

Resilient Farming Systems

Surviving volatility

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Summary

“Markets love volatility”

Christine Lagarde, Managing Director of IMF

- In the future, the only constant will be change! Milk price and input prices will be more variable than they have been historically.
- Farming businesses will need to be resilient; this requires a solid farm system foundation (strategic plan) with the technical expertise to make appropriate tactical decisions (tactical implementation).
- Farm businesses must be business focused; they must be designed with land production capacity, soil class and rainfall in mind; they must be based on elite high performance animals, they must be highly efficient per unit of land, labour and capital, and they must limit their exposure to external forces.
- Such businesses should:
 - provide a reasonable rate of return on equity,
 - be environmentally sustainable and animal welfare compliant,
 - allow for an enjoyable and rewarding lifestyle, and
 - allow opportunities for training and personal development.

Introduction

“If you don’t like change, you’ll like irrelevance even less”

Gen. George Shinseki

The business environment for dairy farming is changing. While it has always been difficult to predict international commodity prices or foresee production risks (climate, feed availability and price), the reduction in dairy product stores in Europe and the USA and increasing wealth in previously developing countries has led to price volatility, arguably, not witnessed before. Future milk production will be set against a backdrop of increased farm business uncertainty. As a consequence, modern dairy farming systems must be sufficiently resilient to respond positively and rapidly to change.

The need for system resilience is even more important in expanding businesses. Dairy farm expansion has risks, as the additional infrastructural investment must be financed by the existing dairy enterprise(s). Such investment increases expenses and, yet, is almost always accompanied by sub-optimal biological performance initially. This places significant additional pressure on the original farming business. While prudent use of debt is an effective part of a growing business, heavily geared farms are significantly exposed to downturns in product prices, increases in input prices, ‘changes’ in banking priorities, and the vagaries of climate, particularly during the developmental phase of the new business.

Fundamentally, resilient systems must:

- have a low production-cost base to insulate the dairy farm business from price shocks, and
- allow farms to generate sufficient funds in better times to meet requirements in lean years.

This paper discusses the design of our production system against a backdrop of a more uncertain production and economic environment.

What is a Resilient Farm System?

Resilience denotes the capacity of a system to absorb and thrive in a changing and uncertain production environment. Resilient farm businesses must, therefore, have a plan (strategy) for how the farm will run in an 'average' year.

Resilient farm businesses are those that are designed to utilise their competitive advantages. This requires a 'fit for purpose' system that will provide a consistent level of production at a consistent price, within the general averages of climate, input price, and milk price uncertainty. A resilient farm system will also have sufficient tactical flexibility to overcome unanticipated events that can lower short term profitability (e.g. cold wet spring, low milk price, etc), but the system principles remain the same.

Although there are many components to a successful farm system, we believe that there are four 'pillars' that define resilient farm systems (Figure 1), irrespective of region, rainfall, or farming philosophy.

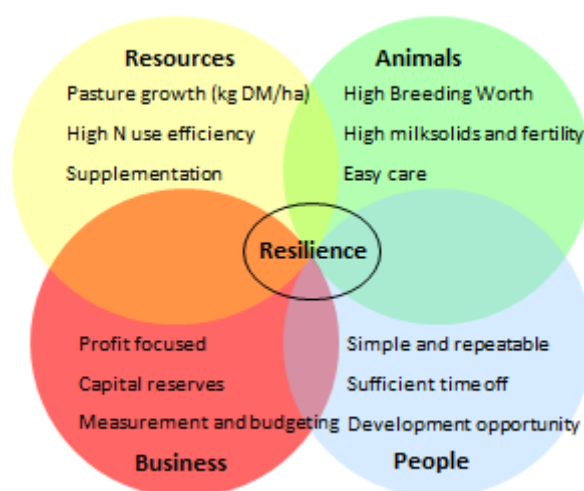


Figure 1. The 'pillars' of a resilient farm system.

Efficient utilisation of available resources

Land-base

Although dairy farms differ in their capacity to produce and utilise pasture at different times of the year, one of the most important drivers of operating profit and, therefore, return on capital, is maximising the amount of pasture that is grown and utilised. This requires consistent monitoring and effective record keeping of pasture grown in each paddock, so that strategic decisions around drainage, fertiliser, and pasture reseeding can be made to maximise pasture grown in all paddocks. Although farmers instinctively know their best and worst paddocks, without measuring weekly pasture covers you will not accurately rank paddocks in the middle or the magnitude of the difference between the worst and best. “You cannot manage what you do not measure”.

The development of management practices to improve pasture production and quality should take precedence over practices informed by individual animal performance. Grazing management is concerned with achieving adequate soil fertility, the reseeding of underperforming swards and achieving the correct balance between grazing severity and individual animal intake. Grazing to a consistent post-grazing residual height of 3.5-4.0 cm maximises pasture growth and results in consistently higher quality pasture.

Supplementary feed

The decision to feed supplements and how much supplement should be fed each day is part of tactical management. However, the decision on how much supplement should be incorporated into the system on an annual basis is a strategic decision (i.e., an annual feed budget). This decision is based on the amount of pasture grown, the stock carrying capacity of the land, and the level of financial exposure that the importation of feed creates in the business. Resilient businesses limit exposure to outside influences where possible. The greatest operating expense in dairy farming businesses is purchased feed, leaving dairy businesses that are heavily reliant on bought-in supplements very exposed to the vagaries of international commodity prices. For example, we have recently seen both milk price and supplement prices rise and fall by 30-50% and the requirement for supplementary feeds increase by more than 20% in some regions because of drought and poor pasture growth.

In the UK, Ireland and New Zealand, datasets analysed to determine associations between feeding and cost of production indicate that for every 1c spent on feed, operating expenses increase by 1.3 to 1.6c. This means that a kg of supplement must be purchased for considerably less than the value of the milk it produces. Under ideal circumstances, supplementary feeds result in 7.5 g MS/MJ ME consumed (i.e., 80 g milksolids/ kg DM for a 10.5-11 MJ feed). However, recent farm systems analyses indicate that on-farm responses are only two-thirds of those achieved in research experiments (~55 g MS/kg DM).

DairyNZ proposed a ‘5% rule’ to aid farmers in decision making around supplementary feeding: to be profitable, feeds needed to be purchased for less than 5% of the milk price. This rule accounts for the increase in non-feed costs, but assumes a response of 80 g milksolids/kg DM, 50% greater than the estimated response on the average dairy farm.

If, instead, we assume the average milksolids response achieved on farm, then the breakeven cost of feed is actually 3.5% of milk price. This means:

- at a \$6 milk price, supplements must be purchased for less than 21 c/kg DM,
- at a \$5 milk price, supplements must be purchased for less than 17.5 c/kg DM.

The calculated breakeven price for supplements (as a percentage of milk price) at different milk responses and after accounting for all costs is presented in Table 1.

Response to supplements, g MS/kg DM	Breakeven price for supplements, % milk price
80	5.0%
60	4.0%
55	3.5%
40	2.5%
20	1.5%

Table 1. The breakeven price of supplements (as % of milk price) at different milk prices and responses to supplements. The average milk response to supplementary feeds on farm is highlighted.

In addition to considering the price of supplements strategically placed into the dairy system, it is also important to consider the amount of supplement that the farm system depends upon. In analysing the requirement for supplement and the risk of exposure to economic forces external to the farm gate, we propose limiting the use of supplements to less than 500 kg DM/cow. This limits the exposure of the business to an increase in feed prices. These supplements must be purchased for less than 3.5% of milk price (Table 1).

Supplements used tactically to fill unexpected feed deficits can be priced according to need and the value proposition can be evaluated using the [DairyNZ supplement price calculator](#); however, the majority of supplement must be sourced at less than 3.5% of milk price.

Environment

The efficiency of nitrogen (N) and phosphorus (P) use within pasture-based systems is variable and can potentially result in nutrient loss to water resources. In future, on-farm management practices must be tailored to achieve excellent nutrient management. Intensive production systems require grazing and nutrient management practices that increase the efficiency of effluent use, optimise fertiliser N use, and minimise the cultivation of grasslands and nutrient overloading associated with external feed supplementation. Recent evidence from both New Zealand and Ireland suggests that where intensification (i.e., more milk/ha) is fuelled by increased grazed pasture utilisation (i.e., increased stocking rate), nitrate leaching can be reduced; however, when intensification is fuelled by purchased feed nitrate leaching increases.

The appropriate animal for the system

If we accept that the comparative advantage of dairy production in New Zealand involves the efficient utilisation of grazed pasture, then the appropriate cow must be able to harvest pasture efficiently. To do this in a farm system context, she must re-calve every 365 days to ensure peak intake demand coincides with peak pasture supply, she must be an aggressive grazer, and her live weight must be no more than is required to maximise intake (i.e. big cows do not eat proportionally more than medium sized cows in grazing systems). Excellent research over the last two decades has led to the production of a multi-factor, profit-focussed, breeding index (Breeding Worth; BW) that takes the guess work out of choosing the appropriate cow for New Zealand dairy systems. In addition to BW, crossbreeding may offer significant financial reward, improving production and fertility beyond the value of the improvement in BW.

Developing people

Dairy production systems must be simple and labour efficient, providing adequate time off and training opportunities for those working in the business. The requirement for greater labour efficiency increases the need for an easy care dairy cow and simplicity in operational protocols to minimise the requirement for additional labour. It is also essential to enable sufficient time for farm staff and owners to develop new skills that will increase the efficiency of the production system and to make farming a viable and attractive career choice relative to a 40 hour working week in town.

The need for continuous improvement cannot be overstated. It will be vital that farmers are adaptable, flexible and are able to make appropriate decisions quickly. In the past, farm management was dominated by production economics, and farmer learning has traditionally focussed on plant and animal husbandry rather than acquisition of broad management skills. With modern dairy farming increasing in complexity, farmers of the future need a broader range of management skills (e.g. human resources, contract negotiation, forward contracting of milk and feed). The rapid pace of change in technologies necessitates lifelong learning and continuous education and training to ensure the viability and sustainability of the businesses.

Developing a business discipline

Dairy farmers will need an increased level of understanding of business principles if they are to prosper in a tumultuous 'price-taker' environment. Every dairy farm business needs to develop their farming operations in a manner consistent with the requirements of a vibrant business for the future; upgrading skills in financial management (e.g. accounting, business structures, strategic planning, succession planning), people management, communication and negotiation, in addition to skills in technically efficient sustainable farm management will be essential. Recent studies have highlighted the important role of financial management skills in underpinning successful dairy farm businesses, as people with these skills achieve a higher level of business growth in the long-term.

Resilient farm systems and Comparative Stocking Rate

In the last section we defined a resilient farm system as any system that efficiently utilises natural resources in an environmentally sustainable manner using appropriate dairy cattle genetics, thereby generating sufficient financial reward and free time to achieve lifestyle and wealth creation goals. This definition was predicated on continuous professional improvement and strong business acumen. In this section, we combine these parameters to produce a 'strawman' system as an example of what we believe a resilient farm system will look like.

A resilient system needs to account for land class and usability, supplement purchases, and the type of cow being used. These factors are encapsulated in the concept of Comparative Stocking Rate (CSR).

- When most people hear the term Stocking Rate, they automatically equate this with cows/ha. But this metric does not allow people to compare different land classes or regions capable of growing different amounts of pasture, differences in the size of cows (e.g. 2.5 Jersey cows require less feed than 2.5 Friesian cows), or differences in the amount of supplement purchased.
- The use of the metric live weight per/ha was an improvement over cows/ha, as it accounted for the different demands of different sized cows; however, it doesn't account for purchased supplements. Considering the contribution of purchased

supplement to variable expenses, failure to plan usage of supplements undermines the resilience of the system.

- Comparative Stocking Rate is an attempt to include all of these variables in the one metric, whereby the carrying capacity of the farm is defined by the live weight of the cows, the potential of the land to produce pasture, and the amount of supplement purchased: simply put, Comparative Stocking Rate is defined as the amount of live weight that can be fed per tonne of feed DM available (kg of live weight per tonne of feed DM available: kg Lwt/t DM).

What is the optimum stocking rate?

We already proposed that to limit exposure to international commodity prices, resilient farm systems should maximise the use of grazed pasture and limit planned supplement purchases to no more than 0.5 t DM/cow. We also established that a crossbred cow of high BW was the most efficient cow for a grazing system. In addition to BW and crossbreeding, however, we believe that cows should average no more than 500 kg live weight, with, arguably, no advantage to cows greater than 550 kg live weight in the herd. The relationship between cow live weight and DM intake in a grazing system is not linear. Intake increases with cow live weight up to about 500 kg, but the factors regulating grazing behaviour limit further increases in DM intake with increasing cow size in a largely pasture-based diet. Although bigger cows can eat more total DM intake and, therefore, may have some value in systems feeding higher amounts of supplement, justifying these cows in this way leads to the greater use of supplements, which, we believe, undermines the resilience of the system.

With these variables in mind, the results of extensive NZ farm systems research indicate that the optimum CSR for grazing systems is between 75 and 85 kg live weight/t DM. This is equivalent to offering a 400 kg cow between 5.0 and 5.5 t DM total feed DM/year or a 500 kg cow between 6.0 and 6.5 t. This means that the optimum stocking rate will be different for different farms and different farm systems. In Table 2, the optimum stocking rate for farms that produce different amounts of pasture and feed different amounts of supplement are defined. For example:

- a farm capable of growing 12 t DM pasture/ha while feeding 0.5 t supplement DM/cow to 500 cows, should be stocked at 2.2 cows/ha.
- a farm capable of growing 18 t DM pasture/ha while feeding 0.5 t supplement DM/cow to 400 kg cows should be stocked at 4.0 cows/ha.

If the actual stocking rate is less than optimum, the farm should be feeding less supplements/cow, while more supplements at the optimum stocking rate indicates that either pasture growth is over-estimated or that pasture grown is being wasted.

Although not foolproof, the concept of CSR allows farmers to set a stake in the ground regarding the optimum stocking rate for their farm. This does not suggest 500 kg DM supplement/cow should be a target in years where pasture growth exceeds the average used in strategic planning or where milk price drops and supplement price does not follow suit; nor does it preclude the use of more supplements in poor pasture growth years or for winter milk. Such decisions are tactical and must be made with all of the available immediate information. Nevertheless, it allows you to plan what the number of cows on the available land should be and makes mistakes around use of supplementary feed less likely.

Supplement fed/ha, t DM	400 kg Cow					500 kg cow				
	Pasture grown, t DM/ha					Pasture grown, t DM/ha				
	12	14	16	18	20	12	14	16	18	20
0.00	2.4	2.8	3.2	3.6	4.0	1.9	2.2	2.6	2.9	3.2
0.25	2.5	2.9	3.4	3.8	4.2	2.0	2.3	2.7	3.0	3.3
0.50	2.7	3.1	3.5	4.0	4.4	2.1	2.4	2.8	3.1	3.5
1.00	3.0	3.4	3.9	4.4	4.9	2.3	2.6	3.0	3.4	3.8
1.50	3.3	3.8	4.3	4.9	5.4	2.5	2.9	3.3	3.7	4.1
2.00	3.7	4.2	4.8	5.4	5.9	2.7	3.2	3.6	4.0	4.4

Table 2. Stocking rate* (in shaded boxes: cows/ha) that optimises profit on farms growing different amounts of pasture and feeding different amounts of supplement/cow. The proposed stocking rates for a resilient system are highlighted.

* All of these stocking rates equate to 80 kg live weight/t feed DM available.

Tactical management

Tactical management involves making short-term decisions to ensure the viability of the business (i.e., tactical management is about reacting to an immediate or upcoming situation). For example, during bad weather, the need for supplements will be greater because of poor pasture growth or an inability to utilise the pasture grown, whereas when pasture growth exceeds demands, supplement use should be less than budgeted and/or the amount of silage harvested greater.

The importance of tactical management cannot be overstated; this is where the farmer's ability and experience of their own farm come into play. "The difference between a good farmer and a bad farmer is a week". In other words, they will both do virtually the same thing; the big difference is the timing of action. The effect this has on farm profit, however, can be extraordinary.

Tactical management decisions must be made in conjunction with a cash flow budget. As an example, in years where the milk price is low and supplement price high, it would be unwise to feed all of the supplements budgeted for in the strategic plan; as a consequence, cows will be fed a little less and will produce less milk. But the overall viability of the business will be more secure, as the expense would not have returned value. This is not a recommendation to grossly underfeed cows; it is merely a recognition that the total response to the last 1-2 kg of supplements will not pay for the supplement. Nor will this undermine the cow's welfare, as she will reduce her milk production commensurate with the drop in energy intake and so negative energy balance is not greatly affected. A slight restriction will not impact reproduction. Management issues such as this cannot be planned for. However, the strategic plan facilitates a non-emotive more objective decision, ensuring business viability.

Conclusions

“Change before you have to” Jack Welch

The forecast for food production is bright, but there will be periods of heavy rain!

Demand for dairy products and, therefore, average milk prices will, we expect, be higher than historical values, but there will also be periods when commodity prices soften and milk price drops. Successful dairy farm businesses will need to be resilient. Resilience in any business requires a solid system foundation (a strategic plan) with the technical expertise to make appropriate tactical management decisions.

Resilient dairy farm systems must be designed with land production capacity, soil class and rainfall in mind, they must be based on elite high performance animals suited to the system, and they must be highly efficient per unit of land, labour and capital. Such business must provide a reasonable return on equity, be environmentally and animal welfare compliant, and provide an enjoyable and rewarding lifestyle for those working on the business. The key pillars of a resilient farm business are the efficient utilisation of natural resources, a ‘fit for purpose’ animal, a strong business acumen in management, and a policy of continuous improvement for staff at all levels of the business.