Dairy Australia
Your Levy at Work

# Profitable dairy farming: Good business management reduces greenhouse gases

## Managing effluent to increase profit and reduce carbon emissions

### Key points

- Effluent should be viewed as a valuable source of nutrients which can be recycled into the system to offset fertiliser inputs, save money and reduce emissions
- Reducing effluent volume will significantly reduce methane emissions from ponds
- Methane capture technologies are highly effective at reducing emissions from effluent, but aren't currently economically feasible in typical, grazing-based Australian dairy systems
- Management of effluent beyond the pond system will influence nitrous oxide and ammonia emissions and environmental pollution

### Key recommendations

- Use effluent and soil tests to match reuse applications with soil fertility deficits and plant requirements
- Spread effluent regularly, over large areas of the farm to allow better utilisation of nutrients, and minimise the likelihood of nutrient overload and nutrient rich runoff
- Apply best-practice nitrogen management to effluent re-use to minimise nitrous oxide and ammonia emissions and other forms of nitrogen pollution.

### Why manage emissions through effluent management?

Methane is emitted from effluent ponds as a result of the anaerobic decomposition that occurs during the storage and treatment of effluent. Nitrous oxide emissions from effluent largely occur as a result of re-use on pasture or crops, especially when nitrogen applied is in excess of plant uptake.

Although the contribution of effluent to total dairy farm greenhouse gas emissions is relatively small at about 8% (PE Australasia and TIA, 2012), there are practical strategies that can reduce emissions from ponds and re-use, while also minimising environmental impacts, improving farm efficiency and saving money.

Effluent should be viewed as a valuable source of nutrients rather than a waste product. Best practice application of effluent to pasture or crops improves soil fertility and enables recycling of nutrients back into the plant-soil system, reducing losses of nitrogen via nitrous oxide and ammonia emissions. When properly incorporated into a farm's nutrient management plan, effluent re-use can reduce fertiliser inputs, save money and reduce pollution.

## What does the research say?

**Reducing unnecessary load on the effluent system will reduce emissions**

Minimising the amount of effluent generated at the dairy shed will reduce total emissions from the farm, and also reduce the labour and costs involved in storage and re-use. Cows deposit about 10% of their faeces and urine on the yard each day. Greenhouse gas emissions from stored effluent are much higher than from the dung voided in the paddock (Saggar et al., 2004) because of the anaerobic conditions in effluent ponds, so minimising the time cows spend in the dairy is one of the simplest strategies for reducing both effluent volume and emissions.

Stressed cows will deposit more dung and urine than calm cows, so stock handling and the operating environment can play a major role in effluent volume. Options to decrease stress include calm stockmanship around the yard and shed; providing shelter from extreme temperatures; and avoiding overcrowding.

Herd diet will affect the volume of dung, as well as the level of nutrients excreted into effluent and potentially lost from the system. Meeting animal feed requirements with high digestibility feeds will reduce dung volumes compared to high fibre, low digestibility feeds. Excessive levels of crude protein will increase nitrogen load in urine and dung. This will increase losses of ammonia directly from the effluent system, as well as nitrogen losses from re-use.

**Methane capture from covered ponds reduces emissions but isn't feasible for most farms**

There has been growing interest in recent years in capturing methane from dairy effluent ponds for flaring or generating renewable energy. This is partly in response to rising power costs, but also as a result of the rollout of an Emissions Reduction Fund methodology for 'destruction of methane from dairy manure in covered anaerobic ponds'. The methodology enables dairy farmers to generate carbon credits by installing covers and gas capture and combustion equipment on ponds to reduce methane emissions from effluent.

To date, however, only a small number of Australian dairy farms have installed methane capture technology and none remain operational. This is for the simple reason that for most farms the scale of their operation makes establishing methane capture infrastructure economically unviable. In addition, generating ERF carbon credits requires a considerable monitoring and reporting effort which can increase costs substantially, and the current carbon price does not provide adequate financial incentive. With research on methane capture still in the early phases, it is likely that costs, technologies and policies will change in the coming years.

Methane capture from covered effluent ponds becomes more viable as herd size and time on concrete increases, as this increases the amount of feedstock available to produce methane. More information on feasibility of methane capture technology is available in the *methane capture fact sheet in this series.*

**More research is needed on other options for reducing emissions from stored effluent**

Other potential options for managing emissions from effluent ponds include separating and composting of solids. Although this would reduce the amount of feedstock in, and emissions from ponds this may be counteracted by higher nitrogen losses during composting or following application to the land.

There are currently a number of research activities looking at whole systems emissions from solids separation, composting and other waste management practices. The results from these studies will be available in the coming few years, and will provide guidance for the industry on reducing emissions from stored effluent and solids.

**Spread effluent regularly, on as many paddocks as possible**

Minimising effluent retention times in the ponds by spreading effluent regularly will reduce emissions, as this lessens the amount of time effluent spends in anaerobic conditions which are conducive to methane production. However, applying effluent directly onto pastures to avoid the anaerobic pond stage altogether is generally not recommended on most soil types because of the potential for water pollution during the wetter months of the year.

The application of lighter rates of effluent across a larger number of paddocks helps to avoid excessive nitrogen concentrations and soil nutrient overloading. It also enables captured nutrients to be spread across a larger area, potentially offsetting part of the farm's fertiliser requirements. Soil testing to understand where the nutrients are needed will allow better targeted and more strategic fertiliser applications.

**When applying effluent, follow best-practice nitrogen management**

Once effluent is in the pond system, it should be viewed as a valuable source of nutrients with the potential to reduce fertiliser inputs, save money and minimise environmental pollution.

Best practice effluent application to pasture follows the same principles as industry-accepted practice for responsible environmental management of nitrogen fertilisers. Effluent should be used strategically, when pasture and crops are actively growing and when extra feed is needed, to avoid losses and maximise nutrient uptake and yields.

Application rates should be adjusted based on soil types, pasture demand and existing nitrogen supply to avoid high levels of denitrification or run-off and leaching below plant root zones. Application rates should also take into account the nutrient profile of the effluent. If the effluent is from a first pond with large amounts of sludge, sampling for testing should be done after the pond is stirred. As it is unlikely that the pond will be stirred again after sampling for analysis, effluent test results from the previous year are adequate for determining nutrient composition and application rates.

Post-application soil tests in effluent application areas will provide an indication of remaining soil fertility deficits, so that fertiliser applications can be modified to match targets.

As with nitrogen fertilisers, effluent application should be avoided in wet weather or on waterlogged soils due to an increased likelihood of runoff, leaching and nitrous oxide losses.

## What will it mean for emissions?

Using effluent to offset fertiliser use can result in significant savings. Each tonne of nitrogen fertiliser applied to pastures emits 1.9 t CO2e directly and 2.3 t CO2e indirectly. In addition, the manufacture of fertiliser (urea) emits 1.9 t CO2e. Therefore a 1-tonne reduction in the use of nitrogen fertiliser will reduce emissions by **6.1 t CO2e**.

Similarly, reducing P and K fertiliser use by 1 tonne would save **4.6 t CO2e and 0.3 t CO2e**, respectively, due to the reduction in emissions from manufacturing.

In an 'average' farm system (300 milkers, average quality diet, around 6000 litres per milker), reducing the time spent in the dairy and yard by 10% (with cows spending this time on pastures instead) would reduce emissions by around **10 t CO2e / annum.**

## Further information

Effluent management:
www.dairyingfortomorrow.com/index.php?id=116

Composting:
www.dairyingfortomorrow.com/index.php?id=85

Effluent and Manure Management Database for the Australian Dairy Industry:
www.dairyingfortomorrow.com/index.php?id=48

Department of Environment and Primary Industries Victoria (2009). Minimising dairy shed effluent stream. Farmnote AG0433. Published by Department of Environment and Primary Industries, Melbourne. www.depi.vic.gov.au/agriculture-and-food/dairy/managing-effluent/minimising-dairy-shed-effluent-stream

PE Australasia and the Tasmanian Institute of Agriculture (2012). Final report: Farming—Carbon Footprint of the Australian Dairy Industry. Dairy Australia, Melbourne.

Saggar S, Bolan NS, Bhandral R, Hedley CB, Luo J (2004). A review of emissions of methane, ammonia, and nitrous oxide from animal excreta deposition and farm effluent application in grazed pastures. New Zealand Journal of Agricultural Research 47, 513-544, DOI: 10.1080/00288233.2004.9513618

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