FUTUREDAIRY **information sheet**

Complementary Forage Rotation (CFR)

Sustainability research results

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A study of FutureDairy's Complementary Forage Rotation (CFR) has shown the system is environmentally sustainable.

Complementary Forage Rotation (CFR)

The CFR is an intensive system, offering dairy farmers the opportunity to produce more home-grown feed than could be achieved from pasture alone. It involves growing two or three crops on the same area of land within the one year, for example:

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

The crops grown complement each other or the system

The CFR may offer benefits to dairy farmers with limited land and irrigation, particularly if grain-based concentrates become more expensive in the future.

The idea is to allocate inputs, such as nitrogen and water, properly in a relatively smaller area; rather than scattered throughout the whole farm with reduced efficiency.

Annual yields from the CFR are more than 40t dry matter per hectare, compared to a maximum of about 20t from the best managed perennial ryegrass or kikuyu-based pastures.

Sustainability studies

The CFR is an intensive system, involving high inputs of fertiliser and water so it is important to understand the potential environmental impact. Over the past four years, FutureDairy conducted several studies to investigate this.

Soil health

The first study evaluated the impact of growing double- and triple-crop CFRs on soil fertility, health (microbial activity) and pathogen build-up.

The results showed no evidence of any adverse effect of the CFR on these soil characteristics.

Nutrient flows

FutureDairy scientists conducted a larger-scale study to monitor the key indicators of health status and nutrient flows within the system over four seasons.

The data allowed us to assess the likely impact on areas away from the CFR site and to compare nutrient and water use efficiency with both intensively and extensively managed pasture systems.

The results showed no changes in soil organic matter or any adverse effects from an intensively managed CFR.

The organic matter content of a soil is an indicator of its potential fertility and it can be dramatically reduced after a few years of continuing cropping. However this doesn't seem to happen with CFR, which involves crops such as forage rape and legumes that have beneficial properties to the soil.

Fertiliser efficiency

Although the system requires a high level nitrogen fertiliser, it is twice as efficient at using nitrogen due to increased forage yields.

And the high yields mean the CFR is also twice as efficient at using irrigation water.

The loss of soil nutrient through run-off was surprisingly low, even in a relatively wet year.

These intensive forage rotations have the potential to 'sink' more carbon into the soil than a typical pasture, reducing carbon losses into the atmosphere.

Plants use sunlight to fix carbon dioxide and grow. The more forage biomass that is produced above and below ground, the higher the amount of carbon captured.

At the other end, low forage production (e.g. overgrazed pasture or during drought) means a greater amount of carbon emission into the atmosphere. This is because the losses of carbon due to soil microbial activity and plant decomposition are not offset by carbon captured by photosynthesis.

This is why intensive cropping system under irrigation can contribute to lower carbon emissions.

Conclusions

Overall, these studies show that the increased intensification in home grown feed through CFR system can be achieved without adverse effects on soil physical and chemical properties.

Future research

FutureDairy's on-going research is investigating the CFR on a larger scale, where it is being grown on 35% of the farm area, with the rest used for intensively managed kikuyu-based pasture oversown with short rotation ryegrass each autumn.

For more information

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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 NSW Department of Primary Industries' Elizabeth Macarthur Agricultural Institute at Camden. From mid-2009 we will be 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/y rover 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

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