Loose housing – with compost bedded pack

Peter Mulcahy and family – Kyvalley, North-central Victoria

Farm location

Farm history

The Mulcahy family has been dairy farming in North Central Victoria since 1879. Peter Mulcahy, with his brothers David and Wayne are the fifth generation, and now own and operate Kyvalley Dairy Group, one of Australia's largest family-owned dairy operations.

Together with co-operative family farms in the area, the Mulcahys now manage over 7,500 dairy cows, process over 75 million litres per year in their processing facilities at Kyabram, and market a range of high value dairy products throughout Australia and Asia.

When Peter and David formed Mulcahy Brothers in 1987, they purchased the family farm at Kyvalley from their parents. Over the next 12 years the Kyvalley farm herd was expanded from 280 cows to 600 cows, and neighbouring farms purchased to increase the cropping area.

In 1998, Peter built a facility with a roofed concrete feedpad with a central drive alley and a flush system, and adjacent resting areas for their moderate-large-framed Holstein herd. This facility was used to feed a partial mixed ration with grazed pasture. Then, in the very wet year of 2016, Peter ceased grazing and used the facility as a contained housing system supported by total mixed ration feeding.

"While the facility certainly gave us more control over the herd's nutrition, and reduced heat stress, we found it difficult to rest cows properly, particularly after Winter rain events and Summer storms, when it would get very muddy," said Peter. "So we decided to invest in a new contained housing facility."

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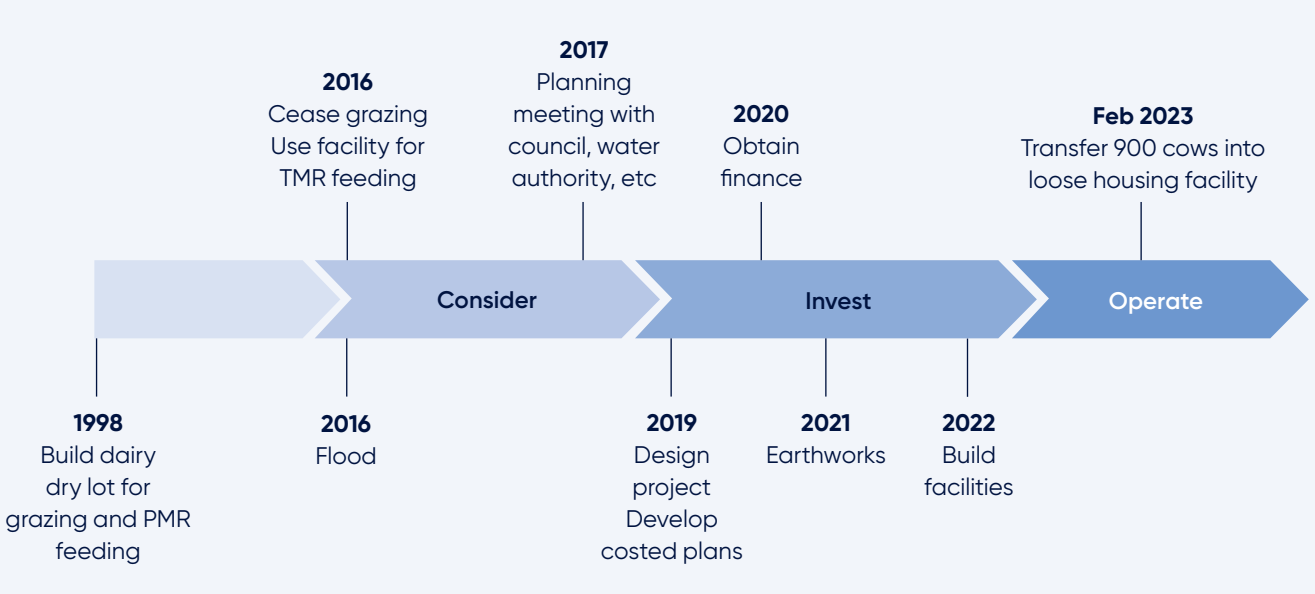
Timeline



Consider phase

Peter's motivation for investing in the new facility was a desire to:

- Keep cows comfortable, happy and clean, with plenty of feed, water and places to lay down.
- Continue to improve our herd's production, health and fertility.
- Reduce labour and provide a better working environment for us and our farm team.

"We looked at many contained housing facilities in the US," said Peter. "All except one were freestalls. However, we opted for a loose housing facility with a compost bedded pack, because we thought it would be easier on the cows and probably less work than a freestall."

An experienced consultant was engaged to design the loose housing facility to accommodate 900 cows. Prior to building the shed, the Mulcahys accumulated 18 months usage of home-grown fodder in storage, to help make their operation more drought resistant.

Invest phase

Construction of the loose housing facility began in January/February 2022 and it was commissioned in July 2022. To ensure that construction was not delayed by rain, the steel frame, roofing and gutters were installed first, and then the internal fittings of the facility were constructed.

The facility, which is 300m long and 55m wide (including a 2.5m eave on each side) is on a 1 per cent slope and unlike most loose housing facilities it is oriented north south. The structure has an open-web truss, portal frame and a corrugated iron roof with an 18° pitch. It has a 6m wide, concrete central drive alley, either side of which is a 4.75m wide, concrete cow feeding alley and a resting area providing 450 cows with 13m^2 space per cow. The facility's total capacity is therefore 900 cows.

The facility has several interesting design features. Roof support poles which run down each side of the drive alley (rather than poles at the back of the cow alley, or a wide span design with no internal support poles at all). This saved A$150,000 saving (12 per cent of total cost of shed). It also increased the strength of the feed rail and enabled a one metre truss to be used instead of a 2m truss, thereby increasing headroom above the pack near the eaves for safe movement of machinery. Having poles down each side of the drive alley rather than at the back of the cow alley avoided any problems from cows or machinery running into them.

The 2.5m eaves are designed to stop 85 per cent of rain coming in. The large box gutter (300mm x 300mm) running along each side of the shed with only one down pipe at the end. The box gutter is designed to cope with rainfall rate up to 100mm/hr, well above the maximum rate expected for this region.

The facility is oriented north-south to support the overall site layout. In the near future multiple loose housing facilities are planed all requiring access to the existing dairy parlour. Contingency plans have been put in place to mitigate weather, given the north south orientation. While the facility has been designed to have a ridge vent fitted, the Mulcahys are yet to convince themselves that it is a necessary expense (A$60,000).

The Mulcahys were concerned that having some form of barrier along the back of each cow alley and the bedded pack, with passageways every 20m or so to enable cows to move back and forward between the cow alley and the bedded pack, would result in high traffic areas on the pack which would get very wet and contaminated. So they opted to have no barriers at all. Concrete cow alleys are grooved to minimise slipping.

Each tipping metal water trough is surrounded on three sides with a 1.6m high solid metal shield, so that it is only accessible from the cow alley and cows cannot splash water onto the bedding pack. The source used to supply stock water is untreated irrigation channel water. All water troughs are tipped every day to ensure water is fresh and they are cleaned once per week.

Sprinklers along the top rail over the feed bunk wet cows along their backs without getting udders wet. They operate at greater than 22°C, running on a one minute on / five minutes off cycle. Peter considers fans as an integral part of the system for maintaining airflow over the bedded pack and keeping cows comfortable in warm-hot weather. The fans used are 40 per cent more energy efficient than conventional fans. They run constantly except when the wind speed is above 16km/hr. As the ambient temperature in the shed rises above 26°C, the speed of the fans increases gradually from 55 per cent of maximum speed to maximum speed at 32°C and above. In Winter, if the ambient temperature in the shed falls below 4°C or humidity is too high, the fans switch off. The fans are a little noisy. Peter says that when they build the next sheds, they will fit them with quieter, magnetic driven fans.

Lights are fitted down the centre of the shed. They turn on at 2:30am to wake up the three-times group of cows prior to milking at 3:15am and switch off again at sunrise when the light intensity in the shed rises above 50 lux. If the light intensity in the shed falls below 250 lux at any time during the day, the lights will turn on. In the evening the lights turn on at about 6:30pm and stay on until 10:00pm.

The shed's cow alleys are flushed using a 10-inch pump, rather than by gravity using large holding tanks at the top of each cow alley. This has two advantages. First, with the pump, water flow down each alley is constant (rather than an initial surge and then a gradually decreasing flow) and if alleys require a little more flushing to perfectly clean them, the pump can simply be run for an extra minute. Second, the pipe from the pump to the top end of the shed can readily be extended and used to flush additional sheds built nearby, which is much cheaper than building a gravity flush system with holding tanks for each shed.

To save time, dual lanes between the shed and the dairy enable cows from one side of the shed to be moved to the holding yard while cows from the other side are returning from the dairy parlour after milking. Each group of cows only spends about 60 minutes out of the loose housing facility each milking.

The large reception pit (can hold 1 1/2 flushes of the entire housed facility) is equipped with dual pumps – one operates while the other is kept in reserve in case the other pump fails. Slurry is pumped to the manure solid/liquid separator located near the shed and discharged at the top of the screen. As the slurry runs down the screen, water and fines run through it. This liquid stream is then collected and pumped into the holding pond, from where it is used to flood irrigate paddocks.

The manure fibre portion of the slurry runs down the screen to the bottom and is passed through a screw press containing a rotating screw shaft within a screen which reduces the manure fibre's moisture content to about 70 per cent. The solid stream of separated manure fibre is then carried up a conveyor belt and dropped on top of a pile. Over a few days the manure fibre heats up, killing the bacteria. The pile is left to build up over a few weeks and is then spread on paddocks as fertiliser. (While Peter has the option of also using the dried manure fibre to top up the cows' bedding, he prefers to use woodchips). The manure solid/liquid separator the Mulcahys are using is adequate for up to 4,000 cows in their system, compared to about 2,000 cows in a freestall, as only about half as much manure needs to be processed.

Operate phase

The facility has been operating for nearly a year now and it's working well. Cows had no difficulty adapting to it.

"One of the benefits of this style of shed over a freestall is that you don't have to train cows. You just let them in," said Peter. The only teething problem when the shed was commissioned was getting the fans and the lights working effectively.

On the east side of the facility is the high production group of 450 cows, currently averaging nearly 44 litres/cow/day, which are milked three times per day in the 100 stand rotary dairy. On the west side of the facility is the lower production group of 450 cows, currently averaging 34 litres/cow/day, which are milked two times per day. The herd's milk components are currently 4.4 per cent fat and 3.5 per cent protein. "Because the cows feeding is consistent and their environment is more consistent, their milk is more consistent from day to day," said Peter.

The new facility and the old facility, which still accommodates 500 lower production cows, are operated by nine staff members plus six milking crew. With 12 FTEs for 1,400 cows, labour efficiency is high at 116 cows per FTE. Milking times for the two groups in the new facility are:

- Three-times: 3:15am, 12:00pm, 6:00pm
- Two-times: 5:00am and 5:00pm.

While each group of cows is out of the shed being milked their cow alley is flushed and bedding ploughed. Each flush takes 45-47,000 litres of recycled green water and takes six minutes to wash each cow lane. The bedding, which is 500 mm deep, is also ploughed to a depth of 300 mm each time a group of cows is milked. The tractor makes 3 passes up and down the shed in ten minutes, while the cow alley is being flushed.

Three TMR batches are prepared in a 32 cubic metre twin rotor vertical mixer and delivered along the feed bunks once per day, from 7:00am, after residual feed made the previous day (usually two loader buckets) is swept out. (This feed is not wasted – it is fed to dry cows).

Day and night, every second hour, a Lely robot feed pusher runs down one side of the drive alley and back up the other side (taking an hour to park and re-charge between each run).

"The staff get a lot of satisfaction out of coming into the shed and walking the cows to the dairy, all nice and clean and full of milk, in just ten minutes. Within an hour, the cows have returned to the shed and are eating and resting again," said Peter.

Cow management tasks are not performed in the shed at all; an automatic drafting system is used in the dairy. However, should they decide to do so in future, the shed is designed for ready installation of head stalls. (Top rails are easily adjusted to suit cow size or removed).

With the shade provided by the roof, the fans and the sprinklers over the feed bunk, Peter is able to keep cows comfortable, happy and clean, with plenty of feed, water and places to lay down, in all weather conditions.

"This system really takes the weather out of things. On hot days the sprinklers and fans cool the cows, and it has been really nice to see is that the cows' behaviour on a 40°C day no different to what it is normally," said Peter. "In the old shed, the Spring calvers tended to drop off quite quickly at the end of January, whereas in the new shed, they were still doing 40.5 litres, having peaked at 44 litres."

Over their first full lactation in the new shed, Peter expects that the Spring calvers will produce 15 per cent more milk than in their previous lactation, given that they are in a more comfortable environment, healthier, and continuing to be fed a high quality TMR and kept in good body condition. Since moving from the old shed to the new shed, Peter has also been very happy with the cows' health, with the levels of lameness, mastitis and the somatic cell count all falling. Herd reproductive performance have also improved and there are time savings. It is possible that cow longevity may also increase with the new system as the cows are healthier and less stressed.

"This facility is easier to manage than grazing, because grazing changes all the time. With grazing, the weather is changing all the time and the paddocks are changing all the time," said Peter. He says it is also better from an Occuptional Health and Safety point of view.

Maintaining a dry compost bedded pack is critical to the success of the facility. This is achieved by:

- Tilling the pack every time cows leave the shed to be milked.
- Tilling to a depth of 500 mm of bedding, which means it doesn't get as damp as easily.
- Troughs that are designed to prevent water from spraying or leaking onto the bedding.
- Constant air movement over the bedding by fans.
- Providing space of 13m^2 per cow on bedding.

The compost bedded pack was initially set up using wood chips and then fibre taken off the manure screen was added. If/when necessary, the pack will be topped up with woodchips in preference to the manure fibre. Peter says that in Winter the pack is slightly damper but still fluffs up well when tilled. While it is not possible to plough the pack right up to the front of the pack and the perimeter fence, this is fine because the cows use these strips to walk on.

What would you do differently?

Peter is very happy with the new facility. The only change he would make if he had his time again would be to use quieter fans.

Where to from here?

Peter acknowledges that the new facility was a significant capital investment but he expects that he will recoup it within five years. Over the next five years, the Mulcahys intend to build three additional sheds of a very similar size and design to the first one, fitted with quieter, magnetic driven fans. The sheds will be positioned at least 60m apart to maintain good air flow. "They will be cheaper to build than this first one because we have already run power and water to the site and set up our effluent system. We will just have to put the dirt and the sheds there and connect all the utilities up to them."

Within the next 12 months, the Mulcahys plan to install a rooftop solar system on the facility to help reduce its operating costs. They also plan to install a solid roofed structure over the holding yard fitted with fans to enhance evaporative cooling provided by the sprinklers. They will also install fans in the dairy. "The cows are only brought out of the loose housing facility for less than an hour each milking, but it is long enough for them to heat up on a hot day. It then takes them hours to cool down again."

Peter has three suggestions for farmers interested in changing to a contained housing system:

- Have a good look around at different facilities and find out what will work best for you.
- Find out from your local planning authorities whether there is any legitimate reason why you may not be able to build a shed on your preferred site.
- Before proceeding further with your plans, talk with all your neighbours and see if they have any concerns.

FOR FURTHER INFORMATION

myda.dairyaustralia.com.au/fse
dairyaustralia.com.au/nationalguidelines
dairyaustralia.com.au/farmsystems

ACKNOWLEDGEMENT

Thank you to Peter Mulcahy and family for agreeing to share their knowledge and experience with dairy intensification.

Overview

Farm			
Farm size (ha)	400ha		
Grazing area (ha)	300ha		
Cropping area (ha)	1276ha		
Production system	Loose housing facility with compost bedded pack		
Dairy type	100 stand rotary		
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	1,400 (900 housed in facility, 500 grazing PMR)		
Breed	Holstein		
Calving pattern	Year round		
Production per cow per year (L)	11,000		
Infrastructure and equipment			
Infrastructure			
Equipment			
People			
Full time equivalents (FTEs)	12		
Cows per FTE	116		

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