New Knowledge of Facilities and Practises on Irish Dairy Farms – Fundamental Requirements for Effective Extension

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Abstract
Investment in labour is a significant limiting factor to expansion so it is crucial to research technical issues that would reduce labour/cost requirements. The purpose of this study was to establish the profile of dairy farms of various sizes with regard to facilities and practises and to identify labour saving techniques. Data on farm facilities and practices were recorded though a series of one-off questionnaire surveys. These surveys investigated facilities and practices associated with the milking process, grassland management, farm fragmentation and calf care. Data analysis was carried out using chi-square analysis. Herd-size group had a significant effect on the number of cows per milking unit with the number of cows milked per unit being higher on large compared to both medium and small farms (P<0.05). Herd-size group had a significant effect on fragmentation (P<0.05) with the grazing area in one block on 73% of small farms compared to 37% of large farms. Herd-size group had a significant effect on the methods used to transfer milk to young calves (P<0.05) and the type of milk consumed by older calves (P<0.05). Twenty-seven percent of large farms pumped milk to the calf house compared to 3% of small farms. Superior facilities and practices found on large farms illustrated a greater ability on these farms to invest capital. 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.

Keywords: Dairy farms, facilities, knowledge base, practises
Introduction

The limiting factor for agricultural growth is not usually the availability of technology but constraints that prevent the full utilisation of the technology available Mundlak, Larson, and Crego (1997). The small scale of many farms as well as the cost-price squeeze has slowed down the adoption of many technologies in Ireland. Indeed Dillon, Roche, Shalloo and Horan (2005) have stated that the efficiencies of many labour-saving technologies are captured only by increasing herd size. On many farms cheap hired or family labour is used to compensate for a lack of modernisation and investment in facilities, leading to poor working conditions. However, Fau and Chaspoul (1999) identified long working hours, poor working conditions and physical work on French farms as being a major barrier to finding good personnel. Thus such low cost labour sources are eventually exhausted. Gilbert and Pellerin (1996) found that while machinery cost and building maintenance costs on farms in Quebec increased significantly between 1985 and 1994, a significant increase in labour efficiency was also noted.

Previous findings of Ruane and Phelan (2001) and O’Shea, Kavanagh and Reid (1988) point towards a requirement for improvement in facilities and practices on Irish farms, and this is emphasised further by the current and future requirement for enterprise expansion. However, expansion in scale of enterprise would have a direct and significant effect on farm labour as a component input requirement of production. Hennessey, Fingleton, Frawley, Keeney, and O’Leary (2000) have indicated that an expansion of production of 100% would be required if Irish farmers were to maintain incomes in the context of WTO reform and a milk price cut of 20%. While the magnitude of the increase in scale necessary for different dairying circumstances is debatable, any such development will have an associated requirement for change of basic facilities and practices on farms. Consequently, ongoing research is required in order to establish more efficient working methods and labour saving techniques. The purpose of this study was to establish the profile of dairy farms of various sizes with regard to facilities, practises and infra-structure in order to identify labour saving techniques of potential benefit particularly to small enterprises and to assess barriers to expansion.

Methods and Data Sources

One hundred and thirteen spring-calving dairy farms were involved in this study. The farms were categorised into three herd-size groups; small (<50 cows), medium (50-80 cows) and large (>80 cows). There were 30, 53 and 30 farms in the small, medium and large herd-size groups, respectively. These groups had average herd sizes of 44, 63 and 141 cows, and milk quotas of 230×10³, 310×10³ and 711×10³ l, respectively. Data on farm facilities and practices were recorded through a series of one-off questionnaire surveys, completed on a number of farm visits by experienced data recorders. These surveys investigated facilities and practices associated with the milking process, grassland management, farm fragmentation and calf care. Data analysis was carried out using chi-square analysis.

Results

Milking facilities

Herd-size group had a significant effect on the type of milking parlour used (P<0.05) with 37% of large farms using modern parlours (2’ 2” herringbone, 2’ 3” sequential, rotary) compared to 10% of small farms, thus illustrating the greater likelihood of large farms investing in modern facilities (Table 1). Sixty-seven per cent of farms used a pipeline milking system with the remainder using recorder jars, with no effect of herd-size noted.
Table 1

The Effect of Herd-Size Group on the Type of Milking Parlour on Farms (n=113)

<table>
<thead>
<tr>
<th>Herd-size group</th>
<th>Small n=30</th>
<th>Medium n=53</th>
<th>Large n=30</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3’ 0” herring-bone</td>
<td>63%</td>
<td>55%</td>
<td>30%</td>
<td>50%</td>
</tr>
<tr>
<td>2’6” herring-bone</td>
<td>27%</td>
<td>17%</td>
<td>33%</td>
<td>24%</td>
</tr>
<tr>
<td>Modern1</td>
<td>10%</td>
<td>28%</td>
<td>37%</td>
<td>26%</td>
</tr>
</tbody>
</table>

Significance *

1Modern=2’ 2” herringbone, 2’ 3” sequential, rotary; n= number of farms in herd-size group
* = P<0.05

The effect of herd-size on the number of milking units and the number of cows per milking unit is shown in Table 2. Herd-size group had a significant effect on the number of milking units. Herd-size group also had a significant effect on the number of cows per milking unit with the number of cows milked per unit being higher on large compared to both medium and small farms (P<0.05). Herd–size group also had a significant effect on whether or not exit gates could be opened from anywhere in the milking pit (P<0.01), with 67% of large farms using this facility compared to 27% of small farms. Automated backing gates were in use on 10% of farms, while the milking operator had to leave the parlour to bring in most rows of cows from the collecting yard on 31% of farms.

Table 2

The Effect of Herd-Size Group on the Number of Milking Units and the Number of Cows per Milking Unit (n=113)

<table>
<thead>
<tr>
<th>Herd-size group</th>
<th>Small n=30</th>
<th>Medium n=53</th>
<th>Large n=30</th>
<th>s.e.m.</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milking units</td>
<td>7.4a</td>
<td>8.9a</td>
<td>15.5b</td>
<td>0.65</td>
<td>***</td>
</tr>
<tr>
<td>Cows per unit</td>
<td>6.1a</td>
<td>7.3b</td>
<td>9.4c</td>
<td>0.28</td>
<td>***</td>
</tr>
</tbody>
</table>

n= number of farms in herd-size group
a,b,c means on the same line not having a common superscript are significantly different
*** = P<0.001

Milking practices of pre-milking teat preparation and post-milking teat disinfection

Teats were never washed on 41% of farms. Herd-size group did not affect the practice of teat washing. Teats were dried on 30% of farms on which teats were washed (n=67). Herd-size group had a significant effect on whether or not unwashed teats were dry wiped (P<0.01), with 81% of small farms dry wiping cows compared to 38% of large farms. Therefore the absence of teat preparation was more likely to occur on large farms. The use of teat disinfectant was also influenced by herd-size group (P=0.07) with 83% of small farms using teat disinfectant on a year round basis compared to 57% of large farms. The effect of herd-size on the method of teat
disinfection used was approaching significance (P<0.10), with static spray droppers used on 75% of large farms compared to 46% of small farms.

**Grassland management and fragmentation**

Cows travelled directly to paddock after exit from the milking parlour on 60% of farms. Herd-size group had no significant effect on this variable. Fresh grass was allocated twice daily, daily and every second day on 54%, 26% and 20% of farms, respectively, with no effect of herd-size group observed. Herd-size group had a significant effect on whether or not grass covers were being estimated on farms (P<0.05), with 94% of large farms undertaking this task compared to 70% of small farms. Herd-size group had a significant effect on the methods used for grassland measurement (P<0.05), with 41% of large farms using either a plate meter or the Moorepark method (O’Donovan, Connolly, Dillon, Rath, and Stakelum, 2002) compared to 14% of small farms. The average number of parcels on the farms was 3.63 (±1.84, range 1 – 9). The average number of parcels used for dairying was 2.4 (±1.4, range 1 – 6). Herd-size group had a significant effect on fragmentation (P<0.05) with the grazing area in one block on 73% of small farms compared to 37% of large farms. On farms where it was necessary for cows to cross the public roadway in order to go to the milking parlour, 33% did so, on a daily basis, while 41% of farms required two or more persons to accompany the cows. Herd-size group had a significant effect on the method of drover transport used to herd cows (P<0.001), with quads being used on 33% of large farms compared to 8% of small farms. Ninety per cent of drovers on small farms travelled on foot or by bicycle compared to 40% of drovers on large farms.

**Calf care**

Herd-size group had a significant effect on the methods used to transfer milk to young calves (P<0.05), with 27% of large farms pumping milk compared to 3% of small farms. Sixty-seven per cent of small farms used buckets to transfer milk compared to 43% of large farms, illustrating a move by large farms from the more traditional, labour-intensive methods when feeding young calves. Milk transfer to older calf housing was carried out by buckets, trolley, and pipe on 42%, 35% and 23% of farms, respectively, with no effect of herd-size group observed. Herd-size group had a significant effect on the type of milk transferred for consumption by young calves (P<0.01), with 97% of small farms transferring warm fresh milk compared to 67% of large farms. Herd-size group had a significant effect on the type of milk transferred for consumption by older calves (P<0.05), with 80% of small farms transferring warm fresh milk compared to 48% of large farms. Herd-size group had a significant effect on the temperature of milk fed to young calves (P<0.01), with 100% of small farms feeding warm milk compared to 77% of large farms. The effect of herd-size group on the temperature of milk fed to older calves was significant (P<0.05), with 93% of small farms feeding warm milk compared to 71% of large farms. Acidifier was added to milk for young and older calves on 18% and 32% of farms, respectively. Young calves were trained using bucket, bucket and teat and automatic feeder on 46%, 53% and 1% of farms, respectively, with no effect of herd-size group observed. The effect of herd-size group on the methods used for feeding older calves is shown in Table 3.

Herd-size group had a significant effect on the methods used for feeding older calves (P<0.01), with 50% of small farms using buckets compared to 10% of large farms. Thirty-six per cent of large farms used teat feeders compared to 7% of small farms.
Table 3

The Effect of Herd-Size Group on the Methods Used for Feeding Older Calves (n=113)

<table>
<thead>
<tr>
<th>Herd-size group</th>
<th>Small (n=30)</th>
<th>Medium (n=53)</th>
<th>Large (n=30)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bucket</td>
<td>50%</td>
<td>34%</td>
<td>10%</td>
<td>32%</td>
</tr>
<tr>
<td>Trough</td>
<td>26%</td>
<td>21%</td>
<td>29%</td>
<td>25%</td>
</tr>
<tr>
<td>Automatic feeder</td>
<td>17%</td>
<td>35%</td>
<td>25%</td>
<td>27%</td>
</tr>
<tr>
<td>Teat feeder</td>
<td>7%</td>
<td>10%</td>
<td>36%</td>
<td>16%</td>
</tr>
<tr>
<td>Significance</td>
<td>**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n = number of farms in herd-size group; ** = P < 0.01

Milk was fed to young calves twice-a-day, once-a day and on an ad-lib basis on 92%, 4%, and 4% of farms, respectively. The effect of herd-size group on the frequency with which older calves were fed is shown in Table 4.

Table 4

The Effect of Herd-Size Group on the Frequency with which Older Calves were Fed (n=113)

<table>
<thead>
<tr>
<th>Herd-size group</th>
<th>Small (n=30)</th>
<th>Medium (n=53)</th>
<th>Large (n=30)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twice-a-day</td>
<td>74%</td>
<td>52%</td>
<td>36%</td>
<td>53%</td>
</tr>
<tr>
<td>Once-a-day/ Ad lib</td>
<td>26%</td>
<td>48%</td>
<td>64%</td>
<td>47%</td>
</tr>
<tr>
<td>Significance</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n = number of farms in herd-size group
* = P < 0.05

The effect of herd-size group on the frequency with which older calves were fed was significant (P < 0.05), with 74% of small farms feeding such calves on a twice daily basis compared to 36% of large farms. Calves were fed as a group at less than 2 weeks, 2 to 4 weeks and greater than 4 weeks on 79%, 17% and 4% of farms, respectively.

Housing for young calves had solid floors with straw bedding, slatted floors with straw bedding and slatted floors without bedding on 41%, 51% and 8% of farms, respectively. Housing for older calves had solid floors with straw bedding, slatted floors with straw bedding and either sawdust, bark mulch or slats on 53%, 39% and 8% of farms, respectively. Young and older calf pens that contained straw were bedded on a daily basis on 55% and 58% of farms, respectively. No effect of herd-size group on any of these factors was observed. Herd-size group had a significant effect on the frequency with which the pens of young calves were cleaned (P < 0.01), with pens being cleaned on a daily basis on 27% of small farms compared to 10% of large farms. Herd-size group had a significant effect on the frequency with which the pens of older calves were cleaned (P < 0.001), with pens being cleaned on a daily basis on 30% of small farms compared to 6% of large farms. Pens of young calves were cleaned using the methods of fork.
and barrow, fork and loader and loader only on 45%, 30% and 25% of farms, respectively. Pens of older calves were cleaned out using similar methods on 26%, 23% and 51% of farms, respectively. No effect of herd-size group was found. Calves were dehorned with gas or electric dehorners on 97% of farms. Farm operators, farm relief and other labour sources dehorned calves on 84%, 12% and 4% of farms, respectively. Calves were weaned at less than 8 weeks and at greater than 8 weeks of age on 32% and 68% of farms, respectively. Herd-size group had a significant effect on whether or not all calves were reared on the farm until weaning (P<0.05), with 63% of small farms rearing all calves compared to 35% of large farms, illustrating a stronger focus on larger farms on core dairying activities i.e. those related to the herd. Most calves were sold at less than 1 week, at 1-3 weeks and at greater than 3 weeks on 4%, 39% and 57% of farms on which calves were sold, respectively (n=51). Calf houses for young and older calves were purpose built on 54% and 47% of farms, respectively.

Discussions and Conclusions
The superior facilities and practices found on large farms in this study illustrated a greater ability on the part of large farms to invest capital, with less uncertainty surrounding their future in the industry, along with a greater requirement for more labour efficient systems with increased herd sizes. Indeed, Leaver (1994) has previously stated that the balance between labour input and mechanisation changes with farm size, while Nix (1993) has stated that costs per ha related to power and machinery declined with increasing scale.

While the average cow/milking unit ratio of 7.6 found across all farms was within the 8 rows of cows per milking recommended by McMahon and Ryan (2000), the large variation from 4 rows to 15 rows per milking illustrated the capacity for expansion of herd-size on some farms compared to the grossly undercapitalised nature of other farms. The fact that the cow: unit ratio increased with herd-size, illustrated that milking unit numbers were not expanded in line with increasing herd-sizes. Therefore, large farms had a requirement for much improvement in order to reach optimum unit numbers. The recommended cow:milking unit ratio is 6:1 (O’Callaghan, O’Brien, Gleeson, and Donovan, 2001). The main time saving elements of milking include an adequate number of milking units, an efficient work routine time, fast cow flow at entry and exit, a reliable drafting system and stall work that gives good cow control. It is extremely important that the operator does not have to leave the pit during milking. Upgrading of many parlours in respect to these characteristics is required.

Therefore a broader view of the whole package of farm facilities and practices, in conjunction with the long list of tasks, needs to be considered when introducing technological change. For example, the introduction of extra milking units may provide little or no advantage during springtime unless it is accompanied by the required number of milking operators. Teat preparation represented an integral element of the milking routine in terms of milk quality and udder health. Recognising the large herd-sizes in Australia and that best practice is to apply cups to clean dry teats, Klindworth (2000) recommended strategic washing i.e. the washing and drying of dirty teats only. However, this study indicated that teats were dried on only one-third of farms on which teat washing was carried out. Dry wiping of unwashed teats was less likely to occur on the larger farms, as was manual teat disinfection, clearly showing that as herd-size and milking unit numbers increased, the level of pre and post milking teat treatment declined.

Klindworth (2000) identified yards, backing gates, shed design, stockhandling and feeding as the main issues that affect the ease and efficiency with which a cow may walk into a milking parlour. While Irish milking parlours appeared to be adjusting to larger herd-sizes in
terms of milking practices and to a certain extent in terms of milking unit numbers, technologies to improve cow flow were less prevalent on farms in this study. Entry gates, drafting which could be operated from anywhere in the pit and backing gates were rare across all herd-sizes, while narrow doorways and operators having to leave the pit to aid cow flow were both prevalent. On the other hand, exit gates which could be operated from anywhere in the pit were more common, particularly on the larger farms where cow flow became more important with increasing milking unit numbers, longer parlours and reduced available work times. Significant improvement in terms of cow flow was required on many farms in this study, a fact best illustrated by the fact that on almost one-third of farms the milking operator had to leave the pit in order to bring in most rows of cows. Fox (1994) has suggested that cows would walk in by themselves where good cow flow factors are in place, such as lead-in walls, funnel entrances, lower breast-rails, zigzag rump rails, wide exit races that can hold one row of cows, drafting which can be operated from the pit and rough non-slip concrete surfaces. While discussion group recommendations from this study included many of these factors, particular attention was paid to collecting yards, handling facilities and holding yards.

This study indicated that the frequency of grass allocation has changed from the traditional method of grass allocation after each milking to a situation where almost half of the farms allocated grass on a daily or alternate day basis. Recent research has shown that using paddocks for 3 grazing periods (36 hours) increased protein levels while also reducing labour input in terms of strip fencing (Courtney, 2001). However, farm layout must be taken into consideration. While grass measurement was more likely to be carried out on large farms, with a large reliance on visual methods, a significant number of large farms used plate meters. Due to an obvious economy of scale the return on such practices would be more significant on bigger farms and once more it illustrates the earlier adoption of technologies by such farms. As a task, grassland measurement and budgeting is one with a high management element and which is likely to have a higher economic return than many arduous tasks within the farmyard. Indeed the elevation of such management tasks would help to reverse the negative image of farming amongst many farm family members, while increasing the need for more highly skilled labour sources. Allocation of fresh grass at a frequency of > 24 h would reduce labour demand and not have an adverse effect on cow production characteristics (Dalley, Roche, Moate, & Grainger, 2001).

CSO (2002) data indicates that land fragmentation has increased over the last decade with the average number of parcels per farm increasing from 1.9 to 3.1 between 1991 and 2000. A high proportion of large farms were fragmented in terms of dairy cow grazing area, which in turn led to a requirement to take cows across a public roadway for milking, a practice which required a second person on many farms with a matching progression in terms of drover transport also evident. Thus, dependency on a second person emerges, not in terms of meeting labour input quantity demands, but instead by assisting in tasks that require two persons. Ultimately, in the absence of underground tunnels, a clear dependence on labour sources additional to the principal operator will remain.

Many calf houses are not purpose built, but instead are converted buildings and therefore possibly not site specific. Indeed this leads to a necessity for efficient methods of milk transfer between the milking parlour and calf house. Transfer of milk to young calves by a piping system was more common on large farms, while trolleys were used frequently when long distances, older calves and therefore larger milk volumes were involved. Warm fresh milk was sent to younger calves on a large proportion of small farms which usually resulted in increased labour
requirement during milking time, and in many cases created a requirement for an additional operator. Large farms were more likely to feed cold milk to both younger and older calves facilitating a breakage of the link between feeding calves and milking referred to by Fallon (2001). Meanwhile teat feeders which were more common on large farms can accommodate large numbers of calves and also allow the feeding of cold milk. As calves take longer to drink cold milk, traditional bucket feeding methods become even more labour intensive in such systems.

The grouping of calves as a tool for reducing labour inputs, with calves being fed as a group at less than two weeks of age was practised on most farms. Meanwhile automatic feeding of older calves appeared to replace twice daily feeding on larger farms. In a study of 59 Irish spring calving herds Gleeson, O’Brien, O’Donovan and Fallon (2003) found that milk feeding of calves on a once daily basis reduced the labour input per calf and did not adversely affect calf performance. Daily bedding with straw for both young and older calves on many farms would appear to be labour intensive with alternatives such as annual bedding using bark mulch or the use of slats being proposed. This was somewhat evident on large farms with annual cleaning more common than on small farms. While calf house cleaning methods were similar across herd-size groups, a greater number of houses of older compared to younger calves could be cleaned by loader. As calf rearing in converted housing is common, it is possible that calf houses are not generally designed for ease of cleaning.

Meanwhile the rearing of all calves was less likely to take place on larger farms, thus illustrating the specialisation on these farms. However, as most calves were sold at greater than 1 week of age much of the labour associated with calf care had already been carried out. Alternatives of course include the contract rearing of calves or a much earlier removal of calves to outdoor calf rearing systems. However, the overall system must stay in focus. For example striving to lower bedding and cleaning times may lead to outdoor rearing far from the milking parlour and therefore causes losses in terms of milk transport.

The findings 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 for older calves. However, large farms were also more likely to suffer from land fragmentation and the associated difficulties. A heavy reliance on supplementary labour sources during key periods, such as springtime, or to assist with tasks such as herding cows across roadways and separation of cows for calving was also observed. Indeed such issues, relating to facilities and practices will become increasingly important for Irish farmers who wish to expand their scale of output over the coming years and to minimise increases in labour requirements.

In conclusion, the larger farms have been clearly shown to be early adopters of technology, then these farms will continue to benefit directly as unit costs are reduced and are likely to be drawn further in and onto the technology treadmill (Gasson & Errington, 1993). Meanwhile, the introduction of technology ultimately reduces product prices and the consequential cost-price squeeze along with the small scale of many farms slows down the adoption of many technologies in Ireland. Meanwhile Dillon et al. (2005) have stated that increased herd-size is necessary to capture the benefits of many labour-saving technologies. Leaver (1994) has previously described this conventional model of agricultural development, incorporating increasing farm size, increasing mechanisation and reducing labour input, while the Agri Food 2010 (2000) committee have emphasised the need for investment in physical capital and the implementation of improved technologies. Therefore technology adoption decisions will have to be made in the context of the wider farm framework in terms of available labour sources, tasks and the subsequent effect on returns to labour input and efficiency, such as income and...
quality of life. In this context, a significant change in facilities and practices will continue to be necessary in order to enable current labour levels on farms to meet the labour requirements associated with increased scale.

**Educational Importance**

It is critical for extension personnel to have information on the specific type and occurrence of facilities and practices on-farm together with the target farms and work areas where improvements are needed, in order to maximise facilitation of technology transfer. The local knowledge base of the extension personnel may also be a valuable contribution in evaluation of potential farm partnerships or milking parlour sharing to overcome the farm fragmentation issue.

**References**


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