

Precision Dairy Management: Saving Repro Labour with Pedometry

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Presentations on heat detection and managing reproduction in the dairy herd are nearly always written from the perspective of defining programs that result in pregnant cows, and there are sound economic reasons for this approach. According to a 1994 review (Senger 1994) heat detection efficiency in dairy herds is less than 50% and failure to accurately detect estrus costs the US dairy industry \$300 million per year. On a herd level, a computer simulation (Britt, 1995) using an assumed \$800 net cost to replace a reproductive cull, \$12.00 insemination cost and \$1.50 per dose for semen compared a “casual heat detection” program which resulted in 50% of heats observed with 80% detection accuracy, to a “systematic” heat detection program with two 30 minute observation periods per day, with assumed results of 75% detection and 90% accuracy and a “rigorous program that included additional “aids” such as pedometers as well as twice daily observation, with assumed results of 90% detection and 96% accuracy. Reproductive costs for the three programs are summarized in table 1. This simulation clearly shows that casual programs with poor results may be less expensive to implement but poor results are far more costly than the additional investment needed for success.

Table 1. Simulated reproductive costs per year for a 100 cow herd with casual, systematic or rigorous heat detection. (adapted from Britt, 1995)

	Casual observation		2x daily 30 minutes observation		2x 30 minutes plus “aids”	
Assumed heat detection rate	50% detected, 80% accuracy		75% detected, 90% accuracy		90% detected, 96% accuracy	
Herd fertility	50%	70%	50%	70%	50%	70%
General costs: (insemination, semen, days open and replacements)	\$27862	\$18060	\$15250	\$8382	\$9115	\$5484
Savings available to pay for added observation or devices vs casual program			\$12612	\$9678	\$18747	\$12576
Return to labour for 2 x 30 minute observation			\$34.55/hr.	\$26.52/hr.		
Annual return to “Aids” with labour at \$15. per hour					\$13272	\$7101

But today there are several very different programs for reproductive management in use on dairy farms. On the 2005 LHO Outdoor Farm Show Tour our group visited a farm using disciplined observation for heats 3 to 4 times daily, a farm using a commercial service for heat detection and insemination, a farm relying heavily on pedometers and a farm with a strict synchronization protocol and no heat detection. As illustrated in table 2, a good pregnancy rate is achievable with each of these options.

Table 2. Reproductive data from four herds on the 2005 LHO Farm Show Tour.

Program	Heat detection rate %	Days to first service	Conception rate %	Services/conception	Days to conception	Days calving interval	Pregnancy rate %
Commercial Service	59	68	27	3.6	143	429	17
Heat Detection	48	95	47	2.1	125	404	23
Pedometry	68	79	28	3.5	119	408	21
Presync/Resync	57	72	43	2.3	126	402	23

The goal of this presentation is to evaluate pedometry in comparison to heat detection and synchronization programs in terms of its economic potential in current and future herd management schemes. Compared to programs based on heat detection either by farm staff or by a commercial service, pedometry replaces the labour required for observation. Compared to synchronization programs it saves the labour of identifying, sorting and needling cows as well as the substantial drug costs. By reducing routine hormone use it also decreases the potential for criticism of animal welfare and food quality focused criticism of dairy production practices. Since labour costs and labour management are key issues in every aspect of managing the larger dairy herd, including reproduction it may be worthwhile to take an in depth look at how availability and cost of labour is changing.

The Growing Farm Labour Problem

Ontario dairy producers using non-family hired labour, the changing character of the labour force suggests that it may be time to seek a new approach. On a national level, farm labour is being recognized as an issue of increasing concern. Across Canada, unemployment in December 2006 was at a 31 year low of 6.2%. Particularly in the last 3 years, unemployment rates have fallen steadily. (See Fig. 1). In January, Statistics Canada reported 88,900 new jobs were created, the biggest increase in 8 months. And with employment opportunities in other sectors on the rise, the labour force available to agriculture is shrinking. The federal government recently announced it is spending \$1 million over two years to help head off the “growing concern over Canada’s declining farm labour force” The money is being spent on a Canadian Agriculture Human

Resources Council (CAHRC), made up of representatives of farm and commodity groups, with a mandate to identify labour problems and develop solutions.

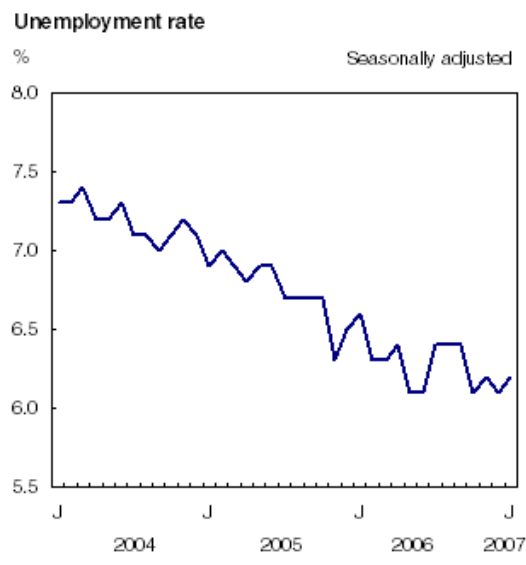


Fig. 1 Canadian Unemployment,
From Statistics Canada

A CAHRC review of existing information has already identified the following key issues (see www.cfa-fca.ca/pages/index.php?main_id+255):

- failure to recruit younger people means that the agricultural work force is getting older and while this means workers generally are experienced they lack “up to date skills” relevant to modern agriculture.
- Negative perceptions about agriculture make it difficult to recruit skilled people
- Young people lack awareness about agricultural career opportunities.
- There is a shortage of seasonal and

harvest labour.

- The industry lacks a culture of training and learning, making it unattractive to career minded employees.

While agricultural faces labour problems throughout the country, there is little doubt the problem is worse in South Western Ontario. For example, in the Woodstock area Toyota announced in 2005 that it would build 100,000 RAV4 vehicles per year in Woodstock by 2008. That year saw the creation of 340 new service sector jobs (140 at Home depot and 200 other restaurant and retail positions in the mall development on Norwich Ave). Toyota said it will employ 1300 and Toyota Boshoku another 330 by 2008, but before a shovel went into the ground, Toyota expanded its plans to 2000 jobs with an expansion of the planned plant to 150,000 vehicles per year. While none of these 2300 automotive jobs have come on stream yet, construction and the service sector are booming already. In fact in December 2005 unemployment in the region was 6.6% or 0.1% above the national average, while today it has dropped to 5.3%, well below the national figure of 6.2%.

Jeff Surridge Director of Community Employment Services in Woodstock feels that in this market, a 5.0% rate would reflect a situation where no one is actively looking for work. He considers 5.3% virtually full employment. In addition to the immediate Woodstock area, the job market is very strong throughout the region (see Fig. 2). Note that the Stratford, Woodstock, Kitchener Waterloo areas all have very low unemployment rates now.

Because of the high labour requirement for milking, dairy farming is one of the more labour intensive livestock operations. The Stratford/Woodstock/Kitchener area where so many dairy farms are located, is also the area where much of the new industrial development is taking place. For the farmer seeking employees, things are very tough now, and when the 2300 automotive jobs come on stream in Woodstock in 2008 the

situation will undoubtedly become even more difficult. In a market where every skilled worker can easily find work, the cost of labour will undoubtedly go up. Starting wages for a labourer at Toyota are approximately \$28 per hour, and skilled trades start at close to \$40 per hour. The profitability of many dairy farms is not high enough to support such wages and competing with these rates will be next to impossible for many farms.

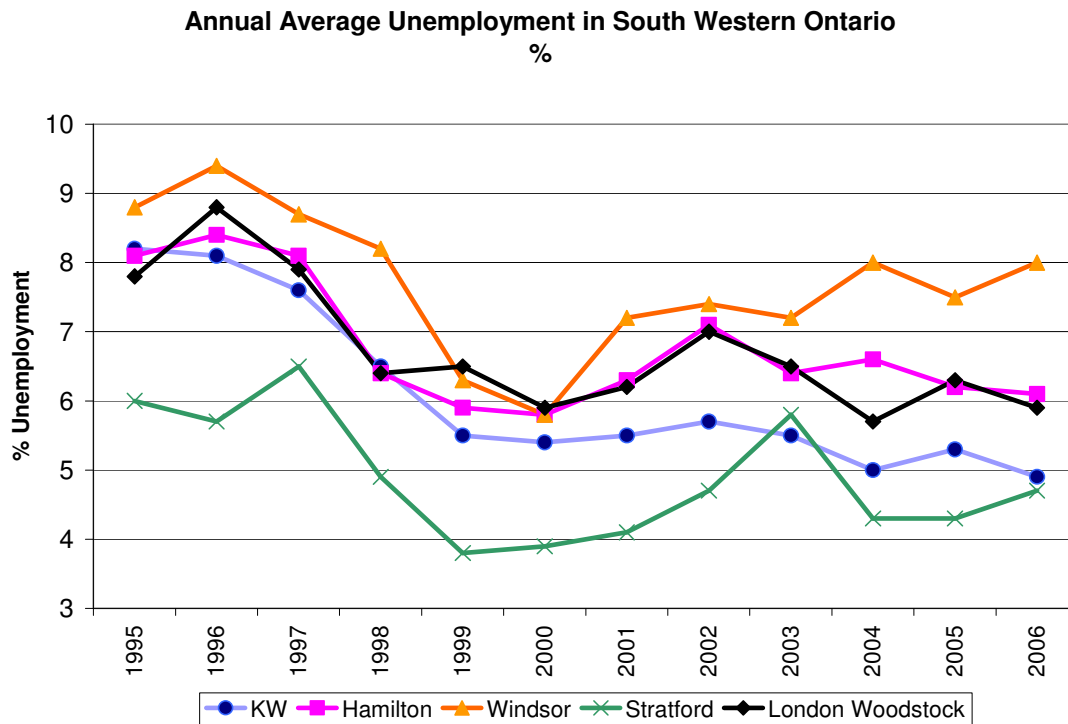


Fig. 2 Source: Statistics Canada

Meeting the Expectations of Employees

If competition for labour is going to increase it will be worthwhile knowing what it takes to keep employees motivated and happy. According to an article by Shannon Linderoth, in the January 2007 Dairy Herd Management magazine, in addition to a good work environment, there are 5 key deliverables a manager has to provide to ensure dairy farm workers expectations are met. These are fair and equitable pay, recognition for work done well, job descriptions, feedback and communication, and training including the opportunity to advance in responsibility and pay.

During the winter of 2004, 105 Ontario Large Herd Operators member farms provided detailed information on their labour force. The 105 survey herds ranged from 40 to 700 cows with an average herd size of 150 cows. In February 2007, 61 LHO member herds provided updated information on their current labour situation. This sample of herds averaged 185 cows. We can examine the information provided by these herds and see whether Ontario dairy producers are meeting the expectations of herd workers as set out in the article referenced above.

Labour on the 2007 survey farms was provided by, on average 6.43 people, 2.15 with an ownership interest, 1.11 non owner family members and 3.17 people who are strictly arm's length employees. Fully 26% of all workers, including 34% of milkers and 68% of calf care staff were women. When we consider the importance employees place on a pleasant work environment a clean, warm comfortable staff room or break room with decent washroom facilities ranks high on their list. Women employees particularly value such amenities. Many dairy managers report that women prefer 4 to 5 hour shifts and have an excellent temperament for milking and calf care. A professional work environment is important for all employees, but especially you plan to hire women milkers a clean well lit parlour and adequate washroom and staff facilities are a must. While it may be somewhat stereotypical to highlight this specific issue, it does reflect the fact that many farmers need to develop a new mindset if they want to adapt to changing labour demographics.

Rates of pay

Personnel management experts say its not just about the money, and employees often rank job security, challenging and interesting work, and a sense of involvement and responsibility ahead of good wages. But wages have to be fair and equitable compared to what others pay.

In 2007, the average wage reported was $\$12.66 \pm 3.72$, per hour up 7.6 % from three years earlier. We also asked respondents to include value for non-wage benefits which they valued at an average of \$0.60 per hour. Average hours of work was slightly lower at 27.6 perhaps reflecting a trend to a continuing shift to part time workers for milking. By asking producers to identify workers who were family members we were able to identify that lower wages are paid to family members. For all employee categories combined the average wage for family members was $\$9.95 \pm 3.35$ plus $\$0.80 \pm$ in benefits, while arms length employees received $\$13.43 \pm 3.44$ plus $\$1.13 \pm 1.72$ in benefits. The 61 herds analyzed included several from Quebec and the Maritimes as well as eastern Ontario herds. When only herds in the 519 and 905 telephone area codes were included, average arms length wages increased by 2% to $\$13.67 \pm 3.58$, indicating labour costs are only slightly higher here at the present time. It is also noteworthy that dairy farmers show little or no gender bias in pay rates. Arms length female employees earned $\$13.44 \pm 4.09$ per hour plus benefits valued at \$0.46, while male employees earned $\$13.41 \pm 3.27$ per hour plus benefits valued at \$0.60. Wages by job title are listed in the table 3.

These wages are given to permit you to compare your practices to others in the industry. Compared to other sectors, these wages are lower than most industries. A qualified person seeking to work 40 hours per week in any setting will clearly earn more in most industrial and manufacturing jobs than on the farm. Hence it is very important that you identify and satisfy the 'benefits' your employees associate with working on the farm.

Job title	Ave \$/Hr. (SD)	Ave. Hrs/ week	Estimated Value of benefits \$/Hr.
Manager	\$14.82 $\pm$ 0.72	36	0.07
Herdsmen	\$15.05 $\pm$ 2.82	51.5	1.06
Herd worker	\$12.10 $\pm$ 2.74	34.5	0.60
Milker	\$14.98 $\pm$ 3.23	21.5	1.17
Feeder	\$14.38 $\pm$ 1.98	37.6	1.68
Calf Feeder	\$9.50 $\pm$ 3.27	17.7	0.01
Labourer	\$11.56 $\pm$ 3.39	31.0	0.19
All employees	\$13.43 $\pm$ 3.44	31.5	0.53

Table 3: From LHO labour survey 2007, arms length employees only

These could include, a desire to have variety in the job, a desire to work with animals. Work outside etc. 46% Of arms length employees received some benefits in addition to wages, with the most common being milk 15%, meat 13%, clothing/boots 13%, health/medical insurance 10%, Christmas/year end bonus 9%, meals 7%, paid vacations, usually 2 weeks 7%, and housing 6%. Other less frequent perks included training courses, staff dinners/meetings, birthday gifts, vehicle, gas, wood, laundry service, cell phones and bull calves. The average value of these benefits was estimated to be \$0.53 per hour.

Recognition and Incentives

Although experts suggest that recognition for good work, and incentives can be great motivators for employees, it would appear that non-monetary benefits like housing which were once the norm, are in decline. 22% of the 54 farms with arm's length employees provided housing, with or without utilities for at least one employee, usually a full time herdsman. Items that are clearly cheaper to supply like meat (20% of farms) and milk (17% - to be home pasteurized of course) and small cost items that add convenience like breaks or day care, are probably beneficial and well worth providing. But the cost benefit of housing is typically under-valued by employees. It is also a good idea to facilitate employee purchases of supplementary health and perhaps life insurance but it may not make sense to pay the premiums (9% of farms did provide some form of medical, dental or drug coverage in 2007). In general employees value jobs and measure their worth in hard dollars, making this the best currency to pay them in. 9% of farms reported paying a "Christmas or year end bonus" unrelated to any specific aspect of performance. Such bonuses can be based on a combination of individual general performance and the overall success of the business.

Job Descriptions

Even though these are highly prized by personnel management experts, only 14% of farms had written job descriptions for employees. In most cases these were standard operating procedures for milking, soon to be required on all farms as part of food safety initiatives.

Feed Back/Communication

“Understanding and knowing your employees on a personal level” is considered critical to success by experts, and 63% of employers indicated they evaluated employee performance but only 8% did so formally. Two farms had probationary periods and only 1 farm reported a formal process of warning an employee and dismissal for a subsequent problem.

Training and Opportunities for Advancement

Despite the fact that it is on every list of do’s for developing good employee relations on the dairy farm, training in the 2004 survey was most often hands on, and on the job, with no written component. Only 2 farms reported providing training as part of a career development process in the 2007 survey.

Reducing Labour Costs through Expansion and Mechanization

The ODFAP data is a source of labour information for Ontario dairy farms. In table 4 below, the 2005 report is broken down by herd size and management system. As illustrated there is a large increase in labour efficiency in bigger herds. In tiestalls labour per hectolitre decreases 27% as herd size increases from 28 to 82 cows. Freestall herds with 42 cows are more labour efficient than tiestall herds of the same size, but labour efficiency in the freestall system increases dramatically in the larger herd. Paid wages are included in income to offset the greater use of paid labour on larger farms. What is most noteworthy however is that income per hour of labour for larger free stall herds is more than double that of even the bigger tie stall herds.

! TIE STALL

! FREE STALL !

	< 30 COWS	30-45 COWS	45-60 COWS	>60 COWS	< 60 COWS	>60 COWS
No. Herds	6	20	17	10	3	19
No. Cows	27.8	37.6	51.3	81.7	42.2	124.5
Kgs Milk/cow	6558	7,805	7,560	7,494	8,351	8,644
Cows/Person Equivalent	14.5	20.3	24.0	30.4	22.5	54.1
Hrs Labour/Hl Milk sold incl. Heifers	2.45	1.63	1.54	1.34	1.67	0.74
Hrs Labour/Hl Milk sold excl. heifers	1.75	1.26	1.14	0.95	1.17	0.57
Return to Labour	\$46,307	\$78,684	\$89,336	\$149,020	\$75,771	\$280,053
Return to Labour per hour	\$10.33	\$16.41	\$14.97	\$18.04	\$12.19	\$37.96

Table 4: Selected Financial and Labour Data. Ontario Dairy Farm Accounting Project 2005

Labour efficiency of Ontario Herds in hours per cow per day is shown for 105 Ontario Large Herd Operators' Herds (LHO) surveyed in 2004. (Table 5) As shown, there are labour savings in free stall management in the 100-200 cow herd size range, but there is still more to be gained through expansion to 300 cows and beyond.

Herd Size (no. cows)	<i>Labour Hrs/cow /day</i>	<i>Number of Farms</i>
60.1 (All ODFAP 2003)	0.27*	91
150.4 (all LHO 2004)	0.22 (0.13-0.32)	105
< 100 cows	0.29 (0.18-0.40)	28
100 – 200 cows	0.21 (0.13-0.29)	48
200 – 300 cows	0.16 (0.09-0.23)	16
>300 cows	0.14 (0.12-0.16)	6

* 86 % of total labour reported to adjust for 14% field work included in the data.

Table 5: Average and (Standard Deviation) Hours of Labour /cow/day on Ontario farms, from LHO Labour Survey 2004

In the traditional “expansion and mechanization model” of increasing labour efficiency labour savings result from applying the “manpower” to a larger piece of equipment or to serving a larger group of cows at one time. The example in milking would be putting the man in a 2 x12 to milk 100 cows per hour instead of a 2 x 8 milking 70 cows per hour. In reproduction management the parallel would be the greater efficiency of observing a larger group of cows for heat. One worker can as easily observe a 100 cow group as a 50 cow group, in fact heat detection should get easier in larger herds because mounting activity increases substantially when there is more than 1 cow in heat at one time (Varner 1994, Britt 1995, At-Taras 2001, Roelofs 2005). If the required observation time for a successful program is 30 minutes twice daily the labour required per cow is half in a herd double the size.

Primarily because of the capital cost of milking parlors and the large labour requirement for milking the current “model” of an efficient mechanized dairy appears to be the 72 stall rotary with 3000 milking cows in 8 groups of 375. Unfortunately the population density of rural Ontario does not lend itself well to this kind of production model.

Precision Management Technology

In contrast to the rotary parlor above, where mechanization allows high labour efficiency, unattended robotic milking represents a new direction in technology in which automated animal identification, automated information gathering and automated delivery of labor and management functions eliminates both the physical labour of milking and the management labour of making milking management decisions. When supported by computerized decision making tools such technology has the potential to add further precision to management application. It is also an approach that minimizes use of labour and takes labour saving into a new and different direction than traditional mechanization. Pedometry, robotic calf feeding, cameras for observation and night checks, automated feed delivery and individual feed mixing are other examples of precision management technology.

Pedometers

Pedometry is an excellent example of an effective precision dairy management tool. In traditional schemes, labour is recognized as the most costly component of heat detection programs (Senger 1994). In high producing cows, the period of mounting activity lasts an average of 5.8 hours (At-Taras 2001). In view of this visual heat detection must be done several times daily to be effective. Studies with early model pedometers (Pennington 1986) showed them to be as effective as twice daily observation for 30 minutes. More recent studies have reported 51 to 87 % detection with a single cow in heat and 95 % with more than 1 animal in estrous (Roelofs 2005). One review of literature (Nebel 1998) reported an efficiency of 83% and accuracy of 85% for pedometers and suggested modern commercial systems have improved greatly since these studies were carried out.

As an observation tool pedometers also have a major advantage over visual observation and that is consistency of delivery. Programs that focus on visual observation with planned times of the day dedicated to watching cows for heat, never work as well in the field as they do in research studies. It is suspected that the human factor, and the difficulty of standing still for a half hour or walking behind cows in a headlock or whatever the program consists of works well on a weekday in the winter when everything is working. But it breaks down quickly on Sunday afternoon, on Saturday night before the hockey game and on any working day when a crisis means some job as to be rushed or left out. Pedometry suffers from no such inconsistency and is much more likely to deliver good heat detection results.

As an aside, numerous studies evaluating heat detection methods have reported that mounting activity, walking activity and all behavioural expressions of heat increase substantially when there are more than one cow in heat at the same time. Since efficient and error free heat detection is valuable to a dairy herd, more activity is valuable to both herds that rely on pedometers or observation. This fact may cast doubt on the practice of segregating cows in heat from the herd, to reduce the disruption they cause and reduce the risk of injury. Hence the question needs to be asked whether increasing the heat detection rate from 80% to 95% (a rough estimate of the difference between one and more than one cows in heat) is worth more or less than the risk of injury and cost of disruption resulting from leaving the cow in the group. Secondly in all of these herds, 15 to 30% of cows will still be bred using an injection program, since some cows don't show adequate heat signs to be detected. Should these cows be synchronized on the same day, to minimize injection and insemination labour, or across a number of days to provide a group of "teaser animals" that will enhance heat detection among the rest of the herd?

A few studies also suggest that reduced activity, measured by pedometers can be used as an indication of health problems. In one study on a dairy in Israel (Mazrier 2006) 21 out of 38 cases of lameness identified by clinical observation, were among a group of 46 cows flagged for having pedometer activity that was 5% less than the previous 10 day average. Reduced activity occurred 7 to 10 days prior to clinical diagnosis suggesting it has some merit as an early detection system, but early intervention would have involved treating a group in which 55% of individuals would not become clinically lame. In 92% of these cows activity declined by more than 15%, but in 17 cows no reduction in

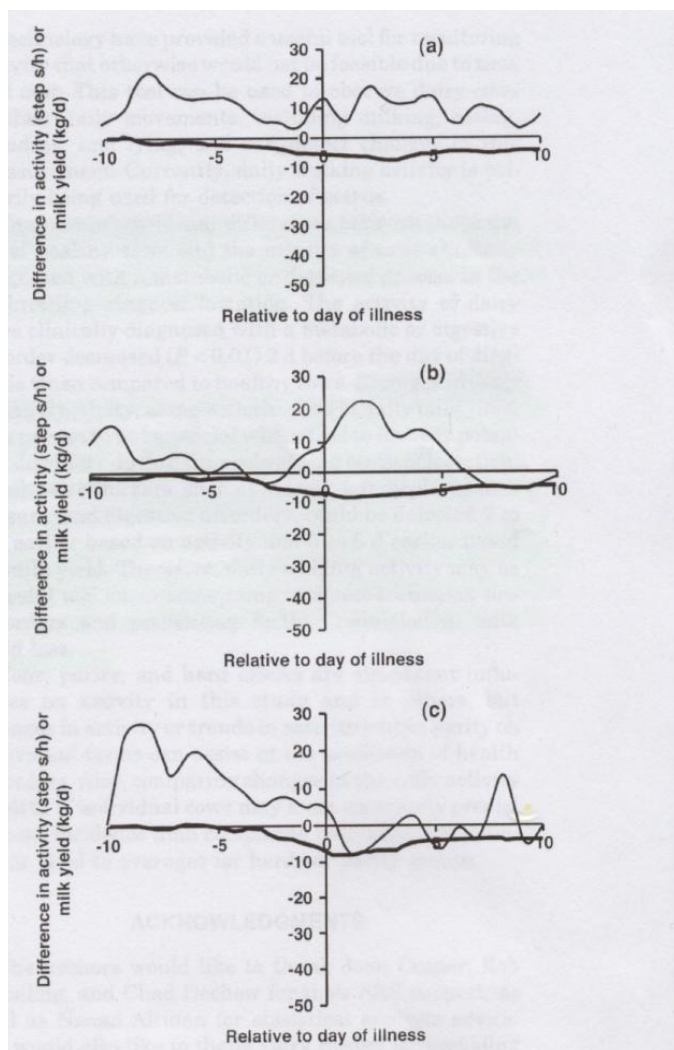


Fig.3 Activity (top line) and milk yield (bottom line) changes relative to healthy cows for cows diagnosed with ketosis (a) LDA (b) and digestive disorders (c)

pedometer activity occurred. More research is needed to define levels of activity reduction at which specificity is high enough to be useful for intervention. While treating such cases may prove worthwhile it is unlikely that sensitivity at this level of activity reduction will be high enough to be a substitute for clinical observation. Other researchers (Edwards 2004) have reported that transition cows with ketosis, LDA's or digestive disorders (Fig. 3)

showed greater pedometer activity than healthy herd mates 10 to 8 days prior to diagnosis and declined in activity in the week preceding a diagnosis.

While they concluded pedometers may be a useful tool in diagnosing metabolic disorders, they did not report sensitivity and specificity data.

Two studies have compared where on the cow activity monitoring devices should be positioned. A German study (Klindtworth 2002) reported that detection rates were 91% with foot attachments but only 78% with neck attachments. Only by attachment near the foot, can actual number of steps be measured and based on this work it appears that walking activity is more strongly correlated to estrus than head and other movements. Field experience

does suggest that leg mounted tags occasionally cause injury to the cow, and most farms remove the leg mounted tags at the end of each lactation and put them back on at the next calving. An Illinois study (Liu 1993) compared tags mounted on front and rear legs and found no difference in detection accuracy.

The following is a brief description of the current state of commercial development in this field:

AfiAct – Has been sold in Ontario since 1996 and it is the product that is most common in Ontario. The leg mounted pedometer can be mounted on either a front or rear leg depending on placement of the antennae. The sensor device carries both the ID and the activity monitor. It is known to be robust and although internal batteries are supposed to be good for 5 years, many last 10. Replacement sensors are \$100 each, and the base

system will cost roughly \$13,000 bringing the cost including parlor ID to about \$23,000. for a 100 cow herd. The data is read in the parlor at milking.

DeLaval Alpro – Is relatively new and while the capabilities are impressive, the systems in use are too new to provide a good indication of reliability. The activity sensor is a separate device from the ID tag, and both are carried on a neck strap. Battery warranty is pro-rated for 10 years, and it can be shut off when the tag is not in use. The battery contains no mercury, making it less of an environmental problem at the time of disposal. The antennae are in the barn and have a read range of 50 to 70 meters.

Westfalia Rescounter is a single tag system that combines ID and activity. The tag can be foot or neck mounted, and it is read in the parlor, and integrated with the companies herd management software. Based on company literature activity data is cow specific and there are no herd adjustment factors used.

BouMatic CowTrakker is a single tag system that is neck mounted and has two batteries instead of one. It also contains no mercury and the ID component is passive and will remain functional when the battery wears out. A full parlor automation package including CowTrakker for 100 cows adds about \$30,000 to the cost of a basic parlor, and this would be about \$7500 less without activity monitoring. Replacement transponders for activity and ID cost approximately \$150 vs \$60 for a transponder with ID only. Tags are read at the parlor entrance, with somewhat greater error consequences than systems with a reader at each stall.

Lely/Gencor Heatime is a stand alone system that does not tie in to any parlor automation software. It functions independently using a neck mounted transponder that carries both ID and activity information. The batteries are guaranteed for at least 6 years of operation. Neck movements are recorded in two hour intervals and stored for up to 24 hours. The data is read by an ID reader located over the entry lanes of the milking parlor or over the water troughs or crossovers in a heifer barn. Somewhat longer read distances are possible with this infrared technology. Data management can be done from the compact control unit and/or from an optional PC. Cost for the system is \$2410 plus \$500 per reader for the base system installed, plus \$105 per cow for the transponders and neck straps. For 100 cows a system that can read in two parlor entry lanes would cost \$13,900.

Dairymaster indicates they have a system in development that will use the RFID ear tag for ID and include a separate activity monitoring device that can be linked at the reader. There are plans for an installation in Ontario soon but there are no systems working yet.

Because these systems are linked to parlor ID and management software, activity monitoring added to existing parlors will invariably be purchased from the same manufacturer as the parlor. The value of parlor ID in terms of automating data collection on milk production, milking speed and other milking information, identifying treated cows, and sorting cows etc. cannot be easily assessed separate from the benefits of activity monitoring. With the rising cost of labour, parlor automation as well as auto sort systems and pedometry are all becoming relatively more affordable today.

Management Strategies on Commercial Dairies With and Without Pedometer Systems

In a survey of 103 large commercial dairy herds in the US (Caraviello 2006) with an average size of 613 cows, the farms reported that cows were observed for estrus 2.8 ± 0.3 times daily for 27 ± 4 minutes, but 78% of farms indicated this was not always the employee's only responsibility in this time period. Hormonal synchronization and timed insemination was practiced on 87% of farms, with 86% synchronizing first services, 77% resynchronizing repeats and 59% treating cysts, anestrus and anovular cows. By comparison only 8% of farms had invested in pedometer systems. Although there are few comparative economic studies of reproduction management strategies one published report (French 2003) ranks pedometers as lower cost than presync, ovsync and visual detection, but it would appear that this conclusion has not reached US producers.

The Cost of Reproduction Management Tools Compared

Pedometer systems provide a reliable substitute for two or three times daily heat detection by observation and in that sense they are a labour saver. With the exception of presync/resync programs all AI breeding schemes require heat detection either to identify cows for first breeding or identify repeat breeders from other schemes. It should be possible to determine the labour cost of this required heat detection and make a simple judgement of whether or not an investment in pedometers is justified. For example, twice daily observation for 30 minutes costs 365 hours of labour per year. If this task is done by the herdsman who according to table 3 costs \$16.10 per hour in pay and benefits, the cost of heat detection is \$5876 per year. If annual maintenance costs on a pedometer system are estimated at \$500 per year there is \$5376 left over to pay for the system. Amortized over 7 years at 6.5% per year, this will pay principle and interest on just over \$30,000. If a stand alone system costs \$14,000 it would appear that every herd with labour costs of more than \$8.00 per hour should consider this a better alternative than visual heat detection. But a system integrated with the parlor can provide many additional benefits and if it adds roughly \$30,000 to the cost of a milking parlor, this feature alone is covering the cost at typical arm's length labour rates.

On the 2005 LHO Outdoor Farm Show Tour our group visited herds using four very different strategies to get cows pregnant. Assuming each of these programs has the potential to yield equal results, here is a projected cost for each for 100 or 300 cows.

100% Heat Detection Program – 100 cows

-Labour of 2 x daily half hour observation (3 times 20 minutes would be better) plus 6 minutes to sort and restrain cows for breeding. 401.5 hrs/yr @ \$16/hr = \$6424.

-Ovsync 25 cows per year that are not bred on heats @ 2.5 services X \$12 drug cost + 15 minutes labour per week for sorting and needling = \$750 drugs, \$208 labour

-Total cost \$6632 labour plus \$750 drugs = \$7382 or \$73.82 per cow

- 300 cows

-Labour of 3 x daily half hour observation plus 15 minutes to sort and restrain cows for breeding. 639 hrs/yr @ \$16/hr = \$10224.

-Ovsync 75 cows per year that are not bred on heats @ 2.5 services X \$12 drug cost + 30 minutes per week for sorting and needling = \$2250 drugs plus \$416 labour

-Total cost \$10640 labour plus \$2250 drugs = \$12890 or \$42.96 per cow

100% Presync Program -100 cows

-\$26 drugs for first service and \$12 for later services with an average of 3 services is \$60 per cow per year or \$6000

- 1.5 hours per week for sorting and needling cows @16 = \$1248

-Total cost \$6000 labour plus \$1248 drugs=\$7248 or \$72.48 per cow

- 300 cows

-\$26 drugs for first service and \$12 for later services with an average of 3 services is \$60 per cow per year or \$18000

- 3.0 hours per week of sorting and needling labour @16 = \$2496

-Total cost \$2496 labour plus \$18000 drugs = \$20496 or \$68.32 per cow

Pedometer System -100 cows

-\$13900 capital investment in a stand alone (Gencor) system @6.5% interest repaid over 7 years this is \$206.40 per month or \$2477 per year.

- maintenance costs of \$500 per year.

Ovsync 25 cows per year that are not bred on heats @ 2.5 services X \$12 drug cost + 15 minutes labour per week for sorting and needling = \$750 drugs, \$208 labour

-Total cost \$208 labour plus \$750 drugs plus \$2977 for system= \$3935 or \$39.35 per cow

-300 cows

- 50% of a \$43,000 capital investment in a full automation system (rest is allocated to milking information, sorting and other functions). Ammortization at 6.5% over 7 years is \$319.25/month or \$3831 per year.

-maintenance cost of \$1000 per year

-Ovsync 75 cows per year that are not bred on heats @ 2.5 services X \$12 drug cost + 30 minutes per week for sorting and needling = \$2250 drugs plus \$416 labour

-Total cost \$416 labour plus \$2250 drugs plus \$4831 for system = \$7497 or \$24.99 per cow.

Commercial service* – 100 cows

-\$25 per day service fee less 15 minutes reduced labour per day (20 minutes for breeding minus 5 minutes owner labour to sort and restrain cows) for inseminations custom done = \$21 x 365 days = \$7665 per year.

-Ovsync 25 cows per year that are not bred on heats @ 2.5 services X \$12 drug cost + 15 minutes labour per week for sorting and needling = \$750 drugs, \$208 labour

-Total cost \$750 drugs plus \$7665 service cost = \$8415 or \$84.15 per cow

-300 cows

-\$10 per insemination for an estimated 1200 inseminations=\$12000

- less 15 minutes net saving in farm labour per insemination because this is included in the service (worth \$4800) for a net cost of \$7200.

-Ovsync 75 cows per year that are not bred on heats @ 2.5 services X \$12 drug cost + 30 minutes per week for sorting and needling = \$2250 drugs plus \$416 labour

-Total cost \$2250 drugs plus \$7200 for service= \$9450 or \$31.50 per cow.

*- note: commercial services are very difficult to pin down in terms of real cost because most also involve commitments to specific semen purchases etc. Unless you think that the technician works for less than \$16 per hour, is far more efficient than farm staff and travel costs no money, you have to be paying for his or her time somehow!

Other Precision management Technologies

Numerous other technologies such as handheld RFID readers linked to computers to aid in cow management, auto sort systems robotic calf feeding, robotic manure scraping, automated feed delivery systems, step/gait analysis to detect lameness etc. etc. The best way to evaluate all these technologies is to estimate how much labor they save and determine if the capital investment has a reasonable payback period. For example, using a labor cost of \$14.83 per hour saving 10 minutes per day is worth 60.8 hours per year or \$902. Using a repayment rate of \$95 per \$1000 invested (15 year payback at 5% interest) you can invest \$9500 to save 10 minutes per day, if no other costs are involved. Nearly all of the available precision management technologies will pay on nearly any size farm with these assumptions. It may be a stretch to expect 15 years out of electronic equipment, and most equipment will cost utilities and maintenance and repairs, but remember, most employees have an added cost as well, in unproductive hours, training time, management time etc. With interest at 6.5% and a 5 year repayment the \$95 above becomes \$237 and with this assumption you can invest \$3820 to save 10 minutes per day. Even at this extreme robotic calf feeding, stand alone pedometry, and cameras for night observation still pay on 100 to 200 cow dairies. More complex automation may demand a bigger herd size, but as labour cost continue to go up almost all of these technologies deserve a closer look. One area where there is great potential is better linkages to reduce the labour of record keeping related to management activities.

Labour and the Future of Dairy Farming

For the dairy industry, hired labour costs will go up faster than the cost of other inputs. These costs will go up, partly due to demands for higher wages but even more due to cost of benefits, time off and shorter work weeks. In the past, isolation and family labour, allowed agriculture to ignore the fact that labour has a cost. As your sons and daughters pursue higher education, and as your neighbour's children do the same, farm wages, benefits and working conditions will have to be more competitive. In contrast, computer hardware and software, electronic sensors and other components of precision management systems are getting better and cheaper. As these trends will undoubtedly continue, the role of pedometry, and other precision management technologies will rapidly gain in importance in dairy production systems.

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