Don't let your profits go up in gas

Reducing nitrous oxide emissions on Tasmanian vegetable farms

Ashley Hobbins, April 2014

(Source: A.Hobbins, 2014)

You don't have to compromise productivity / profitability to reduce GHG emissions, it's a win-win situation for your back pocket and the environment. There are plenty of practical options for farmers to implement on farm; and there are local 'Tas Farming Futures' extension officers around the state who can help you with opportunities on your farm.

Farm sustainability has well and truly entered the public domain, with greenhouse gas (GHG) emissions reduction the latest big issue to impact Australian farms. There is a common misconception in the agriculture community that you need to choose between reducing GHG emissions and productivity. However, at the end of the day reducing agricultural emissions can bring economic benefits through resource use efficiency and increased productivity. "You've got to be prepared to adapt your practices and if there are opportunities to look at different ways of doing things to make life easier and more profitable, then I reckon it's worth going for it" says Sassafras farmer, Matthew Young.

Agriculture emissions are mostly in the form of:

- Carbon dioxide, CO_2 (from fuel and electricity);
- Methane, CH_4 (mainly from livestock), and
- Nitrous Oxide N_2O (mainly from fertilisers and animal waste).

All farming systems produce some GHG emissions, regardless of management practices. As much as we would like to be 100% efficient this is not possible because there is always some energy loss in the system. By mitigating some of these losses we can turn lost energy

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or inputs in to food and fibre products, which at the end of the day can benefit your back pocket as well as the environment. It's a win-win situation.

In Australian horticulture, GHG emissions are mainly from[1]:

- Fuel and electricity (70%);
- Nitrogen fertilisers and animal manures (20%), and
- Waste and refrigerant loss to the atmosphere (10%).

Although horticulture represents a small proportion of total Australian agricultural land (vegetable = 0.034%, horticulture = 0.13%[2]), it accounts for about 12% of nitrogen fertiliser use in Australia[2] and emissions are generally greater per hectare in horticulture than in other industry. This means that although total emissions from Australian horticulture are relatively low, emissions intensity (emissions per hectare) is relatively high. Don't worry though; there are plenty of options for farmers to improve resource use efficiency.

Each year vegetable producers fork out thousands of dollars on irrigation and pumping costs. Although Tasmania's electricity is comparatively low in emissions, as most of our electricity comes from clean power sources, there may be some opportunities to improve efficiency and reduce costs. For example these include energy audits or taking a closer look at pump efficiency.

Carbon dioxide (CO_2) generally takes centre stage when we talk about GHG emissions, however nitrous oxide (N_2O) is the most powerful of the greenhouse gases emitted by agriculture. It has a global warming potential 310 times more powerful than carbon dioxide - agriculture produces most of Australia's nitrous oxide emissions. In horticulture, most of these nitrous oxide emissions are from nitrogen fertilisers.

I don't need to tell you that another major expense for producers is nitrogen fertiliser costs. Not only are they a major expense but they are also a key source of nitrous oxide emissions. If you can save just a few tonnes of nitrogen fertiliser each year – and be confident that you've maximised productivity and gross margins - that's money in the bank.

So, let's take a closer look at nitrous oxide.

Most nitrous oxide emissions result from denitrification, a process that occurs faster under warm and wet conditions. In other words, when irrigating during the hotter days or hotter parts of the day. When soil nitrogen; for example from fertilisers, legumes or bacteria, is broken down by soil microbes, the nitrogen gas is released to the atmosphere. Although this nitrogen gas is not a greenhouse gas, it represents a big cost to farmers. About 2/3rds of applied fertiliser nitrogen is lost to the environment through run-off, leached from the root zone as soluble nitrates or emitted as gaseous compounds. Losses can be as high as 92%[3].

Knowing your nitrogen use efficiency (NUE) may assist you to know your crops emissions. NUE is a measure of yield per unit of nitrogen fertiliser input. By optimising NUE you can minimise nitrogen losses, optimise nitrogen use and increase productivity and/or profits, saving you that all-important dollar. The 'Tas Farming Futures' team can help by calculating your NUE.

What are the options to improve nitrogen efficiency and reduce nitrous oxide emissions?

- **Manage nitrogen inputs**
  - Take in to account all nitrogen sources when applying fertiliser;
  - Use split application of nitrogen; and
  - Avoid direct movement of surface run-off water from irrigation or rain.
  - **For more information see '*Good fertiliser decisions – nitrogen (N) for crops in Tasmania*' (available on the RMCG website or *here*)**
- **Improve drainage**. Applying nitrogen fertiliser to waterlogged soils can result in loss of your valuable inputs to the atmosphere as it increases nitrous oxide emissions. Improved drainage on paddocks subject to waterlogging can reduce losses and also improve profits by improving crop yields and quality. For example, in Tasmanian potato crops, total crop loss can occur in waterlogged areas of a paddock. That can cost $12K per ha for that particular 'zone' in the paddock. So, improving drainage can increase overall returns.
- **Improve irrigation management**. By keeping water-filled soil pore spaces at <40% you can reduce your nitrous oxide emissions. In practical terms this means following industry guidelines on efficient irrigation management and using technologies such as variable-rate irrigation and soil moisture monitoring. So, this not only saves you money on irrigation and fertiliser – but also reduces loss through emissions.
- **Reducing soil compaction**. Reducing soil compaction will improve oxygen diffusion in the soil and can also reduce nitrous oxide emissions. Implementing practices such as minimal till and controlled traffic farming (CTF), can reduce compaction and dramatically improve soil structure. There is currently a lot of work focussing on adapting CTF for vegetable production, with some Tasmanian producers successfully implementing the system.
- **Consider using green manure crops**. Green manure crops can use residual nitrate and make it available for the next crop. This means less nitrogen is lost.

Trials involving bio-fumigants have been getting some great results – we'll provide more information about that in our next article.

Key messages to remember when thinking about nitrous oxide emissions reduction:

1. You don't have to compromise productivity / profitability to reduce GHG emissions, it's a win-win situation for your back pocket and the environment;
2. There are plenty of practical options for farmers to implement on farm; and
3. There are local 'Tas Farming Futures' extension officers around the state who can help you with emissions reduction opportunities on your farm. For more information contact:
   - Ashley Hobbins (NW) on 0447 776 909
   - Tim Ackroyd (South) on 0400 047 665
   - Andrew Winkler (South) on 0428 259 156
   - Adrian James (North) on 0448 318 873

References

[1]State Government of Victoria Department of Environment and Primary Industries, *Greenhouse Gas Emissions from Horticulture.* November, 2013. See http://www.depi.vic.gov.au/agriculture-and-food/horticulture/climate-and-horticulture/greenhouse-gas-emissions-from-horticulture

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[3]D. Chen, H. Suter, A. Islam, R. Edis. J. R. Freney, and C.N. Walker, Prospects of improving efficiency of fertiliser nitrogen in Australian agriculture: a review of enhanced efficiency fertilisers. CSIRO Publishing 2008.