Effective design of a cattle shelter and loafing

Farm systems transition case study

Farm location

Andrew and Robyn Tyler own a 740ha property located in Tongala, North-central Victoria.

Farm history

Andrew and his wife Robyn Tyler embarked on their farm ownership journey in 1989, when they purchased a rundown property with minimal infrastructure. Initially milking 180 cows, the Tylers gradually expanded their herd by acquiring neighboring properties following the millennium drought.

Currently, they manage a sizable herd of up to 1,100 large-framed Holstein cows. The farm encompasses a total area of 740ha, with 340ha allocated for grazing and 400ha dedicated to cropping. Assisting Andrew in operating the farm are his two sons, James and Sam.

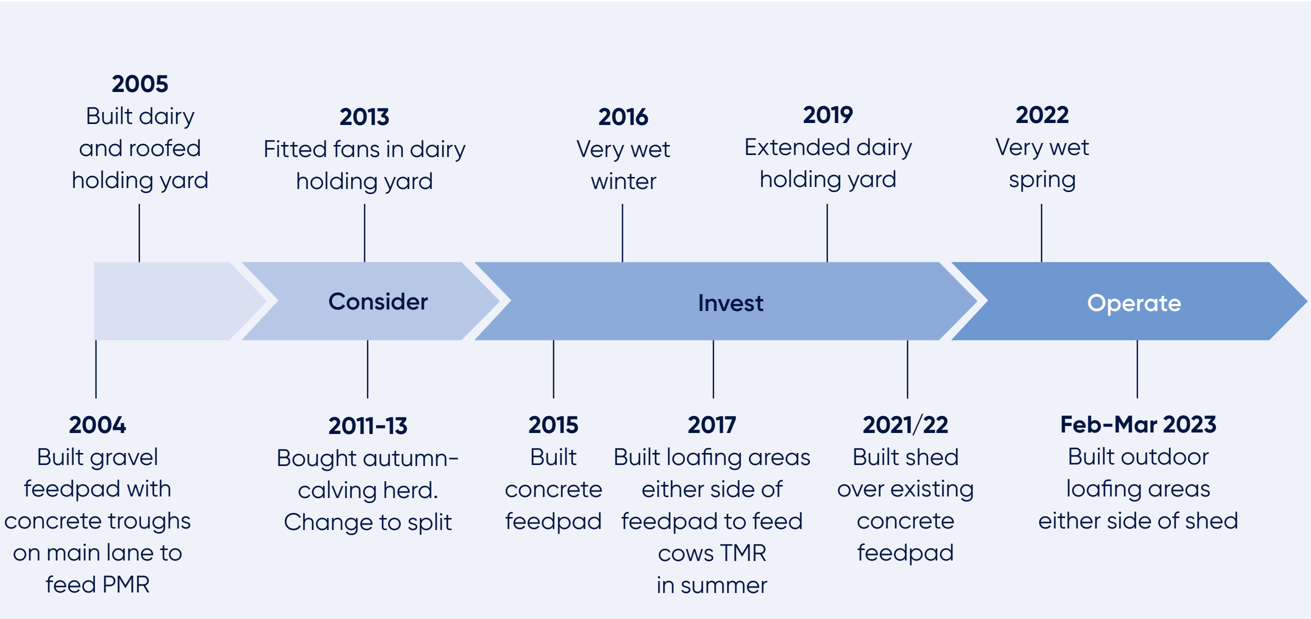
As the Tylers progressively increased their herd size, they encountered challenges in efficiently feeding the cows using a bail feeding system in the dairy parlour, combined with grazed pasture and conserved forages fed out in the paddock. They observed a decline in grazing efficiency and a significant wastage of silage and hay.

To address this issue, in 2004 they decided to install a basic feedpad. This feedpad featured a compacted gravel surface and a single modular concrete trough spanning approximately 300 meters along the main lane adjacent to the dairy parlour.

In 2005, they further upgraded their facilities by replacing the farm's herringbone dairy parlour (32 swing-over) with a modern 56-stand rotary dairy parlour. The new dairy parlour not only reduced milking time significantly but also facilitated the differential feeding of cows. This allowed for the provision of crushed wheat and canola meal at varying levels based on each cow's daily milk yield.

Although the feedpad proved effective in reducing feed wastage, the Tylers realised it was not optimal for maintaining cow health. They found themselves incurring annual expenses ranging from A$20,000 to A$30,000 to maintain the gravel surface. Andrew concluded that investing this money in a new concrete feedpad would be more prudent, with the maintenance costs being redirected to interest payments. Consequently, in 2015 they made the decision to construct a concrete feedpad equipped with a flood wash system. This upgrade aimed to enhance cow health and overall farm efficiency.

Timeline



Consider phase

The Tylers' decision to invest in a concrete feedpad was driven by several key motivations. Firstly, they aimed to further reduce the wastage of the Partial Mixed Ration (PMR) to less than 5 per cent. Additionally, they recognised the importance of cooling cows to enhance their comfort, maintain feed intakes, and sustain milk production during hot weather and extreme climate events such as heat waves and wet weather. Furthermore, they sought to optimise the utilisation of irrigation water on the farm's milking area by growing high-yielding, nutritionally rich fodder and cereal crops instead of relying solely on pasture for grazing.

For many years the Tylers had been aware of the impacts of heat stress on their cows and the merits of providing shade as well as evaporative cooling. “Before we built the feedpad we always envisaged that we would build a shed over it. It was just a matter of when we could afford it,” said Andrew.

In the meantime, their dairy holding yard would continue to serve as a very effective cow cooling centre, as it had been fitted with a solid roof and sprinklers when the new dairy parlour was built in 2005, and in 2013 had fans added.

Andrew extensively researched feedpads in the region and based his design on one that he found to be highly effective. He enlisted the expertise of an experienced consultant to design the feedpad and faced no challenges in securing financing from the bank. The local shire council informed Andrew however that a 1950s flood overlay covered part of the site, necessitating the elevation of the feedpad by 0.5m. Despite the additional cost, Andrew considered it a worthwhile investment.

Construction of the feedpad commenced in December 2014 and was completed in April 2015. The following year, the farm experienced exceptionally wet conditions during winter and spring which posed challenges for the cows and the farm team. Even with the capacity to feed PMRs on the new feedpad, the conditions were difficult.

> “We are never going through that again," Andrew's son James exclaimed once the farm finally dried out."

In 2017, the Tylers established loafing areas on each side of the feedpad and fed the cows a Total Mixed Ration (TMR) during the summer months. This approach worked well until the autumn rains arrived, causing the loafing areas to become excessively wet and requiring them to be fenced off.

Between 2017 and 2020, the Tylers faced challenging operating conditions, preventing them from progressing with the construction of a roofed structure over the feedpad. With improved climatic conditions and favorable milk prices in early 2021 however they were finally ready to proceed with Phase Two of the project.

Since experiencing the 'big wet' of 2016, the Tylers had been contemplating the potential use of the facility not only for feeding cows but also for housing them during wet weather to protect the pastures and laneways. Ample space on either side of the feedpad was available for this purpose. Andrew and his sons carefully considered the advantages and limitations of different housing options, including loose housing with a compost bedded pack or deep litter pack, as well as a freestall system. While a freestall facility with sand bedding was a proven system, the Tylers ultimately opted for a loose housing facility with compost bedded pack. They believed this approach would be more cost-effective and allow the cows to exhibit their natural behaviors. They acknowledged however the higher risk of mismanagement associated with a compost bedded pack compared to a freestall system.

Invest phase

The earthworks and construction of the feedpad in 2015 amounted to A$740,000. Presently, the cost of building the feedpad has increased to A$1 million. The construction of the shed over the feedpad commenced in July 2021 and concluded in February 2022, incurring an additional expense of A$1 million. Due to recent surges in material costs, the current estimated cost of constructing the shed has risen to A$1.7 million.

The facility measures 254m in length and 50m in width, including a 2m eave on each side. Its orientation is east-west to optimise shade during the summer. The feedpad consists of a 6m wide central drive alley, with 6.5m wide cow feeding alleys on each side. The wider feeding alleys allow cows to move more freely past other animals that are eating and transition to a paddock. The feedpad features a flood wash system and has a slope of 0.75 per cent. The cow/feed barrier is made of post and rail, with automated sprays installed to cool cows while they eat in hot weather.

The shed structure is widespan, with an open-web truss and portal frame, topped by a corrugated iron roof with a 21° pitch. The posts at the eaves are 5m high, while the apex of the shed reaches 12m. Additionally, a center ridge vent cover is included to prevent excessive sunlight exposure in the shed during hot afternoons. Tipping troughs have aprons around them to prevent water from splashing onto the compost bedded pack in the loafing areas. Temporary tapes can be used to enclose cows within the feedpad when it is being used to feed PMRs with grazing. However, when cows are housed in the facility, the tapes are removed, granting cows open access to the loafing areas from the cow feed alley located between the water troughs.

The shed's design and supply company took charge of preparing the planning permit and submitting it to the shire council. During the concreting of the steel posts, the shire inspector halted the work temporarily due to a complaint received. After conducting an inspection and confirming that construction was proceeding in accordance with the planning permit, work was allowed to resume. Andrew's bank was willing to finance the construction of the feedpad but expressed hesitation in financing 50 per cent of the A$1 million shed. Andrew noted that banks nowadays possess greater knowledge about dairy feeding/housing facilities.

The process of erecting the shed offered an intriguing opportunity to study cow behavior. The contractor first erected the entire shed frame and subsequently installed the roof iron starting from the east end and progressing towards the west end in February 2022. Throughout this process, the feedpad remained in use on a daily basis for feeding cows a PMR. Andrew observed that nearly all the cows would consume the PMR from the shaded section of the feed bunk first, with fewer than 2 per cent of cows venturing into the sunny section, even when the daily maximum temperature reached only 21°C.

"You don't realise how much cows love shade until you put up a shed," remarked Andrew.

Operate phase

When the concrete feedpad was first commissioned in 2015, the outside of each cow alley was fenced, and cows moved to pasture after PMR feeding following every milking. Much of the farm's milking area was taken out of the grazing rotation and used in a corn-vetch double-cropping program producing about 30t DM/ha of good quality feed with higher water use efficiency. This change in the farm's feedbase was essential to support the PMR feeding system and provide the Tylers with a higher return on the capital tied up in their land.

"The number one thing that farmers need to get right first is to have the capacity to grow as much feed as they can themselves, and be comfortable with that system," said Andrew.

Andrew considers that the concrete feedpad was a great investment on its own, and that its capital cost of A$740,000 was paid back before the shed was added.

"Every farmer should have a concrete feedpad, from a feed wastage and cow cooling perspective," he said.

Andrew explained that on the concrete feedpad, feed wastage was reduced to just 2-3 per cent, and the sprays along the neck rail provided sufficient cooling to enable cows to maintain their feed intakes fairly well in periods of very hot weather.

"They stopped looking to go to the roofed dairy holding yard," said Andrew.

He observed however that on the cooler day immediately after the hot spell, cows' feed intakes would drop substantially. He attributed this to cows being fatigued after standing on the concrete for up to 18 hours per day.

When the shed was completed in February 2022 with compost bedded pack loafing areas established either side of the feedpad, the Tylers divided the herd (now comprising 900 cows) into two groups which loafed either side of the feedpad. They chose to assign each cow to the groups arbitrarily and continue to prepare and feed one mixed ration and milk two times per day.

"We keep things fairly simple. We're not running a high lactation herd and a low lactation herd and having different diets. Every (milker) mix is the same," said Andrew.

The compost bedded pack loafing areas in the shed are not large enough for 900 cows, equating to a stocking density of 8m^2/cow, versus the recommended 13-15m^2/cow. In 2022, the Tylers experienced problems with wet compost bedding, requiring careful management with more equipment and more staff hours to maintain a dry surface for cows. The bedding at the end of the shed nearest the dairy tends to get damper as cows congregate there before milking. Initially, dried manure was used as bedding. Straw was then added. However, only long straw was available, which made tilling difficult, so a thin layer was used just to provide a dry surface for cows. In the very wet spring of 2022, the Tylers chose to keep cows in the facility 24/7 rather than walk them through mud to wet pastures. This put additional pressure on the shed's bedding and it became wet, leading to increased mastitis. Fortunately, hoof problems were minimal through the wet spring. In November 2022, the compost bedded pack was removed and replaced with a 300mm layer of woodchips and some straw. This is tilled twice per day to a depth of 150mm as done previously. This bedding material is performing better despite the added cost of woodchips.

To alleviate pressure on the compost bedded pack, Andrew took action in March 2023 by building up and compacting the open areas on either side of the shed, expanding them to a width of 20m. This created spacious outside fenced loafing areas where cows now have access overnight. In March 2023, following the expansion of the dairy holding yard in 2019 to accommodate 850 cows, the cow transfer lane was duplicated, resulting in dual lanes that facilitate the movement of each cow group between the dairy and the shed. Cows wait for up to 90 minutes in the holding yard before milking.

During summer, the sprays on the neck rail of the feedpad's cow/feed barrier are set to operate on an automated on/off cycle, maintaining a temperature of 18°C overnight to help reduce the cows' core body temperature.

"Sprays are crucial," emphasised Andrew,however fans have not been installed in the facility yet. Andrew stated, "Fans would be beneficial, but I am finding it hard to justify their installation based on what I have seen so far."

If he decides to install them in the future, it would be to aid in drying the bedding and provide additional cooling.

Andrew mentioned that it takes only 10 minutes to bring the cows from the shed to the dairy.

“That’s a time-saving, but on the flip side, someone needs to handle feed mixing, flood washing, and cultivating while the cows are being milked. So, organisation is key,” he explained.

The dairy parlour is equipped with milk meters, and cows are fed according to their current milk yield in the bail, receiving varying quantities of crushed wheat and canola meal along with a mineral mix. Each cow's daily canola meal allocation is divided between the mixed ration and the bail. The cows no longer have to endure the discomfort and stress associated with grazing in wet winter conditions and hot summer conditions.

Andrew likened it to living on a cruise ship, stating, "they eat when they want to and eagerly await the next meal."

Since the shed was built over the feedpad, the Tylers are pleased with the farm's performance and anticipate that, at current milk prices, it will pay for itself within four years. Despite many large grazing herds in the region experiencing a production drop of 20-30 per cent due to the extremely wet spring, the Tylers have remained on track, with their milk solids production currently 16 per cent higher than at the same time last year when the cows were grazing.

They have achieved a 4.6 per cent fat test and a 3.4 per cent protein test. Andrew mentioned that, in addition to being more productive, the cows are also healthier in terms of mastitis and lameness, boasting a half a body condition score increase. They are cleaner, making them easier to milk, and they are worth more as choppers. The cows are treated every four to six weeks with fly repellent during the warmer months. The farm's labor efficiency has remained consistent, and there has been minimal staff turnover.

What would you do differently?

Overall, Andrew is pleased that the facility is functioning well and that nothing needs to be altered.

“I hate spending money twice,” he said.

If Andrew had his time again, he would have spent more on earthworks initially to set up the outside loafing areas. While a 1.5 per cent slope would have been ideal, this would have elevated the east end of the facility an additional 1.5m. Andrew was concerned that steeper cow transfer lanes between the facility and the dairy would have been problematic.

In hindsight, Andrew would have limited the number of cows using the facility through the winter to 600 to help manage the risk of wet bedding. This could be achieved by adjusting the proportion of cows calving in autumn and spring to 25-75.

Where to from here?

As Andrew has been operating the facility, he has identified three alternative future strategies for a 1,200 cow herd:

1. Remove late lactation cows from the facility and run them as a separate herd across the milking area on a grazing rotation, thereby reducing the stocking density in the facility so that each cow has 12-14m^2 of bedding.
2. Build a second shed of similar dimensions and design adjacent to the existing one and operate it as a loose housing facility with a compost bedded pack to reduce the stocking density in the current facility. Use sections of the second shed to better care for groups of dry cows and close-up heifers during the warmer months.
3. Build a second shed adjacent to the existing one and operate it as a freestall with sand bedding for early and mid-lactation cows, and use the existing loose housing facility for late-lactation cows and groups of dry cows and close-up heifers during the warmer months.

At this stage, Andrew is leaning towards the second strategy but will consider freestalls further before committing to it. In the meantime, he is progressively developing the farm's feed storage infrastructure to better handle the larger quantities of feed being stored and fed out each day.

For further information

Visit **dairyaustralia.com.au** and search 'National Feedpad and Contained Housing Guidelines'

Visit **dairyaustralia.com.au** and search 'Farm Systems'

Visit **dairyaustralia.com.au/farmsystemevaluator**

Acknowledgement

Thank you to Andrew and Sarah Tyler for agreeing to share their knowledge and experience.

Overview

Farm			
Farm size (ha)	740 (including 200ha leased)		
Grazing area (ha)	340		
Cropping area (ha)	400		
Production system	Grazing based, with roofed concrete feedpad		
Dairy type	56-stand rotary dairy		
Climate (BoM historical data for farm locality)			
Mean annual rainfall (mm)	449		
Mean no. rain days/year	110		
Mean no. days/year ≥ 35°C	17		
Mean no. days/year ≥ 40°C	2.6		
Mean annual daily solar exposure (MJ/m^2)	18.2		
Conditions over summer	**Dec**	**Jan**	**Feb**
Mean temperature (°C) at 3:00pm	26.3	28.3	28.4
Mean Relative humidity (%) at 3:00pm	35	34	36
Mean Temp. Humidity Index at 3:00pm	72	74	74
Mean wind speed (km/h) at 3:00pm	17.1	16.3	14.7
Mean daily solar radiation (MJ/m^2)	27.6	27.5	24.2
Herd			
Milking cow numbers	1,100		
Breed	Holstein-Friesian		
Calving pattern	Split (40:60 autumn:spring)		
Production per cow per year (L)	8,500–9,000 L		
Infrastructure and equipment			
Infrastructure	• Concrete feedpad with flood washed cow alleys and solid, pitched roof • Loafing areas either side of feedpad under shed's roofline with a compost-bedded pack • Additional uncovered loafing areas either side of shed		
Equipment	Mixer wagon and tractor		
People			
Full time equivalents (FTEs)	10		
Cows per FTE	110		

Funded by the Australian and NSW government's Storm and Flood Industry Recovery Program in association with Dairy Australia and Agriculture Victoria.

Acknowledgement
Dairy Australia acknowledges the funding contribution of the Commonwealth Government for eligible research and development activities.

Dairy Australia Limited ABN 60 105 227 987
E enquiries@dairyaustralia.com.au
T +61 3 9694 3777
F +61 3 9694 3701
dairyaustralia.com.au

5304.4 | Feb 2024