FUTUREDAIRY information sheet

Nitrogen efficiency on dairy farms

by Santiago Farina and Yani Garcia

FutureDairy's research has found that a complementary forage system (CFS) achieved the most efficient use of nitrogen at the 'whole farm level,' compared with other dairying systems used around the world.

The research measured the nitrogen efficiency for FutureDairy's CFS farmlet study (see box) and compared the results with other dairy systems studied throughout Australia and internationally.

The CFS in FutureDairy's trial at Camden near Sydney involved allocating 35% of the farm for double or triple cropping, with the rest of the farm used for intensively managed pasture.

Under this CFS, 45% of all nitrogen entering the farm was converted into milk. This compares with an average of about 26% for Australian dairy farms[1] and about 16% overseas.[2]

At 45% nitrogen efficiency, FutureDairy's complementary forage system converted more than one and a half times the amount of nitrogen into milk than the average for Australian dairy farms.

The key to the nitrogen efficiency of the CFS is the higher amount of milk produced from home-grown feed. This came from the combination of the bulk crop (eg maize) and a legume crop and the fact that the pasture area in the CFS had high yields (20 t DM/ha) given the level of nitrogen fertiliser applied (250kg/ha).

Overall the CFS utilised 24.8 t DM/ha/year which meant that the nitrogen entering the farm as bought-in feed was minimised with cows receiving about 1t DM concentrates/cow/lactation.

[1] Data from Accounting for Nutrients project, a 2-year national study that monitored 41 dairy farms across all Australian dairying regions.

[2] Based on farm studies from seven countries measuring N balance with the same critiera as the FutureDairy trials.

Complementary Forage System

A CFS involves allocating a portion of the farm to intensive forage production to increase productivity from home-grown feed. It usually involves growing forage crops, sometimes double or triple cropping. Crops are selected to complement each other. For example they may include a legume for nitrogen fixation, a bulk crop such as a cereal or maize for silage, and a brassica (forage rape) to break pest and disease cycles.

Compared with other intensification systems such as relying heavily on purchased feed, the CFS has a lower potential environmental impact, in terms of producing more milk per unit of nitrogen entering the farm.

The CFS gives dairy farmers another option for increasing their farm productivity in a sustainable way.

Nitrogen hot spots

The project also involved trials to monitor nutrient movement around the dairy farm which revealed 'hot spots' of nitrogen surplus within the system – in specific locations and during certain times of the season.

Nitrogen hot spots occur in places where cows congregate that don't have growing pastures or forages to use the nitrogen; for example laneways and feedpads.

Cows excrete excess nitrogen in dung and urine. The amount of nitrogen excreted in a particular area is directly proportional to the amount of time the cows spend in each spot.

Left unmanaged, these hot spots represent a waste of money and potential risk to the environment.

For example the study measured 2 tonnes of N/year lost as excreta in the laneways on a 22ha farmlet.

The good news is that relatively simple management practices can cut the level of nitrogen at these hot spots.

A good place to start is with strategies to encourage cows to move away from laneways and into the paddocks where nitrogen in excreta can be recycled back into the soil.

Examples include providing more water troughs and shade inside the grazing paddock. These will be good for animal welfare as well as the environment.

The Cool Cows website (www.coolcows.com.au) has practical information and design guidelines for installing water troughs and shade on dairy farms.

For more information

Associate Professor, Yani Garcia
ph (02) 4655 0621
email sergio.garcia@sydney.edu.au

About FutureDairy

FutureDairy aims to help Australia's dairy farmers manage the challenges they are likely to face during the next 20 years. The challenges are expected to be related to the availability and cost of land, water and labour; and the associated lifestyle issues.

Our activities are structured around two priority areas – Precision farming (including automatic milking and innovations) and Feedbase (forages and feeding). These are the areas where there are opportunities to address the challenges related to water, land and labour resources.

For Precision Farming we are investigating technologies with potential to improve farm productivity, efficiency, labour management or lifestyle. FutureDairy is pioneering the development of pasture-based farming systems that use robotic milking for larger herds. Our research is conducted at Australia's first automatic milking system (AMS) research farm, at the Elizabeth Macarthur Agricultural Institute at Camden. Since mid-2009 we have been testing a new concept automatic milking system designed specifically for Australian conditions, while continuing to further develop the farming system around the milk harvesting equipment.

Our Feedbase goal is to develop sustainable dairying systems for the future, with the intensification of home-grown feed to enable more efficient use of land, water and grain. Our trials are being conducted at the University of Sydney's Corstorphine dairy farm and Mayfarm. The investigation is complemented with modelling and component field research in areas of forage production and utilisation.

We are investigating a complementary forage system (CFS) that involves triple cropping on 35% of the farm area and growing pasture on the remaining 65%. Our target is to produce more than 25t DM/ha/yr over the whole farm area, in a sustainable way. The three crops include:

- a bulk crop (eg maize);
- a legume for nitrogen fixation (eg clover); and
- a forage to provide a pest/disease break and to improve soil aeration (eg a brassica).

FutureDairy is now in its second phase. During the first phase, we used existing technology for automatic milking to test the feasibility of robotic milking in a pasture based system. The promising results paved the way for testing a new prototype AAMS with a larger herd during phase 2.

In the first phase, our Feedbase studies tested the feasibility of a complementary forage rotation grown on a small area, both under research and commercial conditions. Phase 1 combined technical research with social research and extension research. During phase 2 we are drawing upon that learning experience to improve our linkages with major extension groups.

Contact us

Project leader:	Dr Sergio (Yani) Garcia ph (02) 9351-1621 email: sergio.garcia@sydney.edu.au
Precision Farming leader	Dr Kendra Kerrisk ph 0428 101 372 email kendra.kerrisk@sydney.edu.au