March for a large proportion of herds, with many herds also going outdoors to grass at this time. Labour utilised on grassland tasks in March was twice that recorded in February. Management tasks also contributed to labour input in March due to the requirements for regulatory compliance with calf registration. Labour input consumed by grassland tasks increased considerably in the months of May and June as the grazing season became more intensive. Veterinary labour also increased substantially in May, which represented the major part of the breeding season. As the management season progressed into the summer and autumn months, the labour consumed by the milking process gradually decreased (corresponding with reduced milk yields), and decreased sharply between October and November as the late lactation period approached and drying-off of cows commenced. Labour utilised in grassland tasks also declined as the capacity for grass growth was reduced. Labour input to cow care and cleaning was highest over the winter months. This was a consequence of the typical Irish spring-calving system when dairy herds are housed between November/December through mid to late February (depending on soil type and weather conditions). The lowest level of dairy labour for all herd-size groups was recorded in the December/January period in this study. The peak-trough ratio for dairy labour input was between 1.63 and 1.86 for all herd-size groups (i.e. ratio of maximum and minimum monthly labour input levels per cow). This was similar to the results of O'Shea et al. (1988) who reported March and December as the months of highest (16.6 h per day) and lowest (9.9 h per day) labour input on Irish dairy farms, respectively, with an average peak-trough ratio of 1.67. Obvious methods of reducing labour peaks include the use of overtime, casual labour and contractors together with increased mechanization, improved employee organization, alternative calving dates and availability of family labour as a reserve labour resource.

With regard to the seasonal requirement for labour resources, the number of labour persons required by the three herd size group farms were calculated from the average number of hours per month of dairy labour input while employing the following assumptions, (a) 4.5 weeks/month in all months except February, June, September and November, which had 4 weeks each and (b) a 39 h working week (AWJLC, 2008). The small herd size group farms required more than one person in the months February to July and in September. However, the additional labour required was small (0.1-0.3 person) and could probably be accommodated by either family or part-time hired labour sources. One person could manage the medium herd size farms during December and January. However, between 0.1 and 0.6 of an additional person would be required for the remaining months. Alternatively, 0.6-0.8 person additional to the main operator would be required on the large herd size group farms between November and January, while 1.0-1.6 additional persons would be required for the remaining months.

With the cost of labour increasing annually, labour efficiency represents an

increasingly important performance measure to evaluate and monitor on dairy farms of all sizes. Labour costs account for more than 20% of total operating costs of producing milk in Australia (Davies et al., 1999) while labour costs as a proportion of total costs were approximately 28 % in Irish herds of 50 to 80 cows, as measured using a dairy systems model (Shalloo et al., 2004) in this study. In terms of the 'cash costs' of hired labour, Ireland compares favorably with England, Denmark and New Zealand due to a comparatively low usage of hired labour. However, when the imputed economic cost of family labour is included, Ireland incurs the highest labour costs as a percentage of total output value (Boyle, 2002). This was confirmed by Thorne (2004) who found that when the imputed charges for owned resources were considered, the competitive ranking for Irish agriculture deteriorated significantly.

The annual hours per cow recorded in this study convert into 37.3, 44.0 and 63.5 cows per labour unit (LU) on small, medium and large herd size groups, respectively, (assuming that 1848 h/year equates to one LU or one full -time farm operator [NFS, 2004]). At the present time, it is considered that a herd of 100 cows is required even to maintain income in the future Irish context (Hennessey and Thorne, 2006). Thus, the 29 h/cow labour input shown in the large herds in this study has to be considerably reduced such that, 100 cow herds may be managed by a minimal amount of additional labour to the main operator. This has been achieved within the New Zealand dairy system (New Zealand Dairy Board, 1996). Since, high labour efficiency facilitates a reduced level of hired labour on large farms, the case to improve farm efficiency rather than increase labour resources on many farms is compelling. This is a key issue, particularly in milking management (Garcia and Fulkerson, 2005). Finally, it is likely that the most successful Irish dairy farms of the future will be those that can adapt to changing economic conditions and can evaluate and adopt cost effecting labour saving technologies.

Conclusions

Labour input per cow has decreased at a rate of approximately 1 h per cow per year, as observed when the data of O'Shea *et al.*, (1988) is compared with the current data from this study. However, this rate of improvement in labour efficiency is far too slow in the current marketplace scenario. This study has indicated the labour demand associated with different farm tasks and allows identification of the tasks which would have a positive impact on labour demand if reduced time were achievable for these tasks. Evidence points to key areas of work which include milking, calf care and management (consuming 51% of dairy labour) where significant and rapid gains in labour efficiency could be achieved. The seasonal labour requirement for different herd sizes has also been established. The small herd size farms need to reduce labour requirement to allow the uptake of off-farm employment to maintain family farm income in many instances. The medium herd size farms also need to reduce labour requirements to enable the main operator to almost manage the farm alone, but with some additional help from family or casual labour in spring and early summer. This is necessary for future viability on such farms.

The large herd size farms have to reduce labour input levels significantly and mechanisms to achieve that include better facilities and technology, such as mechanised/automated completion of tasks and data capture for use in decision-making, e.g. milking and grassland. More specialized dairying with fewer tasks to be conducted per day may also have a positive influence. A relevant question for the future is whether such farms can and will adopt the level of technology to achieve optimum efficiency and thereby, attempt to guarantee survival in an internationally competitively environment.

References

AWJLC (2008). Agricultural Workers Joint Labour Committee. Section 48, Industrial Relations Act, 1990 – Employment Regulation Order, The Labour Court, Tom Johnson Hse., Haddington Rd., Dublin 4.

Annual Competitiveness Report. (2005). Education and training of those in employment in Ireland. *Report to Forfas and the Expert Group on Future Skills*. Published by National Competitiveness Council. (Chairman: Dr. D. Thornhill). Administrative and Research Function, Forfas, Wilton Park House, Wilton Place, Dublin 2, Ireland. 132 p.

Bewley, J., Palmer, R.W. and Jackson-Smith, D.B. (2001a). An overview of experiences of Wisconsin dairy farmers who modernized their operations. *J. Dairy Sci*., 84:717 – 729.

Bewley, J., Palmer, R.W. and Jackson-Smith, D.B. (2001b). Modelling milk production and labour efficiency in modernized Wisconsin dairy herds. *J. Dairy Sci*., 84:705 – 716.

Boyle, G. E. (2002). The Competitiveness of Irish Agriculture, *Report for Department of Agriculture and Food, Government of Ireland*. Published by Irish Farmers Journal, Bluebell, Dublin 4.

CSO [Central Statistics Office], (2005). Central Statistics Office, Skehard Rd., Cork, Ireland. Accessed online; 17/04/08. http://www.cso.ie

Davies, L., Alford, A. and Hollis, G. (1999). The financial performance of the dairy industry in six regions of NSW, 1991 to 1997. *Economic Research Report No 2*, NSW Agriculture, NSW, Australia.

Dillon, P., Hennessey, T., Shalloo, L., Thorne, F. and Horan, B. (2006). Long term vision for the Irish dairy industry. In: *Proc. National Dairy Conference,* Limerick, Ireland. 15th November, 2006. pp 16-34.

Downey, L. (1999). 'What will the agri-food industry look like in 2015?' *In Proc. Agri-Food Millennium Conference*. Teagasc, Dublin, Ireland. pp 1-12.

French, P., Horan, B., Donworth, J. and Shalloo, L. (2007). A roadmap for high profit dairy systems for the future. *Moorepark Open Day Booklet,* Moorepark Dairy Production Research Centre, Fermoy, Co. Cork. 21st June, 2007. pp 5-14

Garcia, S.C., and Fulkerson, W.J. (2005). Opportunities for future Australian dairy systems: a review. *Aust. J. Exp. Agric*., 45:1041-1055.

Hadley, G.L., Harsh, S.B. and Wolf, C.S. (2002). Managerial and financial implications of major dairy farm expansions in Michigan and Wisconsin. *J. Dairy Sci.,* 85:2053-2064.

Hennessey, T. and Thorne, F. (2006). The impact of the WTO Doha development round on farming in Ireland. Teagasc, Rural Economy Research centre publication 4 July 2006.

IFCN [International Farm Comparison Network]. (2002). *Dairy Report. International Farm Comparison Network*. ISSN 1610-434X. Online: http:// www:ifcndairy.org. Accessed 06/14/06.

Jagtenberg, K. (1999). Labour input at low cost farm approaches the objective of 50 hours per week. *Praktijkonderzoek-Rundvee, Schapen-en-Paarden*, 12: 29-31.

Juvancic, L. (2002). Labour supply and employment decisions on agricultural households in Slovenia. *Kmetijstvo Zootehnika*, 80 (2): 129 – 145.

New Zealand Dairy Board. (1996). 1995-1996 economic survey of factory supply dairy farmers. Livestock Improvement Corporation Ltd, Hamilton, New Zealand. 36p.

NFS (2004). National Farm Survey. 2004. Teagasc, Oakpark, Carlow, Co. Carlow, Ireland.

Noldus Information Technology, Costerweg 5, 6702 AA Wageningen, The Netherlands.

O'Brien, B., O'Donovan, K., Gleeson, D., Ruane, D.J. and Kinsella, J. (2006). Improving labour productivity to facilitate viability on smaller Irish dairy farms. *Journal of International Farm management,* 3 (4). http:// ifmaonline.org/pages/journals.php

O'Brien, B., Gleeson, D., Ruane, D.J., Kinsella, J. and O'Donovan, K. (2007). New knowledge of facilities and practices on Irish dairy farms – Fundamental requirements for effective extension. In: Proc. 23rd Annual Conference of AIAEE (Association for International Agricultural and Extension Education). Ed. M. Navarro. 20-24th May, 2007. Polson, Montana, USA. pp 270-279.

O'Shea, J., Kavanagh, A.J. and Reid, P. (1988). Labour use on Irish dairy farms. *Irish Grassland and Anim. Prod. Assoc. J.,* 22:112-120.

Ordolff, D. (1986). Fully automatic milking: technical aspects and developments. *Landtechnik,* 41:227-229.

Ruane, D.J., and Phelan, J.F. (2001). Making labour more attractive for Irish farms; a case study of South Tipperary in the Republic of Ireland. *In Proc. 15th ESEE Congress.* Wageningen, The Netherlands. 15pp.

SAS. (2002). Statistical Analysis Systems Institute, 1999. ® Proprietary Software Release 8.2 (TM2MO) SAS Institute, Inc., Cary, N.C.

Shalloo, L., Dillon, P., Rath, M. and Wallace, M. (2004). The Luxembourg common agricultural policy reform agreement: Irish dairy farmers development options. *J. Farm Management*, 12(2):91–104.

Shalloo, L. and Horan, B. (2008). The effect of mean calving date on farm profitability in a no quota scenario. In: *Proc. Agricultural Research Forum, Tullamore, Co. Offaly, Ireland*. 12-13th March, 2008. pp. 36.

Sonck, B.R. (1993). The modern littered house for dairy cows: too much labour? Labour planning. Labour and Conditions; Computers in agricultural management. *In Proc. XXV CIOSTA-CIGR V Congress*. Wageningen, The Netherlands. pp 260-269.

Swinnen, J.F.M., Dries, L. and Macours, K. (2005). Transition and agricultural labour. *Agricultural Economics,* 32:15–34.

Thorne, F.S. (2004).Measuring the competitiveness of Irish Agriculture (1996-2000). *Rural Economy Research Series No. 9.* Teagasc HQ, Oak Park, Carlow, Ireland.

Turner, M.M. and Fogerty, M.W. (1995). Aspects of change in the UK Farm Labour Force. *J. Farm Management*, 9:13-24.

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