Improving labour productivity to facilitate viability on smaller Irish Dairy Farms

Authors

Bernadette O'Brien[1], Kevin O'Donovan[1,2], David Gleeson[1], Dermot J. Ruane[2] and J. Kinsella[2]

[1] Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co.Cork, Ireland

Telephone: 00 353 25 42274, E-mail: bobrien@moorepark.teagasc.ie

[2] UCD College of Life Sciences, Agriculture and Food Science Centre, University College Dublin, Belfield, Dublin 4, Ireland

Keywords: *dairy farm, labour input, multi-functionality*

Abstract

The purpose of this study was to investigate the labour invested on dairy farms and the feasibility of reducing that labour to provide an opportunity to adopt a multi-functional approach, which may assist in maintaining family farm income. Ninety-four dairy farms participated in the study. Farms were categorised according to milk volume produced, as follows: 135 $x10^3$ to 250 $x10^3$ litres (Group 1); >250 $x10^3$ to 320 $x10^3$ litres (Group 2); >320 $x10^3$ to 500 $x10^3$ litres (Group 3) and >500 $x10^3$ to 1,500 $x10^3$ litres (Group 4). Participating farmers recorded the time taken to perform farm tasks, on consecutive 3 or 5-day periods on one occasion per month. The average dairy labour input per day for farms in groups 1, 2, 3 and 4 over the 12-month period was 7.0 h, 7.9 h, 9.6 h and 13.3 h, respectively. A daily time

saving of 3.0 h and 2.2. hours (H) at the milking process and calf care, respectively, was observed on the most efficient compared to the least efficient farms within Group 1. The data indicated the possibility of reducing dairy labour input on these farms to 3.8 h per day or by 65%, which should facilitate multi-functionality.

Introduction

The contribution of agriculture to national wealth and viability of rural areas in Ireland is significant. However, it is clear that the sector is in a state of flux. The sector is undergoing structural change with declining farm numbers and labour resources on farms (Frawley & Phelan, 2002). The recent EU agricultural policy reforms are anticipated to result in a reduction in product prices paid to dairy farmers. This will mean an inevitable increase in scale in order to maintain future competitiveness. Hennessey *et al.* (2000) indicated that an expansion of production, of between 60 and 140% is required if Irish farmers are to maintain their incomes. However, these researchers also showed that labour represented the binding constraint to expansion on 40% of Irish farms. Thus, expansion may not be a feasible or desired option of many dairy producers. Alternatively, the increasing pressure on farm incomes means that the continued existence of many such family farms cannot be maintained from farming alone. Phelan (2005) observed that the contribution of farm income to household income decreased from 70% to 41% between 1973 and 1999/2000 in the Republic of Ireland. Aggregate farm income levels declined in real terms by 14 points between 2000 and 2003 (Department of Agriculture and Food, 2004).

Thus, alternative income sources will be required to retain farm families on an increasing number of potentially non-viable farms. The adoption of off-farm work by farm households

is an important, well-recognised and growing phenomenon in the EU (Kinsella *et al*. 2000). The proportion of farm operators involved in off-farm employment increased from 26% in 1995 to 32% in 2000. However, 69% of these farmers who had off-farm income were engaged in a dry cattle enterprise. But the current inflexibility of dairy systems in terms of labour requirement means that operators within this sector cannot easily engage in off-farm employment. Thus, labour productivity must be addressed for the future, if a substantial number of dairy farm households, especially those on smaller dairy farms, is to be maintained.

Other Irish studies have highlighted the continuing concerns of the dairy industry with the issue of on-farm labour. O'Shea *et al.* (1988), who assessed labour use over a one-year period, on 37 farms in Ireland, found that labour-use varied according to layout, herd size and general organisation of the farm. Gross profit margins did not correlate with labour input per cow. Ruane & Phelan (2001) suggested that dairy and calf facilities required considerable improvement in order to reduce labour input to those tasks on Irish dairy farms. But the issue of labour efficiency at farm level is not unique to the Irish dairy industry. Research studies from other countries have measured labour costs as a proportion of total costs. Carley (1979) indicated that increasing production per cow by 100% reduced labour inputs per 45 kg of milk by 50% for all herd-sizes. Robes and Angaricia (1991) showed that labour costs on Cuban dairy farms accounted for 20% of the total costs of milk production while, Cleary and McKerrow (1996) showed that labour accounted for 21% of total costs on farms in the Western District of Victoria in 1984. Holt (1989) assessed labour use on 61 dairy farms in England (average herd size was 118 cows) and indicated a labour input of 8,253 h/annum, which was equivalent to 1 labour unit to 38 cows. Turner & Fogarty (1995) also completed a

labour study which showed considerable differences in labour required on different sized English dairy farms.

Since increased labour productivity is expected to become a prime factor influencing farm household income by accommodating either expansion or multi-funtionality, there is currently a need to establish the patterns of labour input on-farm and how this is influenced by facilities, layout and work procedures. The purpose of this study was to quantify the labour requirements of dairy farming and to examine strategies for more efficient labour use, particularly on potentially non-viable farms. This should have application in providing a time opportunity for alternative labour-use on such farms.

Methodology and data sources

The study was conducted with dairy farmers mainly in the Munster region of Ireland, since this area accounted for 65% of the total manufacturing milk supply in the country. Individual letters were sent to 360 farmers outlining the purpose of the study and inviting their co-operation. Of these, 143 farmers opted to participate in the study. Proportionally 0.80, 0.18, and 0.02 of these farms had spring (February/March), mixed (spring and autumn) and autumn (October/November) 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. Farms were classified as one of four categories based on milk volume produced.

The categories were considered representative of different farm groupings in Ireland; group 1 = 135 $x10^3$ to 250 $x10^3$ litres, group 2 = >250 $x10^3$ to 320 $x10^3$ litres, group 3 = >320 $x10^3$ to 500 $x10^3$ litres, and group 4 = >500 $x10^3$ to 1,500 $x10^3$ litres. Proportionally 0.32, 0.28, 0.21 and 0.19 of the farms fell within quota groups 1, 2, 3 and 4, respectively. Farms in milk

groups 1, 2, 3 and 4 had an average milk production of 212 $x10^3$, 281 $x10^3$, 388 $x10^3$ and 764 $x10^3$ litres, respectively. These farms had an average herd size of 47, 55, 74 and 149 cows, respectively, of which almost all were Friesian breed.

The category of milk quota size 135 $x10^3$ to 250 $x10^3$ litres and average herd size 47 cows (Group 1 farms) was selected for detailed analysis of labour input. In both 1992 and 2002 studies of competitiveness in Irish agriculture (Boyle, 2002) found that scale economies existed in herds of 50 to 60 cows. However, 'small farms' below this scale were considered as disadvantaged because they had insufficient scale to adequately remunerate the owned labour input. Thus, Group 1 farms which may require additional income from other enterprises were critically examined for potential time availability for such enterprises.

Data collection

Data was collected over a 12-month period between February, 2000 and January 2001. All farm operators (farmers and/or farm staff) recorded the duration of each task they performed (including contractor time) throughout the day. Two data recording methods were used. The main method involved a timesheet designed to record the total time consumed by 29 different farm tasks for each of 3 consecutive days. The second method involved a Psion organiser, i.e. a hand-held, electronic data logger that incorporated the Observer behavioural package (Noldus Information Technology). On the farms using the Psion, each individual worker recorded data for 5 consecutive days. Sixty-five and twenty-nine farms used data recording methods 1 and 2, respectively. The 29 farm tasks were incorporated within 10 task categories for analytical purposes. This study focused specifically on two task categories, i.e. milking and calf care. 'Milking' included herding cows for milking, milking (clusters on / clusters off), washing up and herding cows after milking. 'Calf care' described the tasks

associated with feeding, cleaning and bedding of calves. 'One-off' questionnaires were also completed for each farm. The questionnaires provided information on facilities and layout and farm practices relating to the milking process, calf care, feeding and cleaning associated with winter housing and waste management on the farm.

Data analysis

Data from ninety-four spring-calving dairy farms for whom a complete dataset was obtained was processed using the Microsoft Access database management system and analysed using the SAS statistical package (SAS, 1999). Analysis of variance across months was carried out using the Mixed procedure, which is a generalisation of the standard linear model used in the GLM procedure. In the analysis carried out, the farm was considered to be the experimental unit from which repeated measures were taken on a monthly basis.

Results

The average dairy labour input per day for farms in milk producing groups 1, 2, 3 and 4 over the 12-month period was 7.0 h, 7.9 h, 9.6 h and 13.3 h, respectively (Table 1). Dairy labour input per day increased with increasing milk producing group ($p<0.001$). This equated to 46, 45, 40 and 28 h/cow/year, assuming 5 full and two half working days (week-end) per week.

Table 1. Dairy labour input per day (h) required by dairy tasks carried out on farms of four milk producing groups

	Milk producing group					
Av. milk produced (litres)	1 212 x10^3	2 281 x10^3	3 388 x10^3	4 764 x10^3	s.e.m.	Significance
Total dairy labour (h) per day	7.0^a	7.9^b	9.6^c	13.3^d	0.50	***

^{abcd} means on the same line without a common superscript are significantly different

*** = P<0.001

Average labour input on milk producing group 1 farms (average 212 x10^3 litres)

It was assumed that volume of milk produced on dairy farms influences the threat to viability on such farms. Labour input on farms within the smallest milk producing group (Group 1 farms) was examined, specifically, to quantify potential available time for involvement in other enterprises, in order to increase total family farm income. The average labour input per day for Group 1 farms over a 12-month period is shown in Figure 1. Total labour input on these farms peaked at 9.6 h in June and gradually declined to 5.4 h in December. (This data represents net labour input per day, excluding mealtimes, etc). When time associated with enterprises other than dairying was excluded, the average labour input per day associated with dairying decreased to 9.0 h in June and to 4.4 h in December.

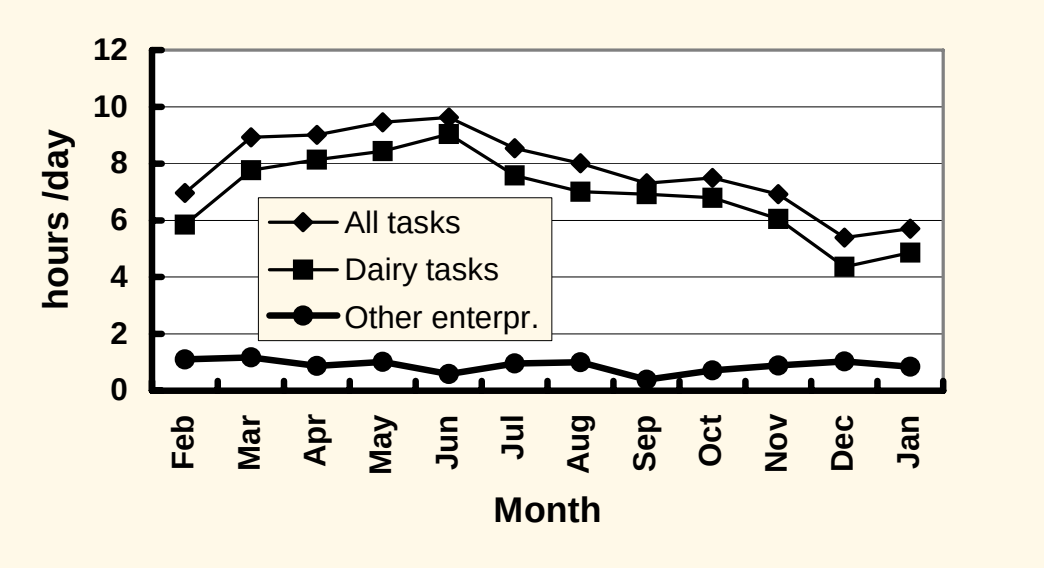

Figure 1: Average daily labour input associated with all tasks, dairy tasks and other enterprises on Group 1 farms (average 212 x10^3 litres)

Dairy labour input associated with specific tasks

Proportionally 0.36, 0.16, 0.12, 0.10, 0.06, 0.11, 0.05, 0.03 and 0.01 of dairy labour time was associated with the task categories of milking process, maintenance (land and buildings), office, grassland management, calving and calf care, feeding and checking dairy animals, cleaning, fertility and miscellaneous over a 12-month period, respectively, on Group 1 farms (average 212 x10^3 litres) (Figure 2).

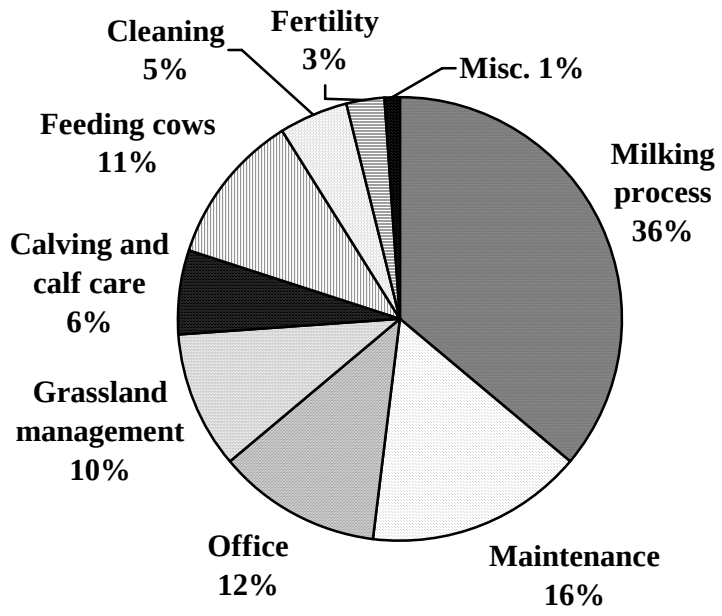

Figure 2: Breakdown of total labour input over the 12-month period on Group 1 farms (average 212 x10^3 litres)

Benchmarking of farms on labour input to different tasks

The dairy task requiring the greatest proportion of labour input was the milking process. The average daily labour input for the milking process over a 12-month period, for the 30 farms was plotted in order to establish the month in which labour input was at a maximum. Labour input was highest for the milking process in May. The task of calving and calf care had a labour demand peak in March. Although calving and calf care accounted for just 6% of dairy labour input over the 12-month period, calf care alone accounted for 13% of dairy labour input in March. The variation in labour input levels in the months of peak labour demand for the tasks of milking and calf care was observed, and potential factors, such as, facilities and practices were compared in order to establish reasons for differences between farms. It was

considered that variation between farms within the same quota category (Group 1 farms) would be best observed by comparing the 20% of farms at both ends of the labour input range. The average daily labour input in the milking process (May) and calf care (March) for the 20% of herds with the least labour input and the 20% with the most labour input, together with quota size and cow/calf number for the respective groups are shown in Table 2. (The least and most efficient herd groupings may consist of different herds for the different tasks.)

Table 2: Average daily labour input of least labour input (20%) and most labour input (20%) herds (within Group 1 farms) (SD) for the milking process (May) and calf care (March), milk quota per year and cow/calf number for the respective groups

	Least labour input 20% of herds	Most labour input 20% of herds
Milking process (May)		
Dairy labour input/day (h)	2.2 (0.35)	5.2 (0.79)
Milk produced ($x10^3$ litres)	207 (43.6)	222 (23.3)
Average cow number	40 (8.9)	56 (6.4)
Calf care (March)		
Dairy labour input/day (h)	0.6 (0.19)	2.8 (0.54)
Milk produced ($x10^3$ litres)	209 (30.7)	209 (38.4)
Average calf number	26 (6.2)	30 (3.6

The milking process

Considerable variation in labour input per day for the milking process during the month of May was observed across Group 1 farms. The 20% of herds with the least labour input (average milk produced = 207 $x10^3$ litres, average cow no. = 40) had an average daily labour input to the milking process of 2.2 h in May. The 20% of herds with the most labour input (average milk produced = 222 $x10^3$ litres, average cow no. = 56) had an average daily labour input to the milking process of 5.2 h during May (Table 2). In terms of labour efficiency, the most and least efficient groups had labour input levels of 0.06 and 0.09 h/cow/d, respectively. In examining the facilities and practices associated with the milking process on the individual farms within the most and least efficient groups, there were a number of factors which could potentially account for the major differences in efficiency. The average number of cows milked per milking unit was 5 and 8 in the most and least efficient herds, respectively. The most efficient herds had pipeline systems with one operator in the pit. Two of the least efficient parlours had recorder plants and had two operators in the pit during milking, thus, doubling the time associated with milking. There was a greater degree of teat preparation carried out in the least efficient herds. A higher proportion of efficient herds had exit gates operated from any point in the pit. The majority of the most efficient farms had the grazing area in one block, i.e. not fragmented, while many farms in the least efficient group had to transfer cows across a public road on a daily basis. The cows in all of the most efficient farms could go to the paddock directly after milking, while in the least efficient group on the majority of farms, cows were retained in the yard until they were subsequently accompanied to the paddock by the drover. There were more instances of mechanized cleaning of yards within the most efficient group, e.g. tractor, pump, slats. The majority of farms in the least

efficient group used some degree of hand cleaning which was generally done on a twice daily basis.

Calving and calf care

Considerable variation in labour input per day for calf care during March was observed on farms in Group 1. The 20% of herds with the least labour input at calf care (average milk produced = 209 $x10^3$ litres, average calf no. = 26) had an average daily labour input for calf care of 0.6 h in March. The 20% of herds with the most labour input (average milk produced = 209 $x10^3$ litres, average calf no. = 30) had an average daily labour input for calf care of 2.8 h in March (Table 2). In terms of labour efficiency, the most and least efficient groups had labour input levels of 0.02 and 0.09 h/calf/d, respectively. In examining the facilities and practices associated with calf care on the individual farms within the most and least efficient groups, there were a number of factors which could potentially account for the major differences in efficiency. The majority of farms in the most efficient group transferred milk to the calf house by a trolley type mechanism, whereas, bucket transfer was used on all of the inefficient farms. A minority and majority of farms fed calves individually by bucket on the most and least efficient farms, respectively. The majority of efficient farms cleaned calving houses mechanically and infrequently, while a majority of inefficient farms cleaned calf houses manually using a fork.

Many other factors influencing labour input to the remaining tasks of cow feeding, grassland management, office etc. were also identified. Further studies investigating practices to improve feasibility of multi-functionality, such as once daily milking and once daily calf feeding are ongoing.

Theoretical dairy labour input

The average for the 20% of farmers having the highest and lowest dairy labour input per day (in group 1), for each month of the year was calculated. (Any one farmer may not have been in the lowest labour input group for all months or for all tasks within a month.) The theoretical profile of dairy labour input over a 12-month period, incorporating the 20% of farmers with the lowest labour input and the 20% with the most labour input (in each month) is shown in Figure 3. The average dairy labour input per day over 12 months for the 20% of farms with lowest dairy labour input per day and for the 20% of farms with highest dairy labour input per day was 3.8 h and 10.8 h, respectively. Taking 6 full working days per week, the average dairy labour input for these two scenarios would be 22.8 h and 64.8 h per week or 1,186 h and 3,370 h per year, respectively. Thus, there is potential to reduce labour input by approximately 65%.

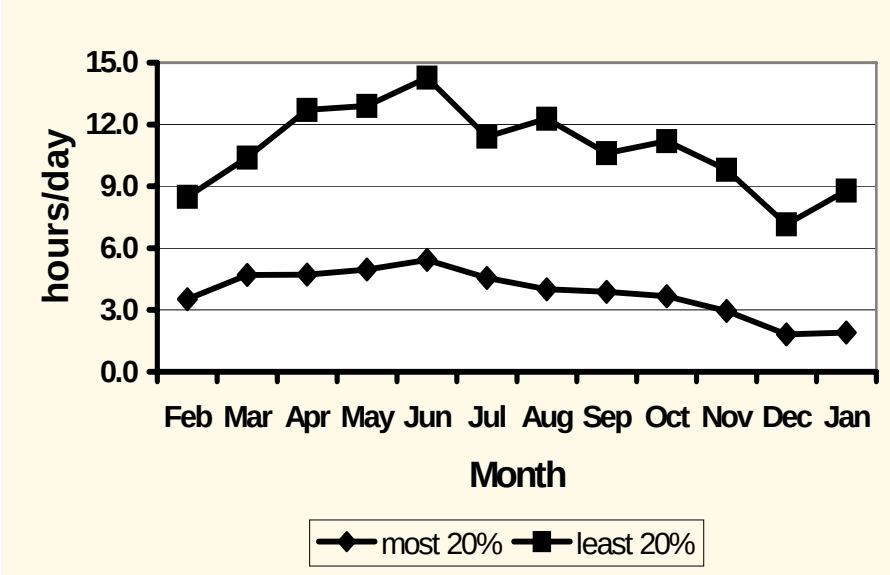

Figure 3: Simulated dairy labour input over 12 months on Group 1 farms – average dairy labour input of 20% highest and 20% lowest dairy labour input farms in each month

Discussion

The increase in labour demand with increasing milk production, found in this study, was consistent with Adamczuk (1978), who also showed greater hours worked with increased farm size. Turner & Fogarty (1995) also found that an increase in the scale of the farm business on English dairy farms resulted in greater labour demand and annual hours worked per individual, and therefore longer working days for the individual worker. Milking emerged as the most time consuming task in this study, accounting for over one-third (0.36) of total dairy labour input. This was somewhat higher than the results of Jagtenberg (1999), who recorded that 0.29 of total labour was required by milking. Ordolff (1986) and Sonck

(1993) both observed a proportion of 0.30 of labour input required by milking on dairy farms in The Netherlands. The higher value in this study may be due to poorer milking facilities. Seasonality of production had a large impact on labour requirements. The springtime labour peak observed in this study has confirmed a previous perception of Irish dairy farmers.

Dairy labour input per day for the Group 1 farms investigated ($135x10^3$ to $250x10^3$ l) was 7.0 h. However, a time saving of 3.0 h and 2.2. h per day at the milking process and calf care, respectively, was observed on the most efficient farms compared to the least efficient farms. The data also indicated the possibility of reducing dairy labour input on these farms to 3.8 h per day, a 65% lowering of current labour inputs on inefficient farms. This is a significant finding for the 'broadened agriculture' concept, as described by Mannion *et al*. (2001), whereby farm households expand the range of goods and services from which they make their living.

The results from this study showing that many farms producing up to 250 $x10^3$ litres require at least one full-time operator are in contrast to New Zealand dairy systems where typically 150 cows can be managed by one labour unit (New Zealand Dairy Board, 1996). This increased labour efficiency on a per cow basis observed in New Zealand, may be due to an economy of scale, where a large number of animals are treated as a group. Reduced labour requirement due to economy of scale is mainly achieved with tasks, such as, milking, grassland, cleaning and cow care (mainly feeding). However, an economy of scale is probably less relevant to tasks such as calf care which require individual animal attention. The reduced labour demand per cow on New Zealand farms may also be due to better facilities and layout, in relation to tasks, such as, milking and grassland. Additionally, the use of overtime, or casual labour, increased mechanization, changing the calving date and use

of reserves of family labour are all key issues in reducing labour requirements on farms. The use of farm contractors for tasks such as maintenance, calf rearing and winter-feeding of dry cows would further reduce the time commitment on dairy farms. Thus, well designed infrastructure and well managed practices employed on farms should facilitate labour efficiency and the possibility of engagement in other farm enterprises or activities, or in off-farm employment. This issue is of increasing importance since farm income has largely been replaced by employment income (Phelan, 2005) resulting in farm and non-farm earning activities competing for time.

Conclusion

It is important that the foregoing knowledge is in the public arena since it indicates that new technologies and good management skill of the operator have the potential to reduce labour input to dairying. In the foreseeable future, low income dairy farmers will need to examine off-farm employment opportunities or to commence new or alternative enterprises or businesses on farms to supplement farm income and maintain or improve farm household incomes. In order to accommodate any available opportunities, the dairy labour input on the farm must be efficiently used or minimized but without adversely impacting on the productivity or profitability of the dairy enterprise. Thus, labour efficiency must be optimized. In this scenario, the number of hours required both for satisfactory farm operation and for any alternative activity must be established. The foregoing data indicates the minimum time required for farm operations, and mechanisms by which this can be achieved on dairy farms.

References

Adamczuk, L. (1978) Research on time allocation amongst the rural population. II. Wies-Wspolczesna, Vol. 22, pp. 75-84.

Carley, D.H. (1979) Labour utilisation and costs on Georgia dairy farms. Research Bulletin No. 241. College of Agriculture Experiment Stations, University of Georgia, pp. 23.

Cleary, G. and McKerrow, P. (1996) Benchmarking: lifting profitability beyond the average. Dairying Research and Development Corporation Report, New Zealand.

Department of Agriculture and Food (Ireland). (2004). Compendium of Irish Agricultural Statistics, Aggregate Farm Income-Operating surplus 1990-2003 (current and real terms); G5a.

Http://www.agriculture.gov.ie/publicat/compendium_nov04/individuals_list/g6.xls

Accessed 26/06/06.

Frawley, J. & Phelan, G. (2002) Changing Agriculture: Impact on Rural Development. Proceedings of Teagasc Rural Development Conference, Dublin, pp. 20-41.

Hennessey, T., Fingleton, W., Frawley, J., Keeney, M. & O'Leary, E. (2000) Changing structure and production potential of Irish dairy farming in the context of quota abolition. Proceedings of Teagasc Agri-Food Economics Conference, Dublin, pp. 41-56.

Holt, C.M.R. (1989) Labour use on dairy farms. Report No. 64. FMS Information Unit, Milk Marketing Board, UK. 74 pages.

Jagtenberg, K. (1999) Labour input at low cost as farm approaches the objective of 50 hours per week. Praktijkonderzoek-Rundvee, Schapen-en-Paarden, Vol. 12, No. 2, pp. 29-31.

Kinsella, J., Wilson, S., de Jong, F. & Renting, H. (2000) Pluriactivity as a livelihood strategy in Irish farm households and its role in rural development. Sociology Ruralis, Vol. 40, pp. 481-496.

Mannion, J., Gorman, M. & Kinsella, J. (2001) Connecting farming, the environment and society: A living coutryside perspective. Tearmann, Vol. 1, pp. 11-17.

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

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

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

O'Shea, J., Kavanagh, A.J. & Reid, P. (1988) Labour use on Irish dairy farms. Irish Grassland and Animal Production Association Journal, Vol. 22, pp. 112-120.

Phelan, J. (2005) Farm Income and Sustainable Livelihoods in Ireland. Proceedings of the 21st Annual Conference of The AIAEE (Association for International Agricultural and Extension Education) 21, 612-622, San Antonio, Texas, 25-31 May 2005. http://www.aiaee.org/2005/papers.htm Accessed 15/06/06.

Robes, B. & Angaricia, L. (1991) Dairy farms (vaquerias) in Cuba: relationship between labour costs and labour productivity as depending on farm size. Agricultura Tropica et Subtropica, Vol. 24, pp. 109-121.

Ruane, D.J. & Phelan, J.F. (2001) Making labour more attractive for Irish farms: a case study of South Tipperary in the Republic of Ireland. Proceedings of the 15th ESEE Congress, Wageningen, NL, August, 2001.

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

Sonck, B.R. (1993) The modern littered house for dairy cows: too much labour? Labour planning. Labour and Conditions; Computers in agricultural management, Proceedings of the XXV CIOSTA-CIGR V Congress, Wageningen, The Netherlands, 10-13 May, pp. 260-269.

Turner, M.M. & Fogerty, M.W. (1995) Aspects of change in the UK Farm Labour Force. Farm Management, Vol. 9, No. 1, pp. 13-24.