Progress and plans to develop a dairy sheep industry in New Zealand

PETER GATLEY
Maui Milk, 15 Rosebanks Drive, RD3, Hamilton

Background

The New Zealand dairy sheep industry consists of several small enterprises supplying a variety of products such as cheese, yoghurt, ice cream and fresh milk for the domestic market, and three businesses aiming to develop export markets on a larger scale. This paper considers the challenges faced by one of the exporters, and poses some potential solutions.

Maui Milk is a joint venture involving the Waituhi Kuratau Trust (WKT), farming west of Lake Taupo, and the Shanghai Maui Dairy Company. Milk is currently sourced from the WKT farm with 3000 milking ewes, but a second farm, Waikino Station, also in the western bays, is being converted from traditional sheep and beef, and will milk 4000 ewes in 2017. Additional supply is sought from third parties in a catchment extending from Taupo to Auckland.

Why milk sheep?

There is a high level of agreement throughout New Zealand agribusiness that this country would benefit from farming options that can deliver:

- Diversification
- Higher value per hectare
- Stability in farm gate returns
- Environmental sustainability

The Hamilton-based Dairy Goat Co-operative (DGC) has delivered these benefits on a modest scale, having grown its business to an annual turnover of about $180m with milk sourced from about 70 herds.

The dairy sheep industry differs from the goat industry in two key aspects:

- New Zealand has a wealth of experience in sheep farming
- New Zealand has a wealth of experience in the conversion of pasture into milk (albeit with dairy cattle) whereas goats are generally fed on a cut-and-carry basis

These factors underpin enormous potential for dairy sheep farm conversion subject to demonstration of a profitable farming system. This will be a function of farm gate payout and the level of productivity achieved.

Farm gate payout

The DGC has carefully managed the supply/demand equilibrium in order to support farm gate pricing, and there is a proven farm system delivering sufficient productivity. As a consequence, the organisation maintains a waiting list of potential suppliers.
The current DGC payout is about $18/kgMS (including lactose), or about $17 after accounting for the value of the farmer’s investment in shares. Maui Milk intends to deliver an equivalent payout, but because sheep milk contains a much higher level of solids, the price per litre is quite different.

<table>
<thead>
<tr>
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<th>Payout/kgMS</th>
<th>% MilkSolids</th>
<th>Payout/L</th>
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<tbody>
<tr>
<td>Goat</td>
<td>$17</td>
<td>11.3%</td>
<td>$1.92</td>
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<tr>
<td>Sheep</td>
<td>$17</td>
<td>19.0%</td>
<td>$3.23</td>
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For comparison, bovine milk at a payout of $6/kgMS (excluding lactose) will be valued at about 40 cents per litre.

Productivity

Whereas there are well established benchmarks for bovine milk production in New Zealand farm systems, guidelines for caprine operations are harder to come by, and for ovine, they are virtually non-existent.

Important determinants of dairy sheep farm profitability will include the following:

- Genetic merit
- Farm system
- Animal health
- Nutrition
- Lamb rearing
- Labour
- Capital cost

Genetic merit

Virtually all milking sheep in New Zealand are descended from a very small group of East Friesians imported in the early 1990s. This comprised only four rams and 11 ewes. The breed is best suited to a small flock environment in cool climates where they are housed most of the time. In their pure form they have been found wanting in extensive farming systems, suffering from climatic extremes (including exposure to our harsh sunlight), facial eczema and foot problems. For these reasons most of the ewes currently being milked are hybrids and in many cases the dairy breed genes are found to be in the minority.

In the following graph the range of genotypes in the WKT flock (represented by grey dots) shows some to be more closely related to Romney (blue) and various other breeds (black) than the East Friesians (purple). In addition, most of the predominantly East Friesian animals are rams rather than ewes. Few of the females exceed 50% East Friesian.
Figure 1. Graphic representation of the degree of relatedness of various sheep breeds based on DNA markers

The relationship between breed and daily production in late lactation is demonstrated in the graph below. The effect is compounded by the tendency of ewes with non-dairy genetic backgrounds to dry themselves off early and shorten lactation.

Figure 2. Correlation between daily milk production and % East Friesian genetics in a sample of NZ dairy sheep

Individual lactation yields in large, extensively farmed New Zealand flocks currently range from less than 100L to more than 200L, with the average closer to 100 than 200. This compares poorly with annual yields of more than 600L in intensive Dutch and German operations using East Friesian sheep, or even with seasonal systems in France where the Lacaune breed averages nearly 400L (after accounting for lamb rearing).

The relative performance of current dairy sheep compared to dairy goats is evident when production is considered relative to live weight. It is not uncommon for dairy goats in the Waikato to produce the equivalent of their body weight in MilkSolids. For sheep to achieve this they would have to produce more than 40L/lactation.

It is clear that genetic improvement has a huge role to play in the New Zealand industry, but this needs to be integrated with parallel development of farm systems.

In the short term, benefit is expected to come from breeding ewes with a higher proportion of East Friesian, while adapting the farm system to enable them to perform.
This is made possible by the acquisition of 1700 pure East Friesian embryos that had been stored in liquid nitrogen since the late 1990s by Dr Jock Allison, the original importer. These embryos were implanted in 2015 and resulting rams are in use during tupping 2016 to generate F1 hybrids out of Coopworth and other breeds.

The genetic programme is owned by Southern Cross Dairy Sheep Technology, an entity involving the Chinese partner in Maui Milk, along with Peter Gatley (General Manager) and Jake Chardon (Geneticist) who have worked together for 20 years and bring experience in breeding of dairy cattle (LIC and CRV), deer (Deer Improvement) and dairy goats (DGC).

Importation of new East Friesian germplasm is required to broaden the genetic base of the breed in New Zealand, and negotiations are underway between MPI and the EU veterinary authorities to facilitate this.

Apart from East Friesian, the only other recognised dairy breed already existing in this country is the Awassi, but most of these were imported for the ‘fat tail’ meat trade, and have not been available for use in dairy sheep programmes.

Maui Milk is particularly interested in accessing the Lacaune breed which delivers higher components and is possibly better suited to our environment, and which would provide opportunities for a crossbred with the added benefit of heterosis.

Genetic merit of course involves more than just milk yield. A useful economic index may well mimic the dairy cow BW (Breeding Worth) currently involving seven traits, all relevant to dairy sheep (milkfat, protein, volume, live weight, SCC, fertility, residual survival). The other traits important in breeding dairy cattle are also vital to the sheep industry. These include adaptability to milking, shed temperament, and various Traits Other than Production (TOP). For example, milking 900 ewes/hour would be a lot easier with consistent and well-formed udders with appropriate teat placement (albeit just two teats instead of four).

**Farm system**

All three of the large, export focussed operations (Blue River, Spring Sheep, and Maui Milk) currently use extensive farm systems where animals are not housed for any significant proportion of time.

Maui Milk intends to breed sheep dominated by dairy genetics and expects to have to provide a hybrid system to enable them to produce to their potential. The system will rely heavily on grazing, but judicious use of barns will enable ewes to escape the worst of the winter weather, the heat of summer, the peak of the facial eczema risk period, and lambing may occur under cover.

If ewes are to be predominantly East Friesian, then protection from the sun will be important. Their naturally pink ears, eyes and noses are often observed to be sun-damaged, and an overnight grazing/daytime barn feeding system will minimise this while preserving some of the benefits of the pastoral system and minimising the requirement for walking during the heat of the day.
Animal health

Dairy sheep are expected to be vulnerable to any animal health challenges faced on dry stock sheep farms, but in some instances the challenges will be more severe because resistance has not been developed in the dairy breeds.

Some issues such as facial eczema and feet problems can be mitigated by choice of farm location, and it is for these reasons (among others) that the pumice country around Taupo has appeal.

Withholding periods of various animal remedies limit their utility in milking flocks, and so other strategies need to be employed in dealing with mastitis and internal parasites.

It is expected that the veterinary profession will play a key role in the development of the industry.

Nutrition

A higher proportion of dairy genes in the milking flock will enable longer, stronger lactations, but only if nutrition is adequate.

This is an area in which the dairy (cattle) industry has much to contribute. The energy demands of a high-performance lactating ewe far exceed those of sheep breeds on a traditional dry stock farm.

Pre-lamb supplementary feeding, early lactation feeding to establish a peak, and late lactation feeding to sustain production when conventional pasture is severely lacking, are critical to success.

Improved ryegrass pastures are expected to provide early season growth, and crops such as plantain and lucerne have much to offer during the summer dry. They may also lessen the risk of facial eczema.

In-shed feeding confers several benefits, encouraging ewes to the shed, getting them onto the platform, relaxing them to facilitate milk let-down, and providing an energy boost.

Lamb rearing

In the south of France where the famous Roquefort cheese is made, seasonal production is compromised by the demands of the cheese manufacturer for milk supply in early winter. It is also compulsory to rear lambs on their mothers for a minimum of 30 days. Regardless of such challenges, the French system far outperforms our efforts to date.

Here we have the luxury of being able to lamb in tune with an optimised pastoral farm system, and also to put ewes directly onto the milking platform.

Experience at the WKT farm shows that artificial lamb rearing provides the opportunity to establish a high peak to set up a strong lactation. It also diminishes mastitis problems and the ewes are seen to settle more quickly into the milking routine.

It is sometimes quoted in the dairy cattle industry that another litre at peak translates into 200 litres over the lactation. If the same principle applies in dairy sheep, we expect
artificial lamb rearing to be the norm in this country. Consequently it is vital that we develop effective and efficient lamb rearing protocols.

In 2015, despite some trepidation, and having not previously reared more than a few dozen orphans, 2500 lambs were reared using a variety of systems, feed sources, and equipment.

All lambs were left with the ewe for 48 hours to ensure adequate colostrum intake.

One thousand and three hundred were reared on the farm, and a further 1200 were transported to the Waikato (a two hour drive) in a converted trailer where three different rearers shared the work load.

Each rearer employed a different system. Mothers’ milk was replaced with Anlamb, whey based powders and some frozen/thawed sheep milk. Meal involved several different formulations. Feeders included traditional ‘calfeteria’ type equipment as well as automatic ad-lib milk dispensers. Accommodation ranged from temporary used of covered yards, to conventional sheds, to tunnel houses.

The common denominator was a pleasing result with very low losses (~5%).

Encouraged by this experience we now plan to rear about 4500 lambs on farm using staggered lambing to manage the supply.

Disease risk mitigation will involve use of mobile shelters as in common use in calf rearing, particularly in the northern hemisphere. Another key benefit anticipated from this approach is a much lower capital requirement.

The cost of lamb rearing is expected to be of the order of $80/head (including feed and labour). As this exceeds the value of a weaned ram lamb, the decision to rear the males is a significant financial consideration. Maui Milk has decided to persist with the rearing of males as euthanasia of new-borns is not acceptable to the consumer.

Rearing on average 1.5 lambs per ewe milked requires that the benefits outweigh the cost of ~$120. Milk production in the first month, at $3/L, and one litre/day is not enough ($90). At 1.5L/day the balance is tipped ($135). At 2L/day the first 30 days milk is worth $180.

As lamb rearing techniques are refined it is hoped to reduce the cost/head but there is more upside in the benefits of improved milk production, not just in the first 30 days, but throughout the lactation. Add to that the benefits of more settled sheep in the milking shed, and fewer mastitis cases, and artificial rearing is expected to become the norm on large scale dairy sheep farms in New Zealand.

Labour

The main financial impact of labour in sheep milking involves the actual milking process, however the implications of labour efficiency extend well beyond the cost factor alone. In some locations, reliable seasonal labour is scarce. Even if it is available, the management requirement is not appealing to many potential conversions which involve family farms.

Current large scale installations in New Zealand (milking thousands of ewes) involve
herringbone ‘rapid exit’ systems, or in the case of WKT, an 80-bale double entry/exit external rotary. All have achieved satisfactory throughput in sheep/hour (800–1000).

In the absence of automated cup removers (ACR), the labour requirement at WKT is for eight staff at each milking. On each side of the rotary someone is responsible for cups-on, another for cups-off, and there is a ‘floater’ to deal with cup slip or unruly ewes. A ‘yardie’ at each entry point is required to maintain a steady flow of animals onto the platform. Even if the sheep can be trained, with the use of backing gates, to flow consistently, so that the yardies are no longer required, there are six staff in the shed.

This system can be compared with the typical internal rotary used in France. These are not cow rotaries made for ‘small cows’, but are designed for sheep. As such they are lighter weight in construction, cheaper, and quieter. The sheep generally step freely onto the platform, albeit having been bred for the purpose, trained, and encouraged to do so in smaller mobs that we expect to run in New Zealand. Regardless of the use, or non-use, of yardies, these installations are seen to handle about 900/hour with a single person at cups-on, and one floater. ARC run on a timed mechanism rather than milk flow which has proved problematic in sheep due to the fast let-down and sometimes intermittent flow.

For the reasons outlined above, the conversion plan for Waikino Station involves the use of French internal rotaries (two of them to milk 2000 sheep each).

Capital cost

The capital cost of a sheep milking enterprise could vary enormously with scale, equipment choices, degree of intensification, and application of technology, however the bulk of the capital tied up in the operation will undoubtedly involve the land itself.

It is important to note that traditional sheep country is not dairy sheep country. Even in an enterprise based primarily on grazing, it is important that most of the milking platform be tractor country. The land needs to be fertile in order to grow the amount of feed needed within walking distance of the milking shed. Mechanical topping is important to enable pasture quality to be maintained, and feed to be conserved when it is prudent to do so.

There are parts of some traditional dry stock farms that lend themselves to dairy sheep potential, and there are established dairy (cattle) farms that could easily be converted, however land of that nature is expensive. Relatively good value for money can sometimes be found where land that would otherwise have been converted to dairy cattle, has been prevented from doing so by environmental regulations.

Environmental impact

Interest in dairy sheep farming is growing as new operations are established, developed and expanded, but also as other livestock farming options come under financial or regulatory pressure.

The potential for sheep milking to offer new opportunity in environmentally sensitive areas is demonstrated by Waikino Station, a traditional sheep and beef farm situated
on the western shores of Lake Taupo. This farm presents particular challenges because
the previous owner sold a substantial proportion of the Nitrogen Discharge Allowance
(NDA), leaving the property with less than 11kgN/ha compared to typical dry stock
operations at 14–17kgN/ha.

Modelling on Overseer indicates the potential to milk 4000 ewes on the property, with
pasture quality being maintained by mechanical means, or by a mob of crossbred
hoggets in areas out of bounds to the tractor. This enables the avoidance of cattle which
would result in higher level of N leaching.

Financials

Four thousand ewes averaging 200L/lactation each, at $3/L, would generate $2.4 million
in milk income. At 300L the milk income would be $3.6 million. With additional income
from meat and wool, the farm could conceivably turn over more than $4 million. This is
about five times the revenue level under the traditional dry stock farming model.

Financial performance will be very sensitive to production/ewe as many of the other
costs are largely fixed.

The current New Zealand average level of production/ewe/lactation is well below 200L
on the existing farms that are running large numbers, but a proportion of animals are
already demonstrating the potential in a sub-optimal environment.

Farm Working Expenses in the proposed system are also hypothetical until the
functioning unit is created, but enough experience has been gained on the WKT farm to
enable some informed estimates. Provided the milk price is maintained, we fully expect
to be able to demonstrate a profitable working model.

Supply and demand

Maintenance of milk pricing at the farm gate will involve careful management of supply
and demand. This strategy has underpinned success for the DGC, and also Tatua, a
small co-operative in the bovine dairy market.

Before oversupply becomes an issue, however, we need critical mass to at least provide
some essential scale efficiencies. All product is currently being processed into Whole
Milk Powder in order to stabilise the output of a six month lactation for twelve month’s
supply. The batch sizes are small and the cost per tonne very high. Not only do we need
multiple farm supply to provide commercial processing quantities, we plan to expand the
range to include other products such as infant formula, liquid milk, cheese, ice cream,
and yoghurt.

Additional supply from new conversions is sought in a catchment area between Taupo
and Auckland, including Rotorua and the Bay of Plenty.