Profitable dairy farming: Good business management reduces greenhouse gases

Herd and breeding management to increase profit and reduce emissions

Key points

- Heifers and unproductive animals cost money to maintain, and continue to produce greenhouse gas emissions during their unproductive periods
- Reducing the amount of time that cows are unproductive will reduce farm emissions
- The key ways to reduce unproductive periods are through timely mating, fertility, reducing replacement rates and increasing lifetime cow production.

Key recommendations

- Improve longevity, fertility, time to first calf, transition cow management and herd health to reduce replacement rates, increase lifetime animal productivity and profitability, and reduce emissions intensity
- Improve feed conversion efficiency to reduce input costs and emissions.

Why manage emissions through herd and breeding management?

Greenhouse gas emissions represent a significant inefficiency in dairy systems. Although a certain level of emissions is inevitable, there are many ways in which animals and the natural resource base can be managed to reduce waste, improve profitability and production efficiency, and reduce emissions.

One of the key drivers of dairy emissions intensity is the amount of time that cows are non-productive or poorly productive. During these periods cows and heifers are contributing to nitrous oxide and methane emissions but are not producing (optimum) milk.

More unproductive days per cow means lower milk yields and higher emissions per kg of milk solids.

The ratio of productive days to unproductive days is influenced by health, fertility, transition management and longevity, each of which in turn influence the heifer replacement rate required to maintain herd numbers and milk production. Higher replacement rates mean there are more ‘passengers’ in the system, costing more money and emitting greenhouse gases.

What does the research say?

Extended longevity will reduce emissions intensity

Cow lifetime production efficiency – milk output per unit of feed input – is the main driver of emissions intensity. Increasing the age at which cows are culled means they produce more milk over their lifetime, and the amount of time that they are unproductive (i.e. time to first calf and subsequent dry periods) becomes a smaller proportion of their lifespan. Therefore their emissions intensity is lower.

The practicalities of increasing cow longevity have to be considered on an individual farm basis, as there may be a number of drawbacks if taken too far. Retaining older cows can slow genetic gain, and older cows are likely to have more health problems.

Another important effect of increasing cow longevity is the reduction in the number of replacement animals required to maintain or to increase herd size and milk production. Fewer heifers means fewer non-productive animals that cost money and produce greenhouse gas emissions but not milk. Carbon foot-printing studies of the Australian dairy system indicate that heifers contribute around 27% of the enteric methane emissions on a typical dairy farm (Gollnow et al., 2014), so minimising the proportion of non-producing animals in the herd can have a significant impact on farm emissions.

Less dry cows means more milk for the same emissions

Reducing the amount of time that cows spend in non-productive periods will also result in higher total lifetime production, as well as lower input costs and emissions intensity. During the period to first calving and subsequent dry periods cows continue producing emissions and costing money to maintain.

Reducing the time to first calving is one option for minimising the number of dry cows and reducing the replacement rate. Heifers can be managed to calve at 24 months by ensuring they are well grown and well fed. They'll then also produce more milk, get back into calf sooner and have improved longevity in the herd.

Extended lactation (18-month calving) will also reduce the number of dry cows and replacement rates, and therefore emissions intensity. From a production efficiency perspective, daily milk production is less in the extended lactation phase but the extra days in milk and higher milk solids concentration are compensating factors. An extended lactation system may also reduce breeding and animal health costs as well as workload.

In simulations conducted on Australian dairy systems (Browne et al., 2014), extended lactation was shown to be more profitable and efficient than 12-month calving due to the extra days that cows were lactating and the increased milk fat plus protein production. In this study extended lactation reduced replacement rates by 9% over the 12-month calving system, mostly due to improved conception rates.

Improved fertility will reduce emissions intensity

Poor fertility means lower annual and lifetime milk yield per cow, and more replacements required to maintain herd size. Improving herd fertility to maximise in-calf cows and improve overall herd fertility – whether through nutrition or breeding – will significantly decrease emissions intensity and lifetime emissions per cow.

Suitable nutritional strategies include maintaining a body condition score to minimise negative energy balance; increasing dietary energy in early lactation to stimulate insulin and ovulation; and increasing dietary fat around mating to improve conception rate. Selecting animals on the basis of their fertility is a permanent and cumulative means of decreasing herd emissions intensity.

Applying best practice transition cow management can have a major impact on emissions, with management during this period influencing some of the key determinants of how long cows are unproductive including: cow health, length of dry period, level of culling required (therefore number of replacements), milk production, time to next calving and herd fertility.

Comfortable, healthy, well-fed cows will produce fewer emissions

Greenhouse gas emissions per litre of milk are higher if the cow is not producing to her potential through ill health, inadequate diet or stress. Common health issues such as mastitis and lameness will reduce milk yield and therefore increase emissions intensity.

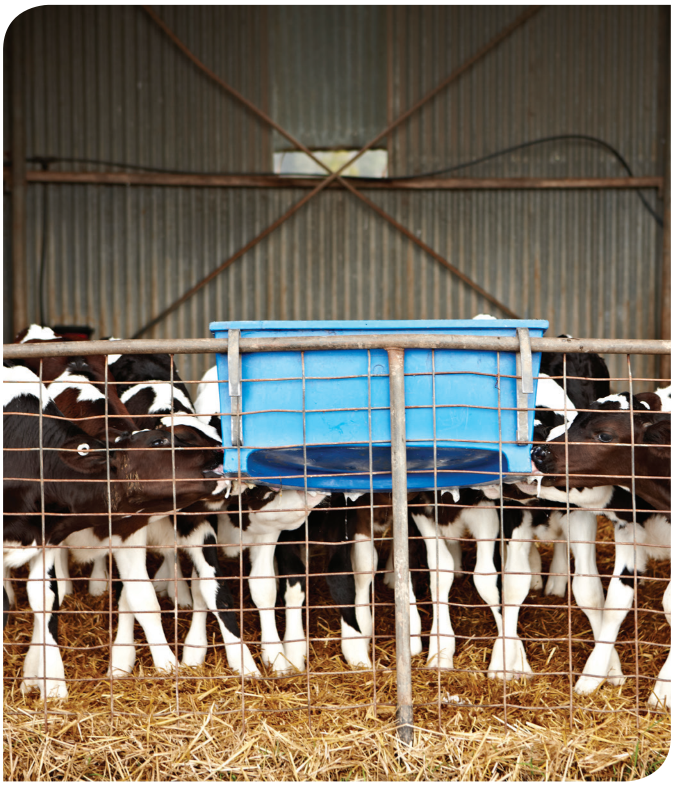
Providing shade and shelter during extreme weather events can reduce environmental stresses, keeping cows more comfortable and avoiding significant losses in milk yield. Trees and shrubs planted in shelterbelts have a number of associated productivity benefits, including prevention of salinity, soil erosion and weed incursion, and protection of pastures from drying winds.

Animals bred for feed conversion efficiency will be less emissions-intensive

Carbon foot-printing studies of the Australian dairy industry have identified feed conversion efficiency as the most important driver of enteric methane emissions intensity (Christie et al., 2011; Gollnow et al., 2014). More efficient animals will utilise a greater proportion of the energy in feed, reducing loss of both methane and nitrous oxide per kg of milk solids. Selecting animals on the basis of their feed conversion efficiency offers the potential to breed animals that better utilise their feed intake, meaning fewer inputs, less waste and higher production.

Genetic improvement in dairy cows over the past few decades via selection for production traits has resulted in improvements in efficiency and therefore reduced emissions intensity. A similar rate of reduction can be expected in the future. Focusing selection on feed use efficiency and reproductive efficiency is likely to accelerate the rate of emissions intensity reductions. It is also permanent and cumulative, and should be cost-effective in most systems.

With currently no direct genetic measure of greenhouse gas emissions, selecting on traits such as dry matter intake or residual feed intake per unit of production (both of which are highly correlated with animal emissions) are alternatives and compatible with existing breeding objectives.



What will it mean for emissions and profit?

Reducing the replacement rate by 1% for every 100 milkers will result in an emissions saving of 1.5 t CO2e / annum. Reducing the time cows spend non-productive by 1 week per annum will result in a saving of 4.2 t CO2e / 100 cows.

The profit in this comes from the cost savings made in having fewer heifer replacements to raise, or fewer non-productive cows to feed.

Australian research: Analysing emissions reduction strategies from a whole farm perspective

Background

Researchers from the Department of Environment and Primary Industries Victoria, the University of Melbourne and the University of Tasmania are modelling a range of farm greenhouse gas abatement strategies to determine their whole-of-farm impact on emissions, productivity and profitability. The whole-system approach allows researchers to identify situations where strategies targeting emissions reductions in one phase of the farm result in increased emissions elsewhere or reductions in animal productivity.

The results will contribute to the development of Emissions Reduction Fund methodologies and inform industry of more efficient management options.

Findings

The simulations showed that:

- Extended lactation, through altering replacement rates and increasing longevity, produced lower lifetime emissions and emissions intensity than annual calving and also resulted in higher operating profits
- Improving animal nitrogen use efficiency via balancing the energy-to-protein ratio in the diet resulted in lower nitrous oxide emissions. This reduced the energy cost of metabolising and excreting excess nitrogen in the urine, which has been shown to cost up to 1.5 L of milk at peak lactation. Individual farm economics will determine which option – accepting the loss of milk production or balancing the diet – is most cost effective.
- Converting to a 3-in-2 milking frequency, where the herd is milked 3 times over a 2 day period, did not increase emissions intensity or affect milk production. An economic analysis has not yet been conducted.

What next?

The team's future modelling studies will evaluate a number of dairy emissions mitigation options, including:

- Diet supplementation with wheat, grape marc, tannins and oils, including analysis of the complementary effects of various supplements (e.g. grape marc and wheat)
- Various natural and chemical products purported to have an inhibitory effect on methane production
- Breeding animals with higher feed conversion efficiency and lower methane.

Project leader: Associate Professor Richard Eckard, Primary Industries Climate Challenges Centre

Project website: www.piccc.org.au/wfsam

Further information

InCalf Resources:
http://www.dairyaustralia.com.au/Animal-management/Fertility/About-InCalf.aspx

Dairy Climate Toolkit:
http://www.dairyaustralia.com.au/Environment-and-resources/Climate/MicroSite1/Home.aspx

Browne N, Behrendt R, Kingwell R, Eckard R (2014). Does producing more product over a lifetime reduce greenhouse gas emissions and increase profitability in dairy and wool enterprises? Animal Production Science, http://dx.doi.org/10.1071/AN13188

Christie K, Rawnsley R, Eckard R (2011) A whole farm systems analysis of greenhouse gas emissions of 60 Tasmanian dairy farms. Animal Feed Science and Technology 166-167, 653-662, http://dx.doi.org/10-1016/j.anifeedsci.2011.04.046

Gollnow S, Lundie S, Moore A, McLaren J, van Buuren N, Stahle P, Christie K, Thylmann D, Rehl T (2014). Carbon footprint of milk production from dairy cows in Australia. International Dairy Journal 37, 31-38, http://dx.doi.org/10.1016/j.idairyj.2014.02.005

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