Greenhouse Gases and Farming Livestock

Introduction

Managing greenhouse gas emissions from livestock is becoming an increasingly important part of the farm business. It is likely that international agreements on climate change, government regulation and market interest in "low carbon" products will increasingly affect New Zealand's agricultural business landscape. This series of info sheets aims to provide simple, independent summaries of some of the key concepts behind managing greenhouse gas emissions in agriculture, or "carbon farming". This info sheet outlines carbon cycling and greenhouse gas emissions from agricultural livestock.

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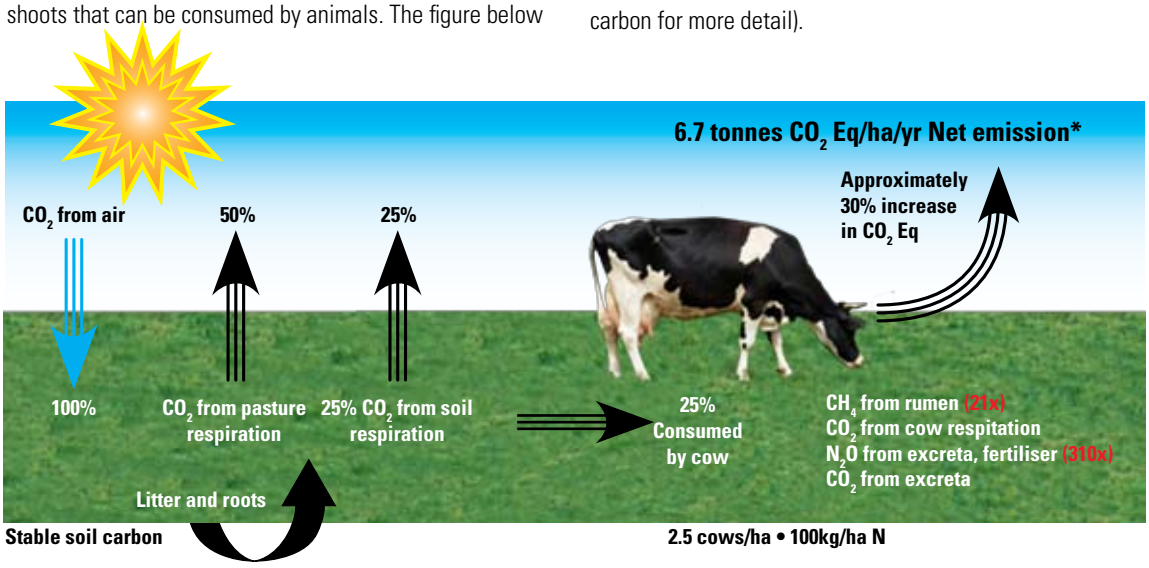
Carbon cycling in a grazed pasture

About half the carbon dioxide (CO_2) gas taken from the atmosphere by plants is converted to a more complex form of carbon called biomass, or herbage in the case of pasture. The rest is returned to the atmosphere as carbon dioxide through plant respiration. About half the carbon in herbage is stored as plant roots while the other half is in shoots that can be consumed by animals. The figure below summarises carbon flows for pasture grazed by ruminants.

Pasture that is not eaten dies and goes onto the soil surface as litter. Soil respiration also returns carbon dioxide to the atmosphere as roots and litter are broken down by soil microorganisms. Soil carbon levels remain relatively stable unless productivity is changed (see info sheet 2 on soil carbon for more detail).



* *Net emissions calculated by Carbon Farming Group and Overseer® carbon calculators, includes nitrous oxide (N_2O) and methane (CH_4)*

FOOTNOTE: The GHG emissions shown in the Figure were calculated using the online Carbon Farming Group calculator (www.carbonfarming.org.nz). Calculations provided by Overseer® (www.agresearch/overseerweb/) for Friesian-Jersey cross cows and 600kg/ha milk solids agreed with the Carbon Farming Group calculator when fuel, electricity and capital development were omitted from outputs.

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The grazing animal

If pasture was cut and left to decompose the carbon would return to the atmosphere as carbon dioxide and there would be no net change in greenhouse gases, only cycling. The digestion of pasture by ruminants makes the difference. Agricultural livestock transform pasture carbon into different greenhouse gases more potent than the original carbon dioxide. Methane (CH_4), which is emitted from the rumen as a by-product of ruminant digestion, has a higher global warming potential than the carbon dioxide from which it came. Nitrous oxide (N_2O), released from the break down of animal excreta and nitrogen fertiliser is similar in this respect.

How do we know what livestock emissions are?

The old maxim "You can't manage what you can't measure" is very applicable to greenhouse gas emissions from livestock. But how do you measure what you can't see or feel? It is critical that NZ remains among world leaders in this area of research. Developing and using accurate measurement techniques is critical. Methane emissions from animals can be measured using a respiratory chamber. The chamber around the body of this sheep is air tight. The air flow going in is controlled and the gases coming out are measured and analysed. Nitrous oxide emissions are measured by trapping and analysing the air above growing pasture. For further information on measuring greenhouse gas emissions see www.pggrc.co.nz.

Greenhouse gases and global warming

In order to compare the relative climate change effects of different gases the "global warming potential" (GWP) rates them on a common scale. The use of the global warming potential for this purpose is internationally agreed (see info sheet 3 for more detail). The warming effect over 100 years of 1kg of methane emitted into the atmosphere is the same as for 21kg of carbon dioxide. Using the same scale, 1kg of nitrous oxide has the equivalent effect of 310kg of carbon dioxide. These values may increase over time. Approximately two thirds of agricultural greenhouse gas emissions in New Zealand are as methane and one third is nitrous oxide.

Further Reading

Carbon Farming Information Report at
www.carbonfarming.org.nz

http://www.maf.govt.nz/climatechange/agriculture/