FUTUREDAIRY

TECH NOTE 7
Complementary Forage Systems
Risks

FutureDairy investigated options to mitigate the ever-increasing limitations imposed by land, water and labour availability and cost in Australian dairying.

A key strategy for farmers is to increase home-grown forage production and consumption. This, in turn, can improve profitability. FutureDairy has proved that forage yields from complementary forage rotations (CFR) can be more than double those of pasture. This has been demonstrated on both research and commercial farms.

Complementary forage systems (CFS) integrate CFR into pasture-based dairy systems. This can be done in many different ways and tailored to individual farmers' needs.

When using forage crops, FutureDairy's approach is to start by setting goals that are based on what is possible (and then determine what is feasible) rather than constraining goals based on known limits to the current farm situation.

FutureDairy has shown that production of ~30,000L milk/ha or ~2,000kg milksolids/ha from home-grown forages and more than 7,500L/cow (>500 kg milksolids) are achievable with only ~1t of concentrate/cow.

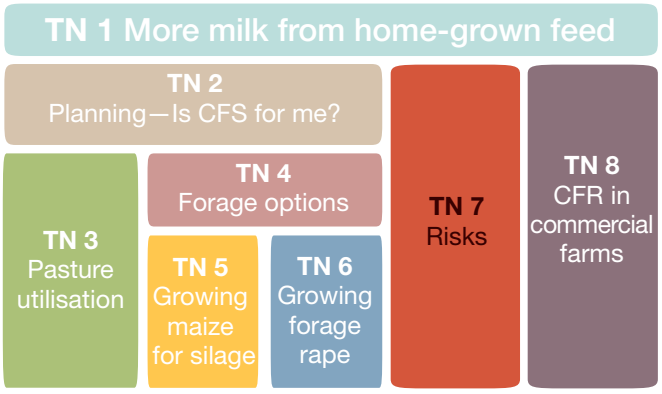
Complementary forage systems may allow you to:

- Increase total forage yield, and therefore milk from home-grown feed, and farm productivity and profitability.
- Replace more expensive bought-in supplements (thus potentially reducing economic risk).
- Increase the efficiency of use of nutrients and water.

This tech note describes:

- The main areas of risk associated with implementing a CFS on irrigated dairy systems.
- The potential impact of different risks.
- Ways to reduce different risks.

This tech note reports on FutureDairy's findings. Further work/discussion is needed regarding the specific application of these findings in different commercial dairy systems.



Managing risk

Don't avoid risk… understand it and manage it!

The aim of feedbase management is to produce and utilise feed to meet the dietary requirements of the dairy herd as cheaply as possible. Complementary forage systems (CFS) can be used to successfully achieve this goal, providing the risks are appropriately understood, evaluated and managed.

Implementing a CFS involves substantial changes at different levels of the farm system. This could include (but are not limited to): the proportion of annual crops, feeding practices, diet composition, stocking rate, labour requirements, nutrients use and distribution, capital investment in machinery and infrastructure. A certain level of risk for the business can be related to these changes.

This tech note describes the main risks associated with the implementation of a CFS on irrigated dairy systems. Understanding these risks and their impacts will allow potential adopters of a CFS to identify and manage the potential risks.

This tech note draws from the findings of FutureDairy's studies including farm modelling, plot studies, farmlet studies and working with commercial farms.

Types of risk

From a business viewpoint, the concept of risk refers to the likelihood of an uncertain event having an impact on my business.

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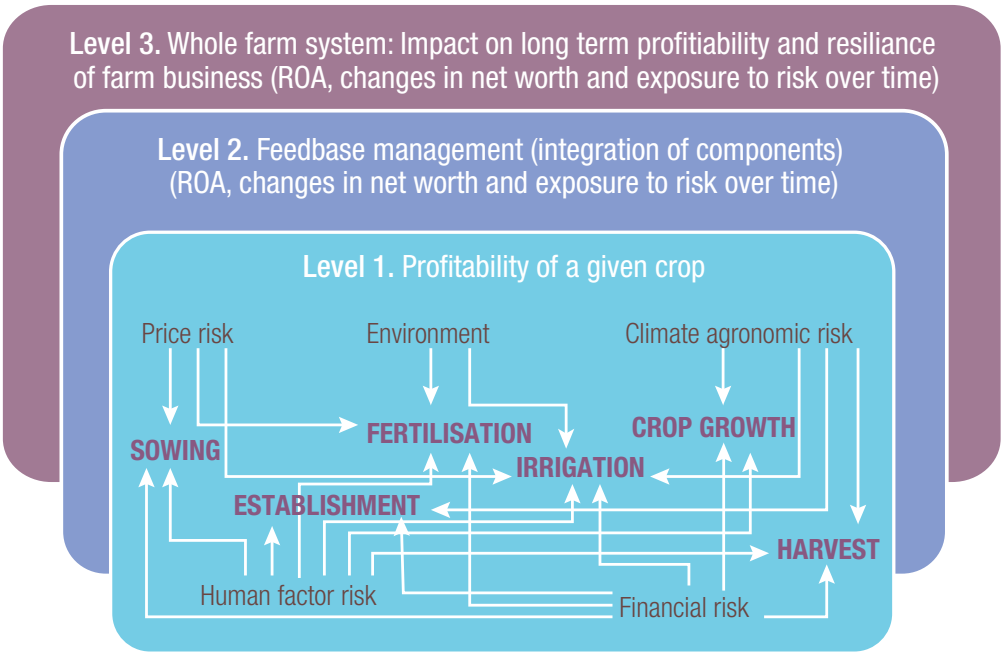

Figure 1. Levels of decision making and the effect of different types of risk on the profitability of a maize crop under irrigation.

There are five types of risk associated with a CFS:

- Climate risk.
- Price risk.
- Human factor risk.
- Financial risk.
- Environmental risk.

These are summarised in Figure 1, which uses a maize crop to illustrate how the different risks can affect the profitability of the crop—but only from sowing to harvest (before conserving and feeding out).

The degree of risk is usually considered in terms of likelihood of occurring (probability) and severity of potential impact.

Climate risk

Variable seasonal conditions and/or adverse climate-related events—such as floods and droughts—can affect the performance of a CFS, particularly crop yields. Climate variability may also have other indirect effects on crop quality and wastage and the prevalence of crop diseases and insect problems.

Probability: Moderate (provided reliable irrigation water is available).

Potential impact: Very high when it occurs (e.g. flooded paddocks or wet, cold weather at harvest of a maize crop).

Crops grown in a complementary forage system use water more efficiently. So it is possible to produce more feed from the available irrigation water and reduce the impact of years with low rainfall on the business performance.

A FutureDairy study modelled the impact of 100 years of climate on the production and profit on a whole farm at Camden (average rainfall 750 mm) with an irrigation allocation of 4 ML/ha. The accuracy of the models utilised (DairyMod and APSIM for pasture and CFR, respectively) was previously validated against field data.

The results showed that a system based only on pasture was more exposed to climate variability and achieved a lower operating profit in drought years than the CFS, due to the greater efficiency of using the limited water to grow water efficient crops such as maize.

Is it manageable?

Yes. We cannot predict with certainty or manage the climate, but we can make our system less exposed to climate variability (see below).

There is also a diversification effect: having different crops with different requirements throughout the year means that a lack of rainfall at a certain time of the year will affect some crops or pastures, but not all of them at the same time. If pasture is the only source of feed and is affected by a climatic event, the whole farm is affected.

Managing climate risk

Match crops with your specific environment (climate and soils): Having the wrong species or cultivars/hybrids can increase climate risk. For example, choosing a long-season maize hybrid that 'pushes' the optimum harvest date into the autumn will increase the risk of the soil being too wet to harvest the crop at the right stage. Plan sowing dates (e.g. for maize) to avoid risk of 'late frosts' and harvest date to reduce the probability of wet soils.

Maintain a flexible approach to feedbase management: Monitor the seasonal outlook and current seasonal conditions. If sowing is likely to be delayed due to the weather, assess if target yields are still achievable. If not, select the next best economic forage option, which may be an alternative crop or bought-in feed.

Ensure irrigation access: A CFS relies on having enough irrigation water to achieve the target yield of your bulk crop (e.g. maize or sorghum). Make sure irrigation allocation is enough to cover the crop requirements even in a low rainfall year (from historical records). If the water available is not enough to support the growth of a full summer crop, irrigation can be used to supplement natural winter rainfall. For example irrigation can be used at the start of the season for the early germination of crops such as early sown brassicas or annual ryegrass.

Price risk

Uncertainty or variability in milk price and the prices of key inputs can affect the performance of a CFS.

Probability: High.

Potential impact: High, particularly, when milk price is below average at the same time as input prices (e.g. fertiliser) are above average.

Milk price has the highest impact on the operating profit variability on a particular dairy farm.

At FutureDairy, we conducted a modelling study to evaluate the impact of historical variation in milk, concentrate, fertiliser and water prices on the operating profit of a CFS and 'pasture only' farms. Milk was clearly the greatest price risk factor, followed by concentrates, water and fertiliser prices, in that order.

Is it manageable?

Yes, to some extent. We cannot manage the milk, grain or fodder market fluctuations but we can make our system less exposed to them.

The CFS is a way to increase milk production per hectare without increasing the amount of purchased feed. The CFS farmlet study conducted at Camden produced 34,200 L milk/ha with 1 t of concentrate/cow as the only bought-in feed. A modelled system based on pasture only needed 2.2 t of concentrates/cow to achieve a similar level of milk production per hectare. The CFS was substantially less affected by fluctuations in concentrate or fodder price and was a more profitable option to support an increase in stocking rate over time.

Terminology

Complementary Forage System (CFS) refers to the whole farming system; that is the combined pasture and forage cropping area; **Complementary Forage Rotation (CFR)** refers to the area allocated to double or triple cropping.

The FutureDairy Hunter Valley case study farms had access to a reliable water supply for irrigation, and were aiming to increase milk production per hectare. However a new milk pricing system was introduced, resulting in any additional milk supplied receiving an income below the cost of production. In this case the use of the CFS will enable them to reduce the demand for 'bought-in feeds' while maintaining existing stocking rates and milk production levels.

Managing price risk

Cost and availability of irrigation water: The success of the CFS relies on the availability of a set amount of water at critical times of the year. If irrigation is limited, expensive or the quality is not good, carefully consider whether the CFS would be economic for your situation.

Impact on farming system, especially in the introductory stage: Growing a CFS on the milking area results in less area available in the grazing rotation until crops are ready to be grazed or harvested. For a CFS to work, pastures need to be grazed appropriately and extra supplements may be required. In the first year of a CFS (until the first harvest) these supplements may have to be purchased, and should be factored into the costings and cashflow budget.

Cost control: Focusing on growing and utilising crops better should not mean overlooking other aspects of the business that can increase the cost of production (e.g. repairs and maintenance, labour, infrastructure, depreciation). A high cost of production can make the business highly exposed to price risk in general, but particularly to milk price risk.

Operating profit margin: A healthy rule for dairy businesses is to consistently retain a high margin of the total income as operating profit. This works as a 'safety margin' so that even if milk price decreases unexpectedly we will not run a loss.

New costs: Additional capital investment such as a mixer wagon or a feedpad may be required to implement a CFS. Make sure this is considered in the initial budgeting as it might increase your overall cost of production and make the system more exposed to price risk. Once additional finance is set to fund infrastructure or capital expenditure, interest on this investment adds to the cost of farm working expenses. If milk price declines over time, farmers are still locked into relatively high expenses. In whole farm budgeting, evaluating different milk income scenarios can help assess the impact associated with these infrastructure or capital investments.

Human risks

Management skills and decision making ability affect the performance of a CFS.

Probability: High

Potential impact: Moderate up to very high.

The main physical risk associated with a CFS is in failing to achieve target crop yields. Management decisions influence crop yields. When growing maize, most of the direct costs are incurred at sowing (e.g. $1,700–$ 2,500/ha at Camden). A low cost per tonne of dry matter (about $110 to $150/tDM) is only achieved if the target yield is actually reached.

FutureDairy's modelling study showed that climate variation and management are both important sources of yield risk in the CFS. There are many aspects of crop management that can easily lead to reduced yields or even crop failure.

Human and climate risks are interdependent. For example, weather conditions that favour pests may not be a big issue for some proactive managers, but will have a huge impact with poor management.

Is it manageable?

Yes. The physical risk associated with poor crop yield can be reduced with good management. For example, by planning for crop requirements and assigning adequate resources to match crop needs; planting in time; and proactively managing key inputs such as fertiliser and irrigation.

Managing human risk

Experience: Human risk will be reduced with experience. Being familiar with best practices to grow and utilise, harvest and feed or graze CFS crops is important for the success of the system. Otherwise seek advice and support!

Attitude: Regardless of the manager's technical knowledge, an innovative system such as the CFS will only succeed if the person implementing it is committed to experiment and change.

Labour: Implementing a CFS for the first time can distract attention from routine farming activities. Ensure that management is maintained across the entire farm, not only in relation to sowing, harvesting, fertilising, weed and pest control but also in other areas such as heat detection, repairs and maintenance, etc. Using contractors can reduce the impact of a CFS on labour (and need for equipment) to some extent.

Pasture utilisation: A common mistake behind an excessive cost of home-grown feed when implementing a CFS is to spend more time and money in the cropping area of the farm than on the pasture area. The result is poor pasture growth and utilisation which will defeat the purpose of the CFS. Do not forget that the CFS is still a pasture-based system where most of feed produced from the farm is pasture!

Timing: Sowing and grazing after their optimal times can significantly reduce the potential yields of crops and benefits of implementing a CFS.

Planning: The key to getting the timing right is planning ahead. Having a solid feed budget will reduce the chances of the unexpected. Contractors might be needed. Be sure to organise this and discuss dates in advance.

Water: Irrigation timing can determine crop failure, particularly for maize. The crop's yield is determined around flowering and any water stress at that time will compromise yield severely.

Nutrients (N, P, K, S): Soil testing is critical to know which nutrients are limiting and if there are any soil factors that can limit responses (e.g. pH, electric conductivity). This needs to be done every year since the nutrients extracted are higher than with pasture.

Financial risk

Uncertainty due to the level of 'financial exposure' can affect the success of a CFS. Financial risk is affected by the level of equity and the capacity of the business to service debt.

Probability: Moderate, but it depends also on human factors (management skills of the farmer).

Potential impact: High, particularly if infrastructure investment is involved and equity is significantly reduced. Typical investments needed for a CFS include machinery, a feedpad or upgrading the effluent system. The potential impact could be higher for small pasture-based farms.

Yields could be compromised if the financial obligations of the dairy operation are likely to restrict expenditure at particular times of the year.

For example, the use and timing of inputs such as fertiliser and water determine the target yields. Financial flexibility is needed to purchase the inputs at the time they are needed.

Is it manageable?

Yes, provided a reasonable level of equity is maintained.

A key tool is to have a cash-flow budget. This will allow you to plan the year ahead and predict when the highest cash expenditure will be needed and how that spread of cash expenses 'matches'cash income. If the proposed CFS program does not fit with the cash-flow budget, change the system or consider not adopting it at all.

Managing financial risk

Level of investment: The value of machinery and feedpads decreases fairly rapidly compared with land. Evaluate of the potential rate of return carefully.

Current situation and potential CFS: Consider a CFS once the ceiling of milk production per hectare from pasture has been reached. If there is still potential to increase home-grown feed production and utilisation from the current pasture base, this might be more achievable as a first step and it will require less cash turnover.

Feed reserves: Planning and monitoring forage crops and pasture can reduce the uncertainty around forage yields and therefore reduce the risk of being exposed to financial pressure at certain times of the year. For example, farmers of the Hunter Valley partner farms using the CFS principles found that their systems were 'less risky' as they had a better idea of how much dry matter they were going to have available.

Environmental risk

This relates to uncertainty about the potential impact of a CFS on the environment.

Probability: Moderate/low.

Potential impact: Moderate in most cases but it will be high if flooding occurs after large application of fertiliser at the establishment of a crop such as maize.

Forages in FutureDairy's triple crop rotation produced more than twice as much dry matter per kilogram of nitrogen fertiliser applied per year, compared with a high input kikuyu-based pasture oversown with annual ryegrass every autumn.

Data from the National Accounting For Nutrients Survey of dairy farms showed that on average only 26% of the nitrogen that enters the farm is transformed into milk. In contrast, the CFS was able to transform about 45% of the nitrogen into milk because the nitrogen use efficiency of crops was higher than pasture and there was less purchased feed.

A 'farm nutrient loss index' can be calculated. This index uses inputs such as landscape features, climatic conditions and pasture management practices to calculate the risk of nitrogen and phosphorus loss from paddocks. It also helps to evaluate the effects of different management practices. For more information visit the Dairying for Tomorrow website (www.dairyingfortomorrow.com).

Is it manageable?

Yes. If managed properly, an intensified system such as the CFS does not necessarily have a greater environmental impact than a pasture-only system.

Managing environmental risk

Nutrient budgeting: To achieve efficiency we need to be in control and aware of how much gets in and out of the system. To achieve this it is necessary to put together a nutrient budget at the start of the year and monitor it periodically.

Soil type: Most of FutureDairy's studies on triple and double crop rotations were conducted on deep clay-loam soils with high organic matter content. A different approach might be needed in more 'fragile' soils in terms of cultivation, nutrient rates and yield targets. However, the relatively high yields obtained by commercial farmers that collaborated with FutureDairy in other regions of Australia (e.g. Mt Gambier, Gippsland, the North Coast of NSW and the Hunter Valley) indicate that the potential effect of soil type would be minimal.

Cow distribution: Studies at FutureDairy's CFS farmlet at Camden showed that cows can excrete up to 160 kg N/ year. The distribution of excreta is directly related to the time that the cows spend on each section of the farm. Maximising the time cows stand on productive land (pasture or crops) minimises the waste of excreta and potential nitrogen leaching.

The impact of environmental risk does not often affect the individual farmer much, but the resulting policy and institutional arrangements do.

How much risk can you live with?

Each dairy business manager will be comfortable with a different level of risk. Some prefer almost none while others are willing to take high levels of risks to make good profits. This different attitude towards risk is known as the 'level of risk aversion.'

FutureDairy used actual data from a 3-year whole farm CFS study at Camden in a simulation study to compare the impact of different levels of risk aversion on the adoption of CFS. In this example the CFS offered a possible average annual operating profit of about $1,800/ha.

We found that 'slightly risk averse farmers' (more risk tolerant) will not take the risk of doing the CFS if they are assured of about $1,000/ha with another activity. That is, they would go ahead unless there is a big reward for **not** doing it!

In contrast, a 'rather risk averse farmer' (less risk tolerant) will avoid doing a CFS if assured they can get as little as about $450/ha in hand with another activity. That is, they would go ahead only if there is a big reward for doing it.

In other words, the higher the risk aversion the higher the reward needed to convince a farmer to try a CFS! A system will be perceived as more or less 'risky' depending on the attitude of the person making the decision. Determine the 'trade-off' between risk and potential reward you are prepared to deal with in your particular situation!

Understanding the implications of a CFS on the farming system can allow management decisions to be made to reduce the actual level of risk associated with a successful outcome.

Farm managers have the option to capitalise on opportunities and take action to prevent negative outcomes. Remember, most risk types cannot be avoided, but they can be managed!

More information

Dr Santiago Fariña, Intelact santiago.farina@intelact.com
Associate Professor Sergio (Yani) Garcia
on 02 9351 1621 or email sergio.garcia@sydney.edu.au

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Copies of these articles are available from FutureDairy, phone 02 9351 1631 or the Dairy Australia library phone 1800 824 377, email library@dairyaustralia.com.au.

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