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Technical Series

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Welcome to the first edition of DairyNZ's Technical Series

Farmers have told us that while they appreciated the range of topics and messages in our *Inside Dairy* magazine, they sometimes wished for more in-depth analysis than could be presented in the *Inside Dairy* format. Farmers were particularly interested in getting the most current information from the research we are funding, both through our own research and technical teams as well as those of our partners.

So the *Technical Series* has been developed as a regular addition to the monthly Inside Dairy pack.

The *Technical Series* illustrates DairyNZ's commitment to the future of dairying, the science that underpins our organisation and to the transfer of that science behind the farm gate.

We hope you enjoy the first issue.

As always we appreciate any feedback on our publications and would value any comments you have for us on our *Technical Series*. Email technicalseries@dairynz.co.nz or call the DairyNZ Farmer Information Service on 0800 4 DairyNZ (0800 4 324 7969).

DairyNZ

Mid-season milking review


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Summary

All staff need to maintain vigilance to prevent mastitis and manage the bulk milk SCC. Key actions include:

1. Apply teat spray to every teat after every milking throughout the season.
2. Treat new clinical mastitis cases promptly. Only treat on clinical (visible) signs.
3. Check teat cup liners and replace after no more than 2500 cow milkings.
4. Consider early drying off for clinical cows that have not responded to repeated treatments.
5. Avoid over-milking, which will cause teat damage and increase the risk of mastitis.

Some herds may consider introducing shorter milking times. This applies only to herds where mastitis is under control and the bulk milk SCC is below 150,000 cells/ml). This involves either:

1. Reducing milking times of all cows by increasing the ACR take-off setting
2. Setting a maximum milking time for slow milkers.

Introduction

Calving is over, the cows have been mated and it's time to take a breather... or is it? Mid-season provides a great chance to evaluate milking practices on farm, to check that best practice mastitis control methods are being implemented and identify if there are opportunities for reducing the time it takes to milk the herd. In this article we will explore the scientific rationale behind recommended practices for achieving good milk quality and udder health as well as some new research that is finding that, on some farms, milking time can be reduced by changing the end-point of milking.

Managing Mastitis

Mastitis is a costly business on most dairy farms. It is estimated that for a 300 cow herd with a bulk milk SCC of 200,000 cells/ml and 15% clinical case rate, the cost of the "gap" in performance in comparison with "target" (150,000 cells/ml, 8% clinical case rate) at a milk price of $6.00/kg MS is $27,000 (page 60 of the *DairyNZ Facts and Figures* book) or $90 per cow. Ensuring that cows remain at a low SCC throughout the season will help reduce production losses associated with a cow SCC above 100,000 cells/ml.

Identify problem cows

Vigilance is key to managing the bulk milk SCC. As a general rule, the bulk milk SCC is likely to double between peak milk production and drying off so herds with bulk milk averaging greater than 200,000 cells/ml at peak will need to be vigilant and manage their bulk milk SCC to avoid grading as the season progresses. Identify the high SCC cows, using herd test records and consider early dry off of these cows if the bulk tank quality requires it. Current indicators suggest that treatment of subclinical mastitis in NZ during lactation is not economically justified.

Teat spraying

Disinfecting teats after milking (teat spraying or dipping) is the most effective way to prevent mastitis in mid lactation but a number of farmers question whether they should continue the practice throughout the season. Studies have shown that applying teat spray immediately after milking reduces the rate of new intramammary infections (IMI) by between 49% and

75% (Williamson et al., 2010). The practice of teat spraying is common on New Zealand farms with 91% of farmers reporting that they routinely disinfect teats after milking (Cuthbert, 2008); however, milking time assessments of 200 herds with poor mastitis performance found that only 12% were achieving good teat spray coverage with the correct dilution of teat spray (Joe et al., 2010).

To achieve the full benefit of teat spraying the whole surface of the teat should be covered. Aim to use up to 20 mls per cow per milking. Although seemingly simple, it is a skilled job and there is room for improvement on most farms. Teat condition is a good test of the teat spray coverage being achieved; fewer than 5% of cows should have teat damage and fewer than 5% should have grossly dry teat skin. Automation of teat spraying is now common place, particularly in rotary dairies (49% of rotaries and 10% of herringbones use an automatic teat sprayer (Cuthbert, 2008)) so make sure that good teat coverage is actually being achieved and that spray nozzles and equipment are performing correctly. Maintenance of the teat spray system should be included as part of the routine farm dairy maintenance.

Change liners after every 2500 milkings

The quality of the liner will affect how well a cow is milked out, cow comfort and teat end condition. Old liners are also a reservoir for bacteria. Liners should be changed after no more than 2500 milkings (or following manufacturer's instructions). To calculate when you should change liners divide 2500 by the number of milkings each set of cups is doing every day (2500 / the number of cows in the herd * number of milkings (once, 1.5 or twice per day) / number of clusters).

For example, a 300 cow herd, milked twice a day in a 24 aside herringbone = each cluster is milking 25 cows per day. Divide 2500 by 25 = 100 days. This farm should change liners every 100 days or approx every 3 months.

Avoid excessive over-milking

Cows with poor teat condition are at risk of developing mastitis (Breen et al., 2009). Prevention of teat-end damage can be as simple as using a teat-spray with extra emollient (especially when weather conditions are bad), minimising over-milking by adopting efficient routines (see the DairyNZ Milksmart website: **milksmart.co.nz**), ensuring that automatic cup removers (ACR) are set appropriately and making sure the milking machine is checked by a qualified technician at least annually.

Spend less time milking

If mastitis is under control on your farm (bulk milk below 150,000 cells/ml), now is a good time to look at ways to spend less time in the farm dairy. See the DairyNZ MilkSmart website **milksmart.co.nz** for ideas about adopting efficient milking routines. Many factors influence the time it takes to milk a herd but the milking duration of individual cows, in particular the slower milking cows, can have a major impact on total milking time. Recent experiments at DairyNZ have shown that increasing the automatic cluster remover (ACR) switch-point setting, or applying maximum cluster attachment times (MaxT milking) can result in a substantial decrease in individual and batch milking times with minor effects on SCC or rates of CM, and minimal or no production loss (Jago et al., 2010a; Jago et al., 2010b; Burke and Jago, 2010).

Increasing the ACR switch-point

The operating principle for ACR is to detach the cluster once milk flow has decreased below a preset level or switch point (kg/min). An additional adjustment, usually called the ACR delay time, determines how long the cluster remains attached after the switch point is reached. In New Zealand it is common to set the ACR to activate at 0.2 kg/min, however, internationally there is a trend towards higher flow rate settings.

MaxT milking

MaxT milking is simply removing clusters from cows after a pre-determined maximum time has elapsed. This approach uses time rather than flow rate as the main criterion for deciding when a cluster should be removed. To set a maximum cups-on time (MaxT), the average yield per cow per day (L) and milking interval are used to determine the duration to harvest the milk at the morning and afternoon milkings (see **milksmart.co.nz**). For example, a herd with an average daily yield of 22 L/cow milked at a 10h:14h interval, MaxT would be set to 7.5 min (morning milking) and 5.5 min (afternoon milking). Eighty percent of the herd should have completed milking within this time, while the remaining 20% of slow milking cows have the cups removed once MaxT is reached. Exceptions are made for high yielding cows (30% or more above the herd average).

New Zealand Research

Studies have been conducted on DairyNZ farms to look at the implications of MaxT and ACR settings in more detail. In the first trial (Jago et al., 2010a), cows were assigned to one of two treatment groups: cups removed at a milk flow-rate of 0.35 kg/min (Control) and cups removed at a flow-rate of 0.35 kg/min or a maximum time, whichever came first (MaxT). The study began at peak lactation and continued until dry-off (26 weeks). On average 29% of the milkings were shortened for the MaxT cows yet there was no effect of on total milk, fat and protein yields. The SCC (Control 193,000 cells/ml; MaxT 213,000 cells/ml), rate of clinical mastitis and proportion of quarters infected with either minor or major pathogens did not differ between Control and MaxT groups.

Trial 2 began at the start of lactation (Jago et al., 2010b). Cows were assigned to one of 4 treatments: ACR200 (ACR set to 0.2 kg/min), ACR400 (ACR set to 0.4 kg/min), MaxTEarly (ACR set to 0.2 kg/min or a maximum cups-on time, whichever came

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first) and MaxTPeak (ACR set to 0.2 kg/min until peak lactation and then ACR set to 0.2 kg/min or a maximum cups-on time, whichever came first). MaxT was calculated based on historical average peak production data, giving milking times of 7.5 min and 5.4 min for the morning and afternoon, respectively. MaxT and the higher ACR setting decreased average milking duration by 9-14%, with the greatest effect in early lactation. Over the 35-week trial the total milk yield, total milksolids yield, incidence of CM and teat condition did not differ among the four treatments. However, the SCC was higher for the ACR400 group. To explore this result further a third trial (Burke and Jago, 2010) was conducted. In a cross-over design, 160 cows in mid lactation were milked with ACR set to either 0.2 kg/min or 0.4 kg/min for a 3 week period at each setting. Milking time was shorter when the ACR was set at 0.4 kg/min, there was a small (1%) decline in production, higher strip yields and no significant effect on SCC (Table 1).

Table 1: The effect of ACR flow-rate thresholds on mean milking duration, production, post-milking strip yield and SCC.

	ACR 0.2 kg/min	**ACR 0.4 kg/min**
Milking duration (min)	6.82	6.04
Daily milk yield (kg)	16.97	16.77
Daily milk fat yield (kg)	0.78	0.77
Daily milk protein yield (kg)	0.65	0.64
Post-milking strip yield (kg)	0.19	0.35
SCC (cells/ml)	186,000	133,000

Overall, these results support international research and indicate that for the growing number of rotary operators with ACR, there is opportunity to reduce milking time by manipulating the ACR switch-point with minimal impact on production and udder health (Clarke et al., 2004). For herringbone operators the impact of slower milking cows can be reduced by setting a maximum milking time.

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A fail-safe way to improve reproductive performance

Chris Burke, Senior Scientist DairyNZ

Before you go out to check that the bulls are doing their best to minimise your herd's empty rate, take a few minutes to reflect on how well you and your team are managing reproductive performance from a strategic and planned point of view.

"New Zealand dairy farmers are fortunate in that they have the most fertile cows in the world and an environment for them to express that high level of fertility. Immediate and sustained benefits are achievable for farmers who commit to improving reproductive performance and go about it in the right way."

The smart way is the right way

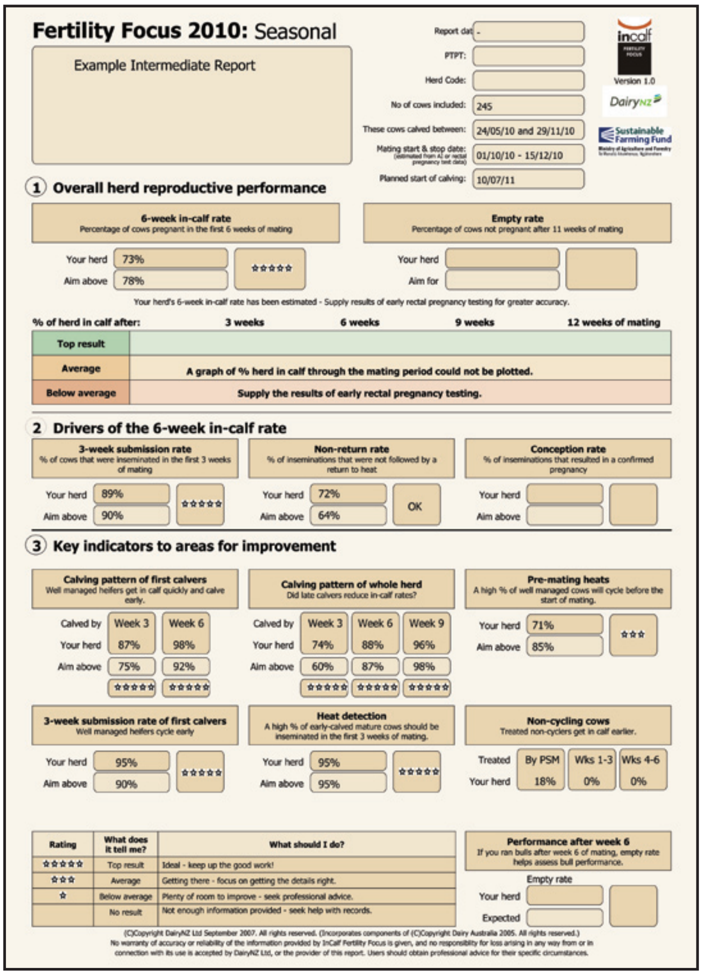
You need to start with a strategic approach by reflecting on your herd's current level of reproductive performance. This is easily done by obtaining an *InCalf Fertility Focus* report (Burke et al., 2008a), currently available through the MINDA, Mistro and Infovet platforms. For most farmers, this report is fewer than five mouse clicks away on the farm computer.

For the 5,000-odd farmers with MINDAPro, click on:

1. Reports icon
2. Reproductive analyses
3. Fertility Focus Report
4. Enter analysis date
5. Preview.

For farmers that use Mistro, the process is essentially the same via Reports, and Fertility. For those on MindaLink, contact your LIC District Manager or MINDA Contact Centre. They should be able to get your report.

The Fertility Focus software will look back from the 'date of analysis'. It will find the last Planned Start of Mating (PSM) date, and report on that season's reproductive performance. By 4 or 5 weeks into mating, it will report on this new season's performance. If you want to view last season (i.e. the 2009/10 year), then change 'date of analysis' to 01/06/2010, and it will find the PSM in 2009.



Fertility Focus 2010: Seasonal

Example Intermediate Report

Report dat	-
PTPT:	
Herd Code:	
No of cows included:	245
These cows calved between:	24/05/10 and 29/11/10
Mating start & stop date: (estimated from AI or rectal pregnancy test data)	01/10/10 - 15/12/10
Planned start of calving:	10/07/11

Version 1.0

1 Overall herd reproductive performance

6-week in-calf rate
Percentage of cows pregnant in the first 6 weeks of mating

Your herd	73%	☆☆☆☆☆
Aim above	78%	

Empty rate
Percentage of cows not pregnant after 11 weeks of mating

Your herd		
Aim for		

Your herd's 6-week in-calf rate has been estimated - Supply results of early rectal pregnancy testing for greater accuracy.

% of herd in calf after:	3 weeks / 6 weeks / 9 weeks / 12 weeks of mating
Top result	
Average	A graph of % herd in calf through the mating period could not be plotted.
Below average	Supply the results of early rectal pregnancy testing.

2 Drivers of the 6-week in-calf rate

3-week submission rate
% of cows that were inseminated in the first 3 weeks of mating

Your herd	89%	☆☆☆☆☆
Aim above	90%	

Non-return rate
% of inseminations that were not followed by a return to heat

Your herd	72%	OK
Aim above	64%	

Conception rate
% of inseminations that resulted in a confirmed pregnancy

Your herd		
Aim above		

3 Key indicators to areas for improvement

Calving pattern of first calvers
Well managed heifers get in calf quickly and calve early.

Calved by	Week 3	Week 6
Your herd	87%	98%
Aim above	75%	92%
	☆☆☆☆☆	☆☆☆☆☆

Calving pattern of whole herd
Did late calvers reduce in-calf rates?

Calved by	Week 3	Week 6	Week 9
Your herd	74%	88%	96%
Aim above	60%	87%	98%
	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆

Pre-mating heats
A high % of well managed cows will cycle before the start of mating.

Your herd	71%	☆☆☆
Aim above	85%	

3-week submission rate of first calvers
Well managed heifers cycle early

Your herd	95%	☆☆☆☆☆
Aim above	90%	

Heat detection
A high % of early-calved mature cows should be inseminated in the first 3 weeks of mating.

Your herd	95%	☆☆☆☆☆
Aim above	95%	

Non-cycling cows
Treated non-cyclers get in calf earlier.

Treated	By PSM	Wks 1-3	Wks 4-6
Your herd	18%	0%	0%

Rating	What does it tell me?	What should I do?
☆☆☆☆☆	Top result	Ideal - keep up the good work!
☆☆☆	Average	Getting there - focus on getting the details right.
☆	Below average	Plenty of room to improve - seek professional advice.
	No result	Not enough information provided - seek help with records.

Performance after week 6
If you ran bulls after week 6 of mating, empty rate helps assess bull performance.

Empty rate

Your herd	
Expected	

(cont'd p6)

(cont'd from p5)

Overall reproductive performance

Why does InCalf use the 6-week in-calf and empty rates as indicators of overall herd reproduction performance? The InCalf study (Morton et al., 2004) demonstrated that the separation of herds into low, average and high levels of reproductive performance is most prominent at six weeks into mating. InCalf includes empty rate as the other overall indicator, in recognition of the wastage and cost associated with empty cows.

Is there room for improvement?

Provided that record keeping is reasonably diligent, your *Fertility Focus* report will indicate how well your herd is performing compared with average herds in the top 25%. By default, 75% of herds have room to improve, half of them by a long way. The *Fertility Focus* report will be brutally honest, with an estimate of the 6-week in-calf rate, the most important reproductive performance indicators. Empty rates and subsequent calving pattern are driven by how fast cows get back in calf within the first six weeks of mating. Attempts to reduce empty rate or improve calving pattern will ultimately fail unless the action taken also improves the 6-week, in-calf rate.

Trouble shooting on a poor 6-week in-calf rate

Can the *Fertility Focus* report tell me why my 6-week in-calf rate is low? Yes. The report will indicate whether the 6-week in-calf rate is being influenced by submission rate or conception rate (the chances of cows holding to insemination) or possibly both. It will even scan through five of the eight managerial areas accepted as having major influence over submission and conception rates. These are performance in the management of heifer rearing, calving pattern, heat detection, noncycling cows and bull management. Inadequate performance in these areas may alert you to look more closely at nutrition and body condition, genetics and AB practices, and cow health. Unfortunately, there is no practical way to include all of these areas on the *Fertility Focus* report.

How does the Fertility Focus report work?

The *Fertility Focus* (report writer) software is a Windows-based application capable of working with any herd recording database provided the required data are present, and can be extracted into a comma separated text (CSV) file. It was written by Mike Larcombe, author of 'UDDER' and 'MISTRO'. The program is owned by Dairy Australia, and is available by sub-licence within New Zealand through an agreement with DairyNZ.

The *Fertility Focus* calculations are based on the findings from the Australian InCalf study (Morton et al., 2004). New Zealand studies show that the same factors affect reproductive performance and that the nature of these relationships is, essentially, identical (Xu and Burton, 2003). For example, later calving cows in New Zealand have less chance of getting back in calf by six weeks, and a higher chance of being empty. The mathematical relationships describing this association are identical to those reported in Australian herds.

The information used is limited by the practicality of it being measurable by farmers and recorded by licensed herd improvement organisations, and by what's important for herd fertility (Burke et al., 2008b). Prior to release in New Zealand, the performance measures and targets were revised to be more relevant to New Zealand herds. An industry working group established these revisions (Burke et al., 2008c).

The *Fertility Focus* report is a dynamic projection of the herd's ability to get back in calf based on scientifically proven relationships. It is presented in a dashboard format (warning lights) to identify management areas needing attention. It is hardwired to assess every herd in the same manner and 'work-arounds' cannot be performed to make results appear better than they really are.

A *Fertility Focus* report is available to virtually all 11,000 herds in New Zealand. The value of it will be dependent on your diligence with recording keeping. Check yours now! Improvements with record keeping might be the first positive step towards improving reproductive performance in your herd.

A team effort is required

Best results are obtained when improving reproductive performance becomes a team goal, and an independent and trusted adviser participates in the journey of achieving incremental gains in reproductive performance from one season to the next. Improving performance can be achieving gains in the 6-week in-calf rate and a reduction in empty rate, but it might also be well represented by the removal of interventions without slippage in these indicators of overall reproductive performance. This is especially pertinent with the current drive for a reduction in calving induction, and the consequential need to reduce the length of mating.

Eliminate the weakest links in the chain

Actions taken to increase reproductive performance need to be prioritised and directed at eliminating the negative impacts of the most under-performing managerial areas. Not because it's something that the neighbour swears by or because it's something new that the market is promoting.

Having systematically evaluated the root source of a poor 6-week in-calf rate, and how much farm profit is at stake (InCalf Herd Assessment Pack tools; **dairynz.co/incalf**), the task then turns to addressing the performance gap in that particular management area. It could be poorly grown heifers with a late calving pattern, it could be poor heat detection, or it could be a low rate of premating heats?

Fit the best option for the farm

Farms are unique. The performance areas, constraints and goals are all variable (Burke et al., 2008d). This 'best-practice' advice is fine for reinforcing principles, but further steps are required to tuning those principles into a workable plan for improving a herd's reproductive performance. The InCalf approach is to measure, assess the scope for improvement, evaluate the options, implement the chosen option, and review the options (Blackwell et al., 2010).

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Recently published by DairyNZ

DairyNZ researchers publish their findings in high calibre national and international journals, so they remain at the leading edge of dairy industry research.

Peer Reviewed Science Publications

Beukes P., P. Gregorini, A. Romera, G. Levy, and G. Waghorn. 2010. Improving production efficiency as a strategy to mitigate greenhouse gases. Agriculture, Ecosystems and Environment 136: 358-365.

Burke C., Y. Williams, L. Hofmann, J. Kay, C. Phyn, and S. Meier. 2010. Effects of an acute feed restriction at the onset of the seasonal breeding period on reproductive performance and milk production in pasture-grazed dairy cows. Journal of Dairy Science 93:1116-1125.

Clark C., A. Romera, K. Macdonald, and D. Clark. 2010. Inter-paddock yield variability of perennial ryegrass (*Lolium perenne L*) dominant swards. New Zealand Journal of Agricultural Research 53(2):187-191.

Littlejohn M., K. Lehnert, H. Ward, R. Snell, C. Walker, D. Clark, R. Spelman, and S. Davis. 2010. Effects of reduced frequency of milk removal on gene expression in the bovine mammary gland. Physiological Genomics 41:21-32.

Meier S., E. S. Kolver, G. A. Verkerk, and J. R. Roche. 2010. Effects of divergent Holstein-Fresian strain and diet on diurnal patterns of plasma metabolites and hormones. Journal of Dairy Research 77:432-437.

Science Conference Publications

Dalley D., R. H. Bryant, V. Walpot, J. Gibbs, and G. R. Edwards. 2010. Manipulating dietary N in perennial ryegrass pastures to reduce N losses in dairy cows in spring. Pages 97-100 in Proceedings of the Australasian Dairy Science Symposium., Lincoln University, Christchurch, New Zealand.

Jacobs J., and S. Woodward. Capturing the benefits of new forages for increased dairy farm profitability. Pages 292-304 in Proceedings of the Australasian Dairy Science Symposium., Lincoln University, Christchurch, New Zealand.

Verkerk G., and P. H. Hemsworth. 2010. Managing Cow Welfare in Large Dairy Herds. Pages 436-443 in Proceedings of the Australasian Dairy Science Symposium., Lincoln University, Christchurch, New Zealand.

For the full list of DairyNZ publications visit the news and media section of **dairynz.co.nz**

Focus on international research

The following is a brief summary of some key science papers recently published

Runciman and others (2010) The use of an internal teat sealant in combination with cloxacillin dry cow therapy for the prevention of clinical and subclinical mastitis in seasonal calving dairy herds. Journal of Dairy Science 93: 4582-4591.

Cows treated with both teat seal and dry cow antibiotic were 70% less likely to have clinical mastitis in the 3 weeks post-calving than a cow treated with dry cow antibiotic alone.

DairyNZ comment: DairyNZ researchers did not record any difference between the combination approach and dry cow antibiotic alone when the original teat seal studies were conducted in the mid 1990s. A combination of teat seal and antibiotic dry cow therapy is a valid approach for systems where a high degree of protection is desired during prolonged dry periods. However, cost-effectiveness has yet to be determined.

Moyes and others (2010) Mammary gene expression profiles during an intramammary challenge reveal potential mechanisms linking negative energy balance with impaired immune response. Physiological Genomics 41: 161–170.

This study compared mammary gene expression in cows subjected to a feed restriction or fed sufficient to maintain a positive energy balance. One of the most important genes affected by nutrition reduced the cow's ability to dispose of bacteria, suggesting that a feed restriction might increase a cow's susceptibility to mastitis.

DairyNZ comment: If grazing residuals are less than 1,500 kg DM/ha, supplementing cows with an energy supplement (silage, PKE, etc) may reduce the risk of mastitis. Results need to be evaluated under New Zealand conditions.

O'Brien and others (2010) The influence of strain of Holstein-Friesian cow and feeding system on greenhouse gas emissions from pastoral dairy farms. Journal of Dairy Science 93:3390-3402.

Greenhouse gas (GHG) emissions from different farming systems were compared. High milk yield potential cows produced more GHG/kg milksolids because of their lower fertility and the greater number of replacement animals required. The most profitable combination of cow genetics and farm systems was NZ cows in a moderate stocking rate pasture-based system. This combination resulted in a system able to deal with milk price fluctuations and resulted in a 12% reduction in GHG emissions per hectare and a 2% reduction in GHG emissions/kg milksolids compared with NZ or North American cows fed concentrates. This demonstrates that pasture-based systems can achieve high profitability and have relatively low GHG emissions simultaneously

DairyNZ comment: This is an important publication for determining the impact of different farm systems and different cow genetics on methane production. Results need to be validated under New Zealand conditions.

Burney and others (2010) Greenhouse gas mitigation by agricultural intensification. Proceedings of the National Academy of Sciences of the United States of America 107: 12052–12057.

Advancements in technology and husbandry practices in agriculture during the last 50 years have dramatically improved efficiency. It is estimated that this improved efficiency is equivalent to a reduction in potential carbon emissions of more than 160 gigatons compared with technology and farming systems of the 1950s. This is equivalent to 34% of total carbon emitted by humans in the last 150 years.

DairyNZ comment: This study demonstrates the importance of technological advancement in agriculture in environmental sustainability.