Department of **Agriculture and Food**
Department of **Regional Development and Lands**

GOVERNMENT OF WESTERN AUSTRALIA

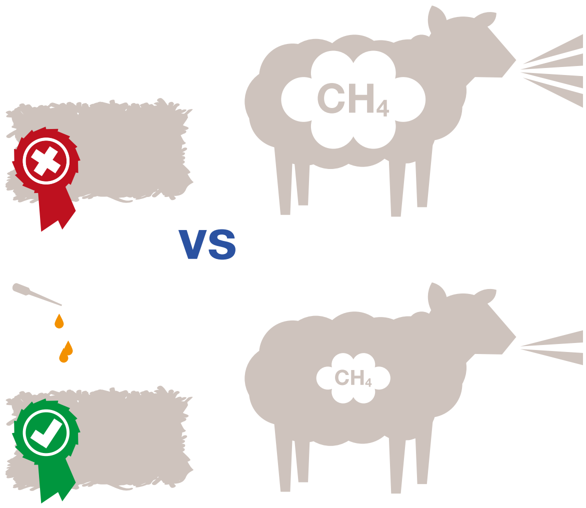
ROYALTIES FOR REGIONS

Carbon Farming in WA

Fact sheet No. 14

PRACTICE: **Nutrition and feed additives to reduce methane emissions**

Description of practice



Improved grazing and feeding practices can reduce methane emissions per unit of product (feed efficiency) or emissions per unit of feed intake (methane yield) but the impacts on total emissions and profitability are not straightforward. There are three main practices to reduce emissions: 1) production feeding of slaughter lambs to reduce time to slaughter; 2) supplementary feeding of ‘additives’ to reduce methane yield; and 3) managing breeding ewes to minimise fluctuations in liveweight during the year. Both production feeding and supplementary feeding are the subject of Emissions trading Fund (ERF) methodologies developed (although not yet approved) for beef cattle in Australia.

Outline of procedure

Production feeding: feeding high quality concentrate diets ad libitum (without restrictions) reduces the amount of methane produced per unit intake but higher intakes increase the total methane produced per day per lamb. Reducing the time to slaughter, however, reduces the total methane produced per lamb from birth to slaughter as the lambs obviously have fewer days of grazing and emitting methane.

Supplementary feeding: a range of dietary additives can reduce methane (CH_4) emissions and the most likely option for widespread use is supplementary lipids. Beauchemin et al. (2008) indicates a 6 per cent reduction in emissions for every one per cent increase in lipids up to a maximum of 6–7 per cent in the diet. However, Grainger et al. (2011) reported a response in sheep of 2–3 per cent for every one per cent increase in total fat in the diet.

To adopt these practices, farmers will need to monitor liveweight of sheep and more actively manage sheep nutrition, whether at grazing or in feedlots.

The Department of Agriculture and Food is the lead agency and is working with the Department of Regional Development and Lands to deliver this Royalties for Regions funded project.

For more information please refer to agric.wa.gov.au

More Information

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Supporting your success

Work done to date

Calculations of emissions associated with altering nutritional management of sheep are based on modelling studies. There are two major modelling studies in Australia relating the impacts of nutritional managements on greenhouse emissions and farm profitability (Alcock & Hegarty 2011; Young et al. unpublished).

Alcock and Hegarty found production feeding lambs ad libitum after weaning so they reached slaughter weights at five months of age reduced emissions intensity by between 16 and 24 per cent. This compared with no supplementation feeding and reaching the same slaughter weights at 12 months of age. However, finishing lambs earlier allowed for higher ewe numbers to achieve similar overall pasture use and resulted in slightly higher absolute emissions levels due to the additional intake of grain supplements. This is termed 'leakage' under the ERF and has to be accounted for. In this scenario, the farmer would not be able to generate credits.

For second cross lamb production systems (offspring of a Merino/meat breed cross; crossed again with a meat breed) producing heavy lambs (53 kg), production feeding increased total methane emissions by 10 per cent (2.0 v. 2.2 t CO_2-e/ha). At the same time, profits increased by between 12 per cent ($275 v. $308/ha) when grain prices were $300/t, and 40 per cent ($275 v. $382/ha) when grain prices were $150/t.

Young et al. examined the impact of feedlotting lambs to achieve turn-off one month earlier. They showed that if the stocking rate is not increased then CO_2-e emissions are reduced by 1.5 per cent. However, it is more profitable to adjust stocking rate in response to earlier turn-off, in which case the stocking rate increased by 7 per cent and CO_2-e emissions increased by 4.8 per cent.

There have been no studies to our knowledge (other than Young et al.) that quantifies the effects of increasing fat content of the diet on whole farm CO_2-e emissions and farm profitability. The effects of such additives to increase the energy density of the diet and reduce methane yield will be greatest when used as a general supplement to all sheep during summer/autumn and winter, rather than specifically for lambs in a feedlot. The results of Young et al. showed that feeding supplements containing 10 per cent oil to animals at pasture resulted in a 1.3 per cent reduction in CO_2-e emissions, which was 235 kg of CO_2-e/t of supplement fed or $5.40/t ($0.50/ha). However, at $700/t for canola oil, there was a reduction in profit of $17/t of supplement fed.

Current level of adoption

We are not aware of any farmers who have manipulated nutritional management of sheep specifically to reduce CO_2-e emissions.

Industry activity

None at this stage. Modeling analyses indicate that in most cases farmers are likely to be financially disadvantaged from manipulating nutritional management of their sheep in order to reduce total carbon emissions as the loss of income is likely to be greater than they are likely to compensated through the ERF.

Carbon benefits

Currently none.

Co-benefits

- These practises can potentially be employed to manipulate the quality of the end product (e.g. prime lamb).

Opportunities

- The practice of manipulating grazing management and supplementary feeding is relevant to all sheep enterprises, including purebred merino, merino crosses and composite breeds in all parts of Western Australia. The state has about sheep 6500 farms with 14.5 million sheep, including 8.6 million breeding ewes. The reduction in emissions per hectare or per farm will vary across regions in proportion to the number of sheep being carried and the quantity of supplement fed.

- About two million lambs in Western Australia are finished to slaughter weights each year, either as sucker lambs at weaning or after being finished either in the paddock or in feedlots.
- Commercial potential: production feeding to increase growth rates and finish lambs for slaughter at a younger age reduces the total methane produced per lamb from birth to slaughter. Increasing the proportion of fat in supplements can also reduce whole farm emissions.

Risks

- No current approved methodology
- Finishing lambs from pasture alone rather than production feeding reduces profit by much more—even at high grain prices—than the current value of the carbon saved. The reduction in profit varied from $33/ha to $107/ha (grain prices $150/t and $300/t respectively) .
- Similarly, including canola oil in supplementary feed reduced methane emissions but also reduced profit, as canola oil is valued at 2.2c/MJ energy compared to other common supplements of 1.5c to 1.9c per MJ. The reduction in profit was $1.65/ha.

Case study

The typical sheep farm in Western Australia runs 1220 ewes, 560 lambs and 170 wethers and rams. This equates to about 2700 dry sheep equivalent (DSE). This farm would emit about 550 tonnes CO_2-e per annum from methane and nitrous oxide emissions. The impacts on emissions and profitability of altering the nutritional management of sheep can be extrapolated from the analysis reported by Alcock and Hegarty (2011) and Young et al. First, finishing lambs from pasture alone would reduce emissions by about 55 tonnes, but the associated reduction in profit is likely to range between $7300 and $23 700 depending on grain prices. Second, including canola oil in supplementary feeding rations would reduce emissions by about six tonnes, but the associated reduction in profit is likely to be $480. Hence, it would appear that there would be financial disincentives for farmers to adopt either of the nutritional strategies referred to in this report to reduce emissions.

Key contacts – Australia

A number of research groups are investigating supplementary feeding strategies and novel additives to reduce methane emissions.

- Associate Professor Richard Eckard (University of Melbourne)
- Professor Phil Vercoe (University of Western Australia)
- Professor Roger Hegarty (University of New England, Armidale, NSW)
- Associate Professor Athol Klieve (University of Queensland)
- Dr Hutton Oddy (Department of Primary Industries, Armidale, NSW)

Key contacts – international

New Zealand Agricultural Greenhouse Gas Research Centre: this is the main international group undertaking work related to nutritional management and its impacts on methane emissions from sheep production systems. There is significant collaboration already occurring between NZAGRC and research institutes in Australia, including Western Australia.

Stakeholders

- Farmers
- State government agencies and research institutions, including the Department of Agriculture and Food, Western Australia, Murdoch University, the University of Western Australia and CSIRO
- Rural Information Resource Corporations (RIRCs): Australian Wool Innovation and Meat & Livestock Australia
- Department of Agriculture, Fisheries and Forestry (DAFF)

Next steps

Major research, development and extension activities related to the effects of nutritional management and methane emissions are planned under the DAFF Filling the Research Gap – National Livestock Methane program. The most relevant projects within this program include:

- understanding methane reducing tannins in enteric fermentation using grape marc as a model tannin source (Australian Wine Research Institute)
- supplementation with tea saponins and statins to reduce methane emissions from ruminants (CSIRO)
- strategic science to develop dietary nitrate and defaunation as mitigation methodologies for grazing ruminants (University of New England)
- enteric methane mitigation strategies through manipulation of feeding systems for ruminant production in southern Australia (Department of Primary Industries, Victoria)
- best choice shrub and inter-row species for reducing emissions and emissions intensity (UWA).

Key references

Alcock, DJ & Hegarty, RS 2011, 'Potential effects of animal management and genetic improvement on enteric methane emissions, emissions intensity and productivity of sheep enterprises at Cowra, Australia', *Animal Feed Science and Technology,* vol. 166–167, pp. 749–760

Beauchemin, KA, Kreuzer, M, O'Mara, F & McAllister, TA 2008, 'Nutritional management for enteric methane abatement: a review', *Australian Journal of Experimental Agriculture,* vol. 48, pp. 21–27

Department of Agriculture, Fisheries and Forestry (DAFF), Filling the Research Gap – National Livestock Methane program, daff.gov.au/climatechange/carbonfarmingfutures/ftrg/national-livestock-emissions-program

Grainger C & Beauchemin KA 2011, 'Can enteric methane emissions from ruminants be lowered without lowering their production', *Animal Feed Science and Technology,* vol. 166–167, pp. 308–320

New Zealand Agricultural Greenhouse Gas Research Centre, AgResearch, Palmerston North, NZ, nzagrc.org.nz/integrated-systems.html