Appendix 3: Modelling approaches to adapting pasture based dairy systems to a changing climate in a carbon constrained world

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Abstract

The temperate regions of Australia support over 80% of the nation's milk production, (Dairy Australia, 2009). Perennial ryegrass (Lolium perenne L.) is commonly sown in a mixed sward with white clover (Trifolium repens L.) and is the dominant pasture specie in many of these regions (Mason, 1993; Fulkerson and Doyle, 2001). In such pasture-based systems, consumption of home-grown herbage is a key determinant to business success (Beca, 2005; Chapman et al., 2008). Increasing pasture productivity, through improved production and consumption, has been highlighted as an important objective for the dairy industry into the future (Dairy Australia, 2010). Modelling the pasture production under future climate scenarios for the cool temperate dairy regions of Tasmanian has shown that pasture production is likely to increase between 15 and 30% (Cullen et al. 2009, Holz et al. 2010). The average per cow production of Tasmanian dairy farms is 5,000 L /cow (Dairy Australia, 2009), with on average less than 20% of the cows diet coming from purchased grain concentrates or by products (Barlow, 2008) and average annual nitrogen fertiliser applications exceeding 200kg N/ha (TIAR, 2010). These dairy farm systems are classified as farm system 1 (FS1) and are characterised by being predominantly pasture based with less than 30% purchased supplementary feeding. Climate change projections for Tasmania's dairy regions has highlighted that the current forage base is quite resilient to future climate scenarios and that adaptations are likely to be within system adaptations with the industry continuing to focus on milk production per ha and pasture consumption per ha as key determinants of business success. Cullen et al. (2010) showed that increasing stocking rate and changes in calving date are profitable adaptive response to a warming climate in these regions, however, there is an emerging conflict between the most profitable approaches to adapting to changing climate and that of mitigation of greenhouse gases (GHG) in a carbon-constrained world. The GHG emissions intensity of milk production of FS1 farms have been shown to be higher than those of dairy farm systems with higher levels of concentrate feeding and higher per cow production (Christie et al. 2009). For these predominantly pasture based systems there is an urgent need to develop agreed approaches to examining adaptation strategies and their influences on total farm GHG emissions, the emission intensity of milk production and farm profitability.

References

Barlow R, 2008. National feedbase stocktake report, Dairy Australia Limited, Melbourne, Australia.

Beca D, 2005. Key profit drivers in pasture-based dairy systems. Proceeding of the 2005 South African Large Herds Conference, Langebaan, Western Cape, South Africa.

Chapman DF, Kenny SN, Beca D, Johnson IR, 2008. Pasture and crop options for non-irrigated dairy farms in southern Australia. I. Physical production and economic performance. Agric. Syst. 97, 108-125.

Christie KM, Rawnsley RP, Eckard RJ, 2009. A whole farm system analysis of greenhouse gas emissions from simulated dairy farm systems in Australia, Proceedings of Greenhouse 2009 Conference Climate Change & Resources, Perth, Western Australia, Australia.

Cullen BR, Johnson IR, Eckard RJ, Lodge GM, Walker RG, Rawnsley RP, McCaskill MR, 2009. Climate change effects on pasture systems in south-eastern Australia. Crop and Pasture Science 60, 933-942.

Cullen BR, Rawnsley RP, Eckard RJ, 2010. Adapting pasture-based dairy systems to future climates. 2010 International Climate Change Adaptation Conference. Gold Coast, Queensland, Australia. http://www.nccarf.edu.au/conference2010/

Dairy Australia, 2009. Dairy 2009 Situation and Outlook. Report to the Australian dairy industry. Dairy Australia, Melbourne, Australia. www.dairyaustralia.com.au/Our-Dairy-Industry/Publications.aspx

Dairy Australia, 2010. Dairy Australia Strategic Plan 2011-15. Dairy Australia, Melbourne, Australia. http://www.dairyaustralia.com.au/Our-Dairy-Industry/Publications.aspx

Fulkerson WJ, Doyle P, 2001. The Australian Dairy Industry. Victorian Department of Natural Resources and Environment, Rodney Printers, Victoria, Australia.

Holz GK, Grose MR, Bennett JC, Corney SP, White CJ, Phelan D, Potter K, Kriticos D, Rawnsley R, Parsons D, Lisson S, Gaynor SM, Bindoff NL, 2010. Climate Futures for Tasmania: impacts on agriculture technical report, Antarctic Climate and Ecosystems Cooperative Research Centre, Hobart, Tasmania, Australia.

Mason W, 1993. White Clover, a Key to Increasing Milk Yields. Dairy Research and Development Corporation, Victoria, Australia.

TIAR, 2010. Impact Dairy Business of the Year Award field day. Tasmanian Institute of Agricultural Research, Burnie, Australia.