Background to the "Sustainable dairy farm systems for profit" project

Findings from the "Sustainable dairy farm systems for profit" project

M5 Project Information Series - Studies on Mutdapilly Research Station and subtropical dairy farms 2001 to 2005

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Overview

DEREGULATION of the dairy industry in 2000 resulted in dairy farmers in the northern half of Australia having to quickly adjust their production systems to handle a 20 to 30% reduction in milk price. This sudden price drop, combined with a run of difficult seasons and water shortages, set a serious challenge for the region's farmers.

Farmers were faced with a number of choices – to leave the industry, to seek part-time employment, to diversify, or to modify their dairy production system to stay viable.

In 2000, the average farm produced 550,000 litres/year. With limited ability to further cut costs, it was estimated that existing farming systems needed to increase productivity by at least 100% within 10 to 15 years to remain sustainable.

For many years, industry analyses have indicated great potential for increasing forage production and use on the majority of farms - with farms in the region utilising an estimated one-third of their achievable dry matter production. Likewise in 2000, production per cow, litres per labour unit and infrastructure were assessed as being used well below their potential.

In anticipation of the significant drop in milk price, a four-year project was planned and put in place in 2001 to allow the industry to 'try out' intensification of the region's farming systems – to produce rapid and large increases in milk production per farm.

Project outcomes

As a result of the project, the industry now understands the characteristics of a profitable dairy farm, and the potential, limitations and viability of intensifying the main farming systems. The project used physical information and computer models to show that all of the common farming systems in the region have the ability to be profitable if changes are implemented, and the farming system matches the farm's resources.

The project concluded that farms in the region could increase production to the levels suggested to remain profitable. However, there were financial risks if such large increases were made quickly - mainly related to the difficulty of maintaining cash flow during the initial period of rapid capital investment and expansion.

The potential for environmental risks and the added pressure placed on the farm family - associated with rapid expansion - were also raised and defined by the project.

The project confirmed that the subtropical environment is capable of much higher milk production from forage - which can be more fully exploited by increasing the focus on better management of tropical species, tight water management, planned forage conservation, good grazing management and complementary feeding with concentrates.

Queensland Government
Department of Primary Industries and Fisheries

Industry background

IN the 1990s, the subtropical dairy region was characterised by increasing rainfall variability and unreliability of irrigation water supplies. As a result, farmers were increasingly incorporating silage into their feeding system - leading to an interest in forage crops vs. pastures as a profitable feedbase for the region.

At the same time, the industry was looking down the barrel of Australia-wide deregulation of the industry in mid 2000. Farmers in the subtropical region were facing a potential drop in average milk price of around 10 cents per litre.

In 1999, researchers and farmers looked at research priorities to help maintain a viable and sustainable dairy industry in the region. The focus was to help farmers adjust their production systems to greater uncertainty in both milk price and seasonal conditions, and to run viable businesses at a predicted average milk price of 30 to 35 c/L.

A 1999 survey of the subtropical region conducted by the Department of Primary Industries and Fisheries provides an indication of physical features of the industry just before deregulation *Table 1*.

TABLE 1. FARM statistics from a Subtropical Dairy Farm Survey of 1999.

	Queensland	Nth NSW
No. of dairy farms	1,553	305
Av. herd size	136 milking + dry cows	138 milking + dry cows
Av. farm area	239 ha	136 ha
Av. stocking rate on milking area	1.15 cows/ha	1.77 cows/ha
Milk prod. / farm	650,467 L	632,675 L
Milk prod. / cow	4,777 L	4,570 L
Silage use	31% farms @ 2.6 tonnes/cow	40% farms @ 1.76 tonnes/cow
Molasses use	45% of farms @ 609 kg/cow/yr	36% of farms @ 559kg/cow/yr
Grain/meal use	87% farms @ 1.3 tonnes/cow	90% farms @ 1.2 tonnes/cow
N fertiliser use	77kg N/cow	70kg N/cow
Minimal till use	on 56% farms	on 95% farms

The postal survey had less than 50% return rate and is likely to be biased towards larger farms, but is a useful indicator.

As predicted, industry deregulation in 2000 led to a major milk price drop and a significant loss of farms and of milk production from the region, *Table 2* and *Table 3*.

Milk price after deregulation was more variable than predicted, with changed processor contracts, seasonally-based pricing and price differences between processors and districts. Very dry seasonal conditions, low water and forage availability, and high supplementary feed costs further deflated the confidence of farmers in the region.

TABLE 2. TRENDS in key business traits of SE Queensland dairy farms 2000 to 2005 (QDAS reports).

	2000	2001	2002	2003	2004	2005
Total milk income c/L	40.0	30.4	32.8	34.5	34.1	34.9
Total variable costs c/L	20.8	19.5	20.6	22.9	20.8	21.4
Gross margin c/L	19.1	10.9	12.7	11.6	13.3	13.6
Dairy operating profit $/cow	732	433	285	266	340	298
RoA %	4.3	0.5	3.2	3.0	3.9	2.5

TABLE 3. TRENDS in Queensland farm production and number from 2000 to 2005. (from Australian Dairy Industry in Focus 2003 and 2005).

	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005
No. Farms	1,545	1,305	1,152	1,125	970	885
Farm production L x 1,000	549	582	645	639	695	688
Total production million L	848	760	744	719	674	619
Production per cow L	4,350	3,940	4,070	4,230	4,162	3,735
Typical milk price c/L	na	30.6	34.5	34.8	33.8	35.0

By the end of 2005, the number of farmers in Queensland had reduced to around 890 – a decline of more than 40%. Milk production for Queensland was around 620 million litres– a decline of more than 25%.

There are no official corresponding figures for northern NSW, but the trends are estimated to be similar.

The *Sustainable dairy farm systems for profit* project

FACED with a lower milk price and little opportunity to reduce costs, the way ahead for the majority of dairy farms in Australia's subtropical region was to increase milk production from their existing resources.

Industry consultation indicated that intensification of forage production was a high priority. An initial proposal was to set up farmlets at Mutdapilly Research Station to compare the profitably of cropping vs. pasture-based systems. This grew into a more comprehensive project to look at the potential and the means for the region's dairy farms to profitably and sustainably double milk production to offset lower milk prices.

A farming system project – including physical farmlets and commercial farms - was set up in 2001 at Mutdapilly Research Station. The project developed links with commercial 'companion' dairy farms across Queensland and in northern NSW to investigate intensification and its implications for a representative range of farming systems.

The project was the first 'farming systems' research to be conducted in the region, drawing together an industry steering committee including farmers, and a research team with expertise in production, business, water use, environmental sustainability, and social studies.

Farmer groups selected feeding systems and seasonal calving pattern as important areas of research that would have greatest impact on profitability; a review process added water-use efficiency.

With industry consultation, the project team identified five relevant farming systems for study. Four were grazing systems typical of the industry at the time, and the other was a feedlot dairy to be established 'from scratch'.

The grazed systems ranged from a raingrown system based on tropical grass, through various pasture and cropping systems with limited and high irrigation-water availability. The production systems all involved large increases in cow numbers, increased stocking rate and high levels of concentrate feeding – to assess the potential impact of intensification on business profitability, on the social well being of farming families and on the farm environment.

The plan was to research what was possible – not to look at the status quo.

The initial aims of the Sustainable dairy farm systems for profit project were:

- To provide physical models of future farming systems as an interactive learning environment for farmers and advisers.
- To understand the management of water in these farming systems, including water-use efficiency, the movement of water and nutrients, and any impact on local catchments.
- To provide decision-support aids and information to help farmers in the region to develop profitable and sustainable farming systems.

Goals for the farmlets were to:

- Produce 600,000 litres milk/labour unit
- Provide a 10% return on assets

Mutdapilly farmlets

Once the most relevant farming systems and business targets for the region were identified, models of five farming systems were developed, based on farm description, land and water resources, human resources, herd characteristics, milk production, fertiliser use, grazing management, purchased feed, stocking rate and financing.

These models reflected the range of farming systems feasible under northern Australian conditions, and shared the principles of optimum forage production and utilisation from the natural resource base, complemented with purchased concentrates.

Using the economic and physical parameters produced by these models, five 20-cow farmlets were set up at Mutdapilly Research Station in southeast Queensland to represent each of the major farming systems, *Table 4* and *Table 5*.

Each of the production systems was assessed as capable of a large increase in productivity, compared with existing industry averages. The modelled systems had similar resources to industry averages, but supported up to three-fold increases in productivity with higher stocking rates and higher levels of supplementary feeding than the industry average. A grain/molasses and protein meal mix was fed at a flat rate of 10 kg/cow/day. The project team estimated that this was the maximum 'safe' concentrate level without compromising cow health. The five farmlets operated from September 2001 to August 2005.

Detailed information on production, economics, water-use, environmental and social aspects was collected over the four years of the project – from both the Mutdapilly farmlets and the project's companion commercial dairy farms.

TABLE 4. DESCRIPTION of the physical farmlet models at Mutdapilly Research Station.

Farmlet	Description	Calving Pattern	Socking Rate head/ha	Milk Production Targets
M1	Raingrown pasture	100% spring	1.9	7,040 (L @ 305 days)
M2	Limited irrigation pasture	50% spring 50% autumn	2.8	6,560
M3	Limited irrigation crops	30% spring 70% autumn	1.4	7,300
M4	High irrigation pasture and crops	30% spring 70% autumn	2.8	7,100
M5	Feedlot	All year round	4.3	9,650

TABLE 5. DESCRIPTION of the feed base of the 5 physical farmlet models.

Farmlet	Off farm feed * (tonne DM/cow)	Winter forage	Summer forage
M1	3 t Concentrate 1 t Hay/silage	Oats	Rhodes grass
M2	3 t Concentrate 1 t Hay/silage	Ryegrass	Rhodes grass
M3	3 t Concentrate	Ryegrass, oats, lucerne	Forage sorghum, lablab, lucerne
M4	3 t Concentrate	Ryegrass, prairie, fescue	Lucerne, forage sorghum
M5	3 t Concentrate	Maize, lucerne and barley silage	

* Concentrate includes grain, protein meals, minerals and molasses.

Companion farms

The research station farmlets were unable to provide accurate information on labour efficiency, and issues of managing a larger herd.

The project assessed the 'real' expansion opportunities for the subtropical dairy industry; implications for the farm family; and longer-term sustainability by incorporating commercial farms into the study.

22 commercial farms became involved in the project as companion farms, representing a broad cross-section of the subtropical dairy industry in terms of location, farming style and herd size. There were 6 companion farms in northern NSW, 9 in coastal southeast Queensland, 5 in the Darling Downs/South Burnett, 1 in Central Queensland and 1 in North Queensland.

These commercial dairy farms were involved in the project in a variety of ways – all participating in QDAS, and all providing regular input into the project and its direction. The companion farms were very important for studying the business and social issues associated with intensification. Environmental monitoring was conducted on some of the farms. Several were also used to monitor water efficiency of forage production, and for applying techniques learnt on the farmlets – such as scheduling irrigation, double cropping and grazing management. Throughout the project – individually and at workshops - the companion farmers identified practical internal and external barriers to making potential changes to dairy farm businesses.

During the course of the project, many companion farms made management changes to their own farm businesses as a direct result of participation in the project.

Streams of study

Business

(Led by Graeme Busby)

QDAS financial information from subtropical dairy farms was used to establish the base starting point for expansion of the five selected farming systems and to establish benchmarks.

Each farming system studied by the project (farmlets and companion farms) was economically evaluated using a System Economic Model, which conducted a number of analyses - including discounted cash flow, cash and profit, breakeven and scenario analysis. Financial records for each farmlet included landed costs of purchased grains, meals and conserved forages; and forage production costs. Imputed costs included herd costs, labour costs, finance costs and costs related to the asset structure.

The majority of the project's companion farms were also long-term QDAS users.

The business information from the project will be used to develop models for expansion of subtropical dairy farms.

Production

(Led by Ross Walker)

The project required the research team and research station staff to physically run the farmlets as close as commercially-possible to mini dairy farms, and to use best-management practices.

Each farming systems was monitored in detail for milk production and composition, paddock and forage records, forage production, forage conservation, ration formulation, feed purchases, climate, herd dynamics, fertility, animal liveweight and health

Water Use Studies

(Led by Mark Callow)

The project aimed to compare the water-use efficiency of the different farming systems, and to define best water and irrigation management for optimum forage yield and quality – including the effect of timing and amount of irrigation on plant growth.

Irrigation scheduling was consistent across all farmlets. Irrigation water was restricted to 6 ML/ha/year

Water-use (rainfall + irrigation) plot studies were undertaken for a range of tropical and temperate

pastures and crops, and the water use of the five farming systems was documented and analysed over four years. Water use considerations were incorporated in species selection, irrigation scheduling, grazing practice and fertilizer management on the farmlets – and in minimising surface runoff and nutrient loss.

The technology developed at Mutdapilly was tested on two companion farms – using an EnviroSCAN to schedule the same volumes of irrigation water normally used by the farmer, but applied strategically to match plant requirements. At the same time, adjustments were made to grazing management to increase utilisation. On one farm, these changes resulted in an improvement of 100% in water-use efficiency and 85% in pasture utilisation, with similar improvements on the other farm.

This aspect of the project will provide farmers in the region with information on the water use efficiency of common forages, and making optimum use of rainfall plus available irrigation.

Environmental Studies

(Led by Rob Chataway)

Intensification of farming potentially increases the risk of nutrient loss off-farm, impact on waterways and on soil health.

Environmental sustainability considerations were taken into account to develop 'best management' farming practices on the farmlets, and to minimise environmental risks within each farming system – with a focus on fertiliser, effluent, irrigation and tillage practices.

Soil and water monitoring were undertaken to evaluate any changes to natural resources over the life of the project. Methods included deep-soil sampling, drainage lysimeters, soil cover photo standards, and predictive models.

The potential environmental impact of feedout areas was also assessed. Systems to handle the waste from 300 milking cows were developed and costed.

Soil cover and soil nutrient levels were monitored on selected companion farms.

Social studies

(Led by Helen Todd)

Prior to the farmlets being established, interviews were conducted with dairy farm families about the key social issues for farmers intending to stay in the industry.

The work continued throughout the project, with companion farmers and the project research team, monitoring and assessing the social aspects of intensifying each farming system – including the farm's stage in the business life cycle; age of farmers; management complexity; demands on time; physical, mental and financial stresses; skills and capability; alternative sources of income and employment; resources to expand; succession planning and opportunities for young people; loss of community 'critical mass'; affordability of skilled labour and labour management.

Outcomes for the subtropical dairy industry

1. Initial Key Messages

Production

- Under the Mutdapilly farmlet structure and environment, all five farming systems achieved substantial increases in milk production.
- The subtropical dairy industry can have more confidence in producing 30 tonnes DM/Ha from crops in a cut and carry system.
- Production systems with high stocking rate need to exploit periods of surplus growth by conserving excess forage.
- High rates of concentrate feeding, coupled with well-managed grazing and forage conservation, can lead to high production per cow. Along with cow numbers these are key drivers of profit.
- Productivity of the M4 (irrigated pasture and crop-based) and M5 (feedlot) farmlets was quite outstanding - 7,400 and 9,200 L/cow/year and 20,800 and 39,500 L/ha total farm production, estimated to be equivalent to 11,500 and 21,600 L/ha from home grown forage.

Water Use

- A small amount of supplementary irrigation has a very positive impact on farm productivity, compared with raingrown systems.
- Farmers can routinely double crop with supplementary irrigation in regions with less than 1,000 mm rainfall.
- Increased forage production and utilisation will improve the efficiency with which water is converted into forage.

Environmental

- Intensification of dairy farming requires a proactive approach to minimise the risk of nutrient movement and pollution.
- A higher cropping frequency better protects soil from erosion, and reduces the risk of nutrient and water loss below the root zone.
- When supplementary feed is increased, fertiliser recommendations need to be reviewed and reduced.
- Annual ryegrass is susceptible to over irrigation during establishment and the first 2 to 3 grazings, leading to potential water and nutrient loss below the root zone.

Social

- Social research during the project (2001-05) indicated a high degree of uncertainty and questioning of the future – for example, should small farms be pushed to become more intensive, or are there other alternatives?
- To create more confidence, expansion or farm intensification needs to demonstrate the ability to provide farm families with adequate cash - for a lifestyle that provides them with sense of 'reward for risk and effort'; pride and control in a farming system that rewards them with a chosen 'way of life' without compromising the sustainability of their land; plus cashflow to allow ongoing farm development.
- Phasing and sizing of expansion is critical. The financial pressure and increased work could push farming families beyond their level of resilience, with the stresses unable to be managed in a sustainable manner.

Business management

There are more implications to any farm expansion than more cows and more concentrate.

- Rapid expansion needs to be well planned to mitigate risk - given the lack of control farmers have over weather, markets, input costs, debt levels, and supply management. The main economic risk in the short term is matching cash flow to increased costs during the expansion phase.
- Sourcing, training and managing labour is a new skill that will be required.
- Larger herds and increased feeding of conserved forage and concentrates will require planning and investment in effluent management.
- The amount of forage that could be home grown had a direct effect on milk production and feed costs. Together with the cost of purchased concentrates, this determined to a large extent the differences in profitability and cash flow between the five farming systems. However, each farm needs to operate within the production resources it has.
- While production targets were largely met, the challenge of achieving a return on assets (RoA) of 10% was not met on the farmlets or on most companion farms. With land values rising significantly in Queensland and northern NSW, farmers' net worth increased significantly. For these reasons, operating profit margin (OPM) - expressed per farm or per cow - may be a better indicator of profitability.

Future farming systems

- Most farm enterprises are working within a resource base that limits the direction and extent of intensification. In southeast Queensland and northern NSW, there is no natural progression from raingrown dairying to irrigated or feedlot dairying.
- Establishing a feedlot dairy, in most instances, will be an existing dairy enterprise relocating to a site with resources suited to feedlot dairying - or a dairy feedlot being developed as a new enterprise on a favourable site for a feedlot.
- Basing an intensive farming system on grazed raingrown tropical pastures is likely to be risky in a lower-rainfall, sub coastal environment.
- The industry can now confidently model productivity from a particular set of inputs. Milk production from the farmlets was very close to the project's estimates of achievable production from a certain set of inputs.
- The subtropical dairy industry has the ability to develop profitable farming systems, as long as they match natural resources of the farm and the payment system.

2. Models and Tools

Dairy Predict

A comprehensive computer feedbase planning and decision tool - Dairy Predict - has been developed from the project. A combination of forages, supplementary feeds and herd structures can be tested for any farm or farming system.

The Dairy Predict program can be downloaded from www.dairyinfo.biz. The file is approximately 12 MB, so a download should only be attempted with a fast internet connection. Alternatively, contact Ross Walker for an installation CD.

See M5 Info Series 08 – Dairy Predict for more information.

Farm Gate Nutrient Balance

A simple mass-balance model was developed from the project. It considers farm nutrient inputs and outputs and the impact on fertilizer requirements and potential environmental impacts.

3. Information Series

A comprehensive series of information sheets is being prepared and will be posted on www.dairyinfo.biz as they are completed.

The diverse range of topics will include: key messages for each farming system; dairy farming profitably in the region; managing cows in hot conditions; intensification – efficiency or more hard work; profitability of concentrate feeding; managing weeds in minimal tillage; water use of different forages; environmental impacts of different farming systems; doing a risk analysis; rate of expansion; labour management.

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Pasture production, business and farm management

The *Sustainable Dairy Farm Systems for Profit* project at Mutdapilly Research Station and on associated commercial farms investigated the potential impact of intensification of five subtropical dairy farming systems on business productivity, on the social well being of farming families and on the farm environment.