Extension and Outreach

#2 GREENHOUSE GAS EMISSIONS IN HORTICULTURE

Level of emissions

Agriculture is currently responsible for about 15 per cent of Australia's total greenhouse gas (GHG) emissions, or about 82 million tonnes of carbon dioxide equivalents each year. Horticulture production emits only a small percentage of the total agricultural emissions (about 700 000 tonnes or less than 1 per cent). However, the intensive nature of horticulture produces a high level of emissions per hectare and has large potential for emissions reductions. Many strategies for reducing emissions have added advantages, such as potentially increasing productivity, lowering production costs, improving environmental sustainability, and increasing adaptive capacity.

Horticulture production releases two main types of GHGs; carbon dioxide (CO_2) and nitrous oxide (N_2O). The largest sources of emissions are electricity consumption, transport and fertiliser use. A small amount of GHGs are also emitted from waste (methane) and the use of refrigeration gases (hydrofluorocarbons).

Different GHGs differ in their capacities to influence climate, and this is referred to as their global warming potential (GWP). To easily compare the different types of GHGs, the GWP is expressed in terms of carbon dioxide equivalents (CO_2-e), or how many more times as much CO_2 would be required to produce the same warming effect.

Table 1: Global warming potentials (GWP) of the main agricultural greenhouse gases (GHG).

GHG	GWP (CO_2-e)	Main contributor
Carbon dioxide (CO_2)	1	Burning of fossils fuels, deforestation
Methane (CH_4)	25	Waste, livestock and waterlogged soils
Nitrous oxide (N_2O)	298	Fertiliser

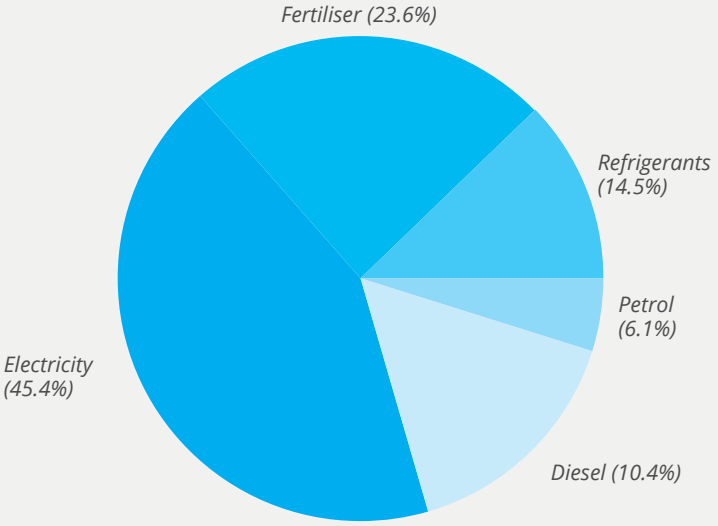

Figure 1: Sources of greenhouse gas emissions from an example farm.

Figure 1 provides an example of one farm's carbon footprint in the Granite Belt in southeast Queensland. The emissions profile varies greatly from farm to farm reflecting different production systems, and all farms will have their individual footprints. Several tools are available online to help estimating a business's carbon footprint (See fact sheet #4). Finding the carbon footprint of different parts of your business can help to draw attention to the areas with especially high or intense emissions. However, it is not always those areas with the highest emissions that will provide the most cost-effective mitigation, so make sure that a thorough assessment is done before deciding on mitigation measures.

Carbon dioxide from electricity

Emissions from stationary energy contribute a large proportion of the horticulture industry's emissions; this includes emissions from electricity, and the use of diesel and petrol for pumps and generators.

The consumption of electricity is classed as a source of indirect emissions, because the emissions are created off-site during generation rather than through on-farm activities. The emissions intensity of electricity generation varies from state to state according to the mix of fuels (e.g. black coal, brown coal, gas,

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hydro, wind and solar). In Queensland with a high proportion of coal-fired generators, the generation of one kWh on average emits 0.81 kg CO_2-e [c].

The high prices of both electricity and fuel are good incentives to consider mitigation possibilities. A number of cost-effective measures can be implemented to improve energy efficiency, ranging from no to high initial costs. More information on energy efficiency measures can be found in a series of energy efficiency factsheets available on the Growcom website (www.growcom.com.au).

About 23 per cent of emissions in horticulture come from the use of diesel, petrol and LPG for vehicles used on-farm. As with electricity, there are opportunities to reduce fuel consumption and emissions that can be implemented with little costs and reap substantial financial savings over time. These include reducing traffic through better planning, in particular reducing multiple passes or trips, and matching plant and machinery size to the task. Other changes, such as investing in more efficient plant and machinery, can have significant up-front costs but provide considerable savings over the longer term.

Nitrous oxide from fertiliser use

Around 20 per cent of horticulture's GHG emissions come from nitrous oxide (N_2O), a by-product of nitrogen fertilisers. While horticulture represents a small proportion of total land used for agriculture in Australia (approx. 0.13 per cent), it is responsible for about 12 per cent of nitrogen fertiliser use [d]. These numbers illustrate the high rates of nitrogen fertiliser used in the fruit and vegetable industry and the consequential high level of N_2O emissions.

N_2O emissions from soils are the result of different processes within the soil called nitrification and denitrification (figure 2). Nitrogen is added to the soil in form of organic nitrogen via fertiliser application or with the help from legumes which can convert atmospheric nitrogen into organic nitrogen. A number of processes in the soil transform organic nitrogen to ammonium and then nitrate and N_2O.

Microbes in the soil transforms organic nitrogen to ammonium in a process called mineralisation. If oxygen is available, nitrification will occur and convert ammonium into nitrate and N_2O. Nitrate is the form of N that is easiest for plants to use, but soil particles do not retain nitrate very well so nitrate is very likely to move with water and therefore leaches easily in high rainfall events and well drained soils. Loss of nitrogen in the form of nitrate is often caused by excessive use of fertiliser compared to plant requirements, but climatic conditions, application method and timing also strongly influence this process.

N_2O emissions from soils varies highly in different climate and soil types, some semi arid regions have N_2O emissions as low as 0.03kg N/ha per day, while fertile soils in high rainfall zones can emit as much as 1kg/ha per day.

Up to 30 per cent of the applied nitrogen is believed to be lost in the cropping systems which indicate a potential for reductions in applied fertiliser. A more efficient approach to the use of fertiliser will not only save money, but can also help to reduce nitrate pollution which is a large threat to the environment and water quality.

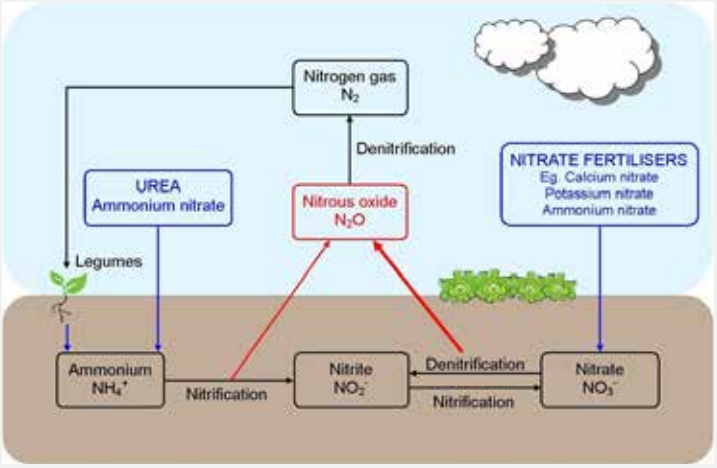

Figure 2: The nitrogen cycle in soil [e].

More information

Other fact sheets in this series present more detailed information on methods to reduce emissions.

For more information about the Government's Emissions Reduction Farm:

- http://www.environment.gov.au/climate-change/emissions-reduction-fund
- http://www.cleanenergyregulator.gov.au/ERF/Pages/default.aspx
- http://www.mycarbonfarming.com.au/

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[a] http://www.environment.gov.au/system/files/resources/f4bdfc0e-9a05-4c0b-bb04-e628ba4b12fd/files/australias-emissions-projections-2014-15.pdf

[b] http://www.depi.vic.gov.au/agriculture-and-food/horticulture/climate-and-horticulture/greenhouse-gas-emissions-from-horticulture

[c] http://www.environment.gov.au/system/files/resources/b24f8db4-e55a-4deb-a0b3-32cf763a5dab/files/national-greenhouse-accounts-factors-2014.pdf

[d] Horticulture Australia Limited (2008). Options for mitigating greenhouse gas emissions for the Australian vegetable industry.

[e] Growcom (2009). Reducing greenhouse gas emissions from your farm.

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