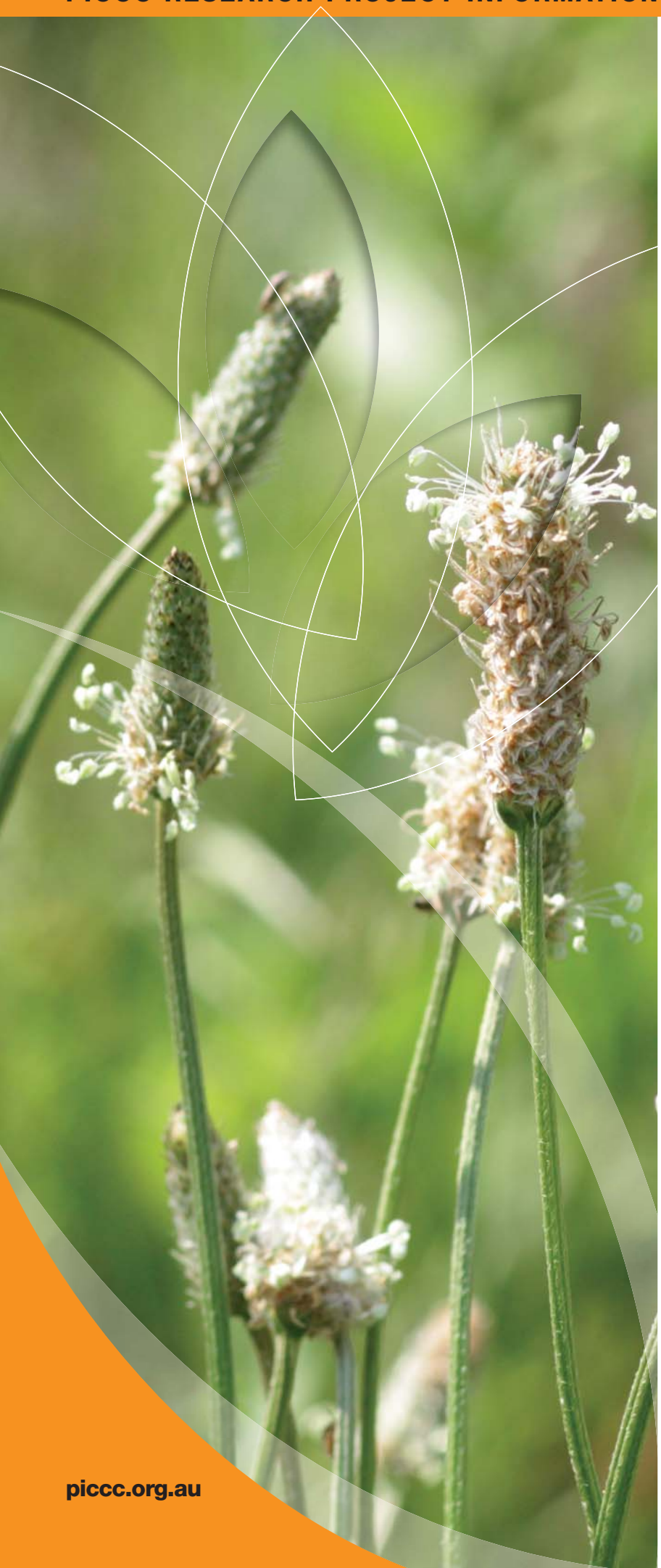

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Primary Industries Climate Challenges Centre

REDUCING METHANE EMISSIONS FROM LIVESTOCK

Enteric methane mitigation strategies through manipulation of feeding systems for ruminant production in southern Australia

Background

The methane produced from enteric fermentation in livestock accounts for 65% of agricultural emissions in Australia. Abatement strategies that offer a practical means of reducing methane production in the rumen are essential to curb overall emissions and enable livestock producers to participate in the Carbon Farming Initiative.

Building on previous dietary supplement research led by PICCC, this program of research is focused on a range of novel supplements and forages that contain compounds reported to mitigate methane production.

The data produced will form the basis for the development of Carbon Farming Initiative offset methodologies, giving farmers a financial incentive to reduce enteric methane emissions as well as proven strategies to improve production efficiency.

Research location

The research is being undertaken at the Department of Environment and Primary Industries Victoria research centre at Ellinbank (*in vivo* supplement and forage experimentation), and at the University of Melbourne's Parkville (*in vitro* experimentation) and Dookie (*in vivo* assessment of pre-treated cereal grains) campuses.

Cows fitted with SF_6 equipment for measuring methane emissions.

Project outline

Researchers are studying novel feed supplements, pasture forages and pre-treatment of cereal-based grains for use in livestock feeding systems in southern Australia, quantifying the impacts on both methane emissions and animal production.

In vitro studies, which allow rapid screening of potential material, are comparing methane production from different feed supplements and forage species, forages grown under varying conditions and forages harvested at different times of the season. Wheat grain treated with BioProtect is also being studied, to determine whether the treatment reduces the rate of wheat grain fermentation and therefore has the potential to reduce methane emissions. Researchers are using the sulphur hexafluoride (SF_6) tracer method, face masks and open circuit respiration chambers to measure emissions from individual animals.

The most promising feeds, supplements and strategies are being tested *in vivo* using dairy cattle and sheep. In the cattle studies total methane production and milk yield are measured at the individual cow level so that effects on both productivity and emissions intensity can be determined. The team are also examining pre-treatment of cereal grains offered to sheep. The treatments are designed to reduce grain digestion in the rumen (and therefore production of methane), allowing digestion further down the intestinal tract so that there is no impact on animal production.

Research progress

IN VITRO STUDIES

A comparison of perennial and summer-active annual forages showed that *in vitro* methane production reflected differences in nutrient availability, with maximum gas produced in forages containing more fermentable organic matter.

The comparison of different forages harvested at different times over winter, spring and summer indicated that pasture species has a greater influence on amount of gas produced than did date of harvest. Treatment of wheat grain with BioProtect reduced the rate of gas production, with 8 litres per tonne found to be the optimum dose rate.

Recent studies undertaken in conjunction with the Australian Wine Research Institute have compared a range of grape marc products. Data analysis is now underway.

IN VIVO STUDIES

An initial *in vivo* study using dairy cattle compared different wheat dosages, showing a linear decrease in methane emissions in response to greater amounts of wheat, as well as a linear increase in milk yield. This result meant that methane emissions intensity (grams methane per kilogram milk) was also reduced at higher wheat dosages. When the 9 kg dosage of wheat was reduced to 3 kg, the carry-over effect on methane suppression lasted one week, and disappeared after 10 days.

The finding that feeding high amounts of wheat significantly reduces methane emissions suggests that the current Australian Inventory of Greenhouse Gases may substantially overestimate emissions from some sectors of the dairy and beef feedlot industries.

A second *in vivo* experiment examined the effect on milk production and methane emissions when dairy cattle were fed supplements of almond hulls or citrus pulp (orange skins) as a substitute for forage. The almond hulls and citrus pulp supported milk production and milk fat percentage, but methane emissions did not decrease.

Next steps

IN VITRO STUDIES

A comparison of summer active forages grown under both dryland and irrigated conditions will be undertaken, and forages will be tested for a range of fermentation parameters plus gas and methane production.

IN VIVO STUDIES

Two upcoming experiments will study the effect of forages and supplements on methane emissions from dairy cows in mid to late lactation. The first will examine various grape marc products selected from the *in vivo* studies, and offered with a spring perennial ryegrass pasture. A summer experiment will compare chicory, plantain and a brassica.

The effect of feeding BioProtect-treated wheat-based diets to sheep will also be studied, with the design of further sheep studies to be dependent on the results of an initial experiment currently underway.

Chicory.

Crushed wheat.

Almond hull and citrus pulp supplements.

Project team

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Collaborators

CSIRO

South Australian Research and Development Institute

University of Sydney

University of Western Australia

Australian Wine Research Institute

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Photos supplied by the PICCC project team unless credited otherwise. Front cover: plantain, Dalgial. Sheep above Department of Primary Industries Victoria. Layout Angel Ink.

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