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Foreword

The papers published in this special edition of *Animal Production Science* comprise research outcomes from the National Agricultural Manure Management Program (NAMMP). This program was developed by a consortium of rural research and development corporations (RDCs) who recognised similar knowledge gaps in manure management systems across Australian intensive livestock production. These gaps included gathering information on the amount of greenhouse gas (GHG) emissions from different livestock and manure management systems, together with the sources and causes of GHG emissions in the different systems.

The consortium comprising Australian Pork Limited (APL), Meat and Livestock Australia (MLA), Chicken Meat (RIRDC), Australian Egg Corporation (AECL) and Dairy Australia was co-funded through the Filling the Research Gap program administered by the Australian Department of Agriculture. Six research projects were funded under NAMMP.

The agricultural sector in Australia contributed up 16% (84.7 Mt) of Australia's net emissions (548 Mt CO_2-equivalents) in 2009 (Department of Climate Change 2009). The main sources of GHG emissions from the livestock industries was from enteric methane (65%), while manure management accounted for 4% of the agricultural GHG emissions (Department of Climate Change 2009). The intensive livestock industries (feedlot beef, piggeries, poultry and dairy) are a significant source of these manure emissions and, combined, account for 84% of manure management emissions (Department of Climate Change 2009).

Although only 4% of Australia's GHG emissions (Department of Climate Change 2009) are generated from manure management, reducing these GHG emissions was identified as a key focus area on Australian intensive livestock enterprises, as there is considerable potential to markedly reduce emissions through better design and management of livestock manure systems. Manure management emissions are often from concentrated areas that are influenced heavily by design and management. By manipulating these factors, there is a significant opportunity for mitigation over a short timeframe. It also offers the industry multiple benefits aside from GHG reduction, such as odour reduction, resource reduction and potential for alternative income streams.

Prior to this NAMMP research, quantification of emissions and understanding of mitigation options from manure management systems in Australia had been limited. Previously, international data and/or modelling were used to represent Australian livestock inventory emissions. These failed to take into account industry-specific characteristics such as feed and genetics, as well as Australia's unique climate, which affects GHG emissions very differently from Europe or America where the majority of inventory data was generated.

Results from the four completed projects have generated outcomes that have added to the basic understanding and quantification of GHG emissions from intensive livestock manure management and land application. These outcomes will assist in verifying and updating emission factors in the Australian Greenhouse Accounts, update industry models, recommend potential management strategies as well as provide baseline data for the possible development of a range of new Emissions Reduction Fund methods. These methods relate to piggery housing and effluent treatment, poultry nutrition and manure stockpile management, treatments to animal manures before land application and field-management practices for the application of manures to soils.

Key outcomes include the following:

- Sorbers applied to different types of soil and manure mixes can decrease nitrous oxide and ammonia emissions substantially, by up to 60%, and potentially reduce the need for conventional fertiliser, while potentially improving seedling vigour and crop yield by up to 20% and boosting carbon retention in the soil by ~50%.
- Piggery effluent-treatment ponds, converted from conventional long to short hydraulic retention times may mitigate total GHG emissions by up to 87%.
- Converting pig housing from conventionally flushed sheds to deep litter systems can reduce total GHG emissions by 85%, while covering spent litter stockpiles reduced emissions by 65%, compared with uncovered stockpiles.
- The poultry industry (both meat chicken and layers) were found to have very low GHG emissions, being only ~10% of the Australian National Accounts data (Department of Climate Change 2009).
- In layer-hen systems, there is potential to reduce GHG emissions by ~88% by covering stockpiled manure removed from the sheds.
- Meat chicken systems had very modest potential for reducing GHG emissions by reducing litter depth and dietary crude protein concentrations.
- Lowering soil application rates of manures to 5 t/ha has the potential to reduce GHG emissions by 60%.
- Dry-seeding wheat into soils with applied manure could result in up to 25% reduction in GHG emissions.
- Incorporation of manures directly into soil, compared with surface application to soil, showed up to 75% reduction in GHG emissions.
- Composting and pelletising manures rather than stockpiling before soil application could reduce GHG emissions by up to 70% and 80%, respectively, when manures were applied to soils.

The NAMMP consortium proved successful for both researchers and industry and is a model that should be considered for any future cross-sectoral programs. Through NAMMP, researchers had the opportunity to collaborate on methodologies and experimental designs, share ideas and samples and value add to the synergies between their research projects and research organisations. More importantly, this collaborative work has provided a much greater understanding to the researchers and industry of the relationships among manure, soil biology and GHG emissions across the various stages of manure management on Australian intensive-livestock farms.

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Reference

Department of Climate Change (2009) 'National greenhouse gas inventory accounting for the KYOTO target May 2009.' (Department of Climate Change: Canberra)

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