INTEGRATION OF DAIRY GOAT FARMING SYSTEMS INTO OVERSEER ® NUTRIENT BUDGETS

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Introduction

New Zealand has a long established dairy goat industry. There are approximately 36,000 milking goats in New Zealand, on farms ranging from 15 to 130 hectares. Most dairy goats are milked by farmer shareholders of the Dairy Goat Co-operative (N.Z.) Ltd (DGC). Goat milk production is estimated to have increased on average by 15% each year for the past five years, with over 16 million litres of goat milk processed by DGC in the 2008-2009 supply year. This increase has been driven both by increases in goat numbers, and increases in per goat production as farmers have moved to more intensive indoor systems.

DGC is the main producer of products from goat milk in New Zealand. Because of the nature of the product, and the sophistication of the market, quality systems are paramount. This begins with on-farm practices including environmental standards. DGC has identified an issue with compliance with regional council's environmental regulations regarding nutrient management and monitoring and reporting greenhouse gas emissions under the pending climate change legislation of central government. OVERSEER® Nutrient Budgets (*Overseer*) is on-farm nutrient budgeting software that is commonly used by the pastoral industry to plan nutrient use; it also estimates nutrient losses and greenhouse gas emissions on farm. *Overseer* has been developed to work on many different New Zealand farm enterprises (dairy, sheep and beef, deer and cropping) but, to date, the model has not been applicable to dairy goat farms. In light of this, DGC and MAF (Sustainable Farming Fund) supported development of a dairy goat module within *Overseer* to enable dairy goat farmers to understand and better manage nutrient losses and greenhouse gas emissions.

Alongside the development of *Overseer* for dairy goats, best management practices (BMPs) have been developed for nutrient management. This paper outlines how the goat model was instigated into *Overseer*.

Approach

The following steps were undertaken taken to develop an *Overseer* module for dairy goat farming:

Definition of data requirements

The main data requirements for the inclusion of dairy goat farm systems into *Overseer* were identified. This required an understanding of the dairy goat production system. This was done by interviewing and collecting information from five dairy goat farmers covering contrasting management systems (grazing and full housing) to understand the drivers of nutrient cycling and define key data requirements necessary to modify the *Overseer* model. A literature review was conducted to assess the extent of published data on dairy goat systems and to identify gaps in the knowledge. In comparison to dairy cow farming or sheep farming, there is little published information available about dairy goat farming systems in New Zealand.

Collection of relevant data
To validate information collected in step one above and to fill the information gaps identified, a study of contrasting dairy goat farm systems was made. This provided detail of farm operations (specifically around grazed and housed systems) and described nutrient flows, sources and sinks. This focused on areas such as the milking platform and its operation, feed management systems including housing and grazing systems, effluent management, stock management and supplementary feeds.

Information collected by the DGC in its annual survey of farmer practices was used to identify five dairy goat farms in the Waikato area as study farms for use in the collection of information and data. These five study farms were selected to be "typical" and did not necessarily represent the full range of management types among dairy goat farms in the country. Two of the study farms manage goats outdoors on pasture all year and milk 250 and 330 does, respectively. The other three study farms operate fully indoor systems and milk 600, 520 and 520 does respectively. In addition, data collected from three other indoor farm systems was used to provide a wider sample base.

The study farmers provided access to records and documented management practices. Samples of farm dairy shed effluent and barn manure were collected and analysed for nutrient contents at regular intervals over a production season. Samples of pastures and feeds were collected and analysed for nutritive value. Live weights of milking does and replacement kids were determined.

DGC provided monthly production records for farms for the 2008/09 and 2009/10 production years. Parameters recorded were volume, solids, fat, protein and lactose.

Feedback to farmers
The knowledge of different practices for nutrient management gained to this point were summarized and communicated to dairy goat farmers at field days to raise awareness of issues and to receive farmer feedback on these. As a result of this, a set of nutrient best management practice guidelines (Carlson et al., 2010) were written, and these have been published and sent to all DGC suppliers.

Defining specifications for Overseer
When all relevant data had been collected, a detailed list of the specifications required for the inclusion of dairy goat farm systems into *Overseer* was made. As well as providing data for the models used to generate reports, suggestions were made to the appearance and content of Overseer screens used to input farm data.

Development of the dairy goat model for Overseer
The collated information suggested that a new dairy goat model could be developed by modifying the existing sheep, dairy lactation and housing modules already used within *Overseer*. Thus, the inputs for dairy goats are essentially the same as for other animal enterprises. Externally, facilities to add dairy goat numbers, breed and production were added. The typical unit of milk production is litres compared to kg milk solids for dairy. Additional supplement management in housed structures was also added as outlined below. Internally, all calculations were based on the sheep model, with the exceptions outlined below.

The ME requirement model in *Overseer* is a generic metabolic intake model using parameters for each animal enterprise. The parameters for sheep were used for dairy goats, except for basal metabolism where goat specific values were available (Tedeschi et al., 2010). Dairy goats continue to gain weight up to 3 years and this is factored into ME requirements. No data on weight variation over year in mature animals was found and hence this is assumed constant. A 12-month milking mob was added as some animals were not kidded annually. Milk fat and protein content of 3.6 and 2.9% respectively was based on average values from the survey.

It was assumed that the pattern of nitrogen (N) leaching for urine excreta added to pasture was similar to sheep as no data to suggest otherwise was found.

Dairy goats have a different way of utilising feed than sheep. Dairy goats tend to select feed from the top down when grazing pasture or eating supplements (Clark D.A. et al., 1982). For grazed pasture, this is likely to result in different quality (N concentration, ME content and digestibility) of the pasture compared with that eaten by sheep. Thus, dairy goats tend to eat more high quality grass and less clover than sheep. However, no data on quality of eaten pasture were found for goats. Hence, pasture quality data for sheep was used. The selection of supplements in a mixed supplement diet depends on feeding regime. The model treated all supplements equally.

For housing, the largest differences between dairy goats and other animal enterprises is the high proportion of unutilised supplement. As dairy goats are fussy eaters, farmers tend to fed supplements in excess, resulting in low utilisation (down to less than 50% utilised). On some farms this ends up in the effluent, much the same as unutilised supplements for other animal enterprises. The rate of utilisation implies that effluent generally contains a high proportion of solid and contains more N when compared to other animal enterprises, or that unutilised supplements are removed and stockpiled. On some farms, the unutilised supplement is on-fed to another enterprise, typically beef. Additional inputs dealing with supplement management in animal housing have been added to *Overseer* to deal with this.

Enteric methane emissions (kg methane/kg dry matter intake) are assumed to be the same as for sheep. This differs from National Inventory, which uses a country-specific value of 9 kg CH_4/head/year (Ministry of the Environment 2010). The increased productivity in dairy goats over time (Morris, Prosser pers. comm.) and the difference between dairy and non-dairy goats supports the use of an approach similar to sheep.

Validation and testing of the model

The dairy goat module is undergoing validation and testing. This includes analyses of six actual farm systems under a range of scenarios.

Promoting adoption of the model

The dairy goat module will be included in the next release of *Overseer*. Promoting its use will involve the use of the model to identify optimum management options for efficient nutrient management, and to limit nutrient losses and greenhouse gas emissions. These practices will be modelled at a farm scale level of some typical farms to produce scenarios that can be used to promote the adoption of the model.

To a large extent, *Overseer* is used by "expert" users, such as farm consultants, fertiliser company field officers and regional council compliance officers. These professionals should

already have in depth knowledge of *Overseer* and be readily able to use the new goat module as long as they also have a good knowledge of goat farming systems.

Most goat farmers themselves will not actually use *Overseer* to prepare nutrient management plans, however they should have a good understanding of the information required for input, and be able to interpret *Overseer* reports. They should also be aware of and able to implement best management practices.

DGC will provide opportunity for *Overseer* to be presented and discussed at supplier field days, and will continue to support the adoption of nutrient best management practice by goat farmers.

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