

First principles and keys to success

Realistic expectations start by understanding the key principles for the successful operation of an automatic milking system.

Farmers who are successful at AMS keep the following principles in mind.

- **Voluntary cow movement** – you need infrastructure and management strategies that encourage consistent and reliable cow traffic around the farm.
- **Accurate pasture allocation** – your pasture/feed management is the key to reliable cow movement. Cows are mostly motivated to move by the hope of accessing more feed.
- **A distributed milking pattern** – this refers to the milking units being used fairly evenly over a 24-hour period. You need to reap the benefit of your investment in milking units by ensuring utilisation rates are optimal.

In challenging practical situations or when you have decisions to make, remember these three principles and what the system needs to achieve overall.

Three key terms:

Milking frequency – number of times cow is milked per day. Helps decide if the herd is on track to achieve production targets. Farmer can set machine to allow/deny milking for individual cows based on stage of lactation etc.

Machine utilisation – number of milkings per unit. Sometimes measured as litres harvested per machine per day or as idle time per machine per day.

Milking interval – number of hours between milkings. Interval too long – drop in production, increase risk of mastitis. Interval too short – milk yield too low and potential for poor attachment with flaccid udder and low milk harvesting rate (yield per minute).

Voluntary cow movement

What drives cow movement?

Cows are highly motivated to move to access feed. You achieve good voluntary cow movement by setting up farm infrastructure in a way that makes it easy for cows to gain access to what they seek.

As an AMS farmer your most important management task is to plan and oversee cow access to these things and to set up and manage the system in a way that encourages a reliable and consistent pattern of cow movement.

Decision	Think about the impact...
Number of laneways to/from the dairy	Lessons from the Camden AMS research farm show that a farm layout with only one split laneway laneway direction extending to/from the dairy can work with AMS but additional laneways increase flexibility. This can improve cow traffic, milking frequency, machine utilisation and regularity of milking interval.

Cows like access to feed/water, loafing areas, shade, shelter, herd mates but the most reliable motivator for movement is access to fresh feed. Design and manage your system to optimise cow flow and cow traffic. Ensure that milking frequency is not impacted by the inability of cows to find their way around.

The more often the available feed source is depleted, the more cows will traffic around the system.

More frequent trafficking can result in increased milking frequency (if this is desired) and reduced variability around milking intervals.

There are a number of key decisions to make:

- How many pasture allocations per day do you require?
- Will you include a feed pad?
- If yes, will the feedpad have a loafing area with it?

Decision	Think about...
Number of pasture allocations	Offering cows two allocations of pasture per day is workable but there are times when offering three per day allows you to target periods of low machine utilisation. This provides an opportunity to increase the milking frequency for selected cows which may include early lactation cows or heifers.

Decision	Think about...
A feedpad – yes or no?	<p>Including a feedpad does provide additional flexibility and they are particularly useful during drought conditions.</p> <p>Your decision to include a feedpad will depend on how much supplement you plan to feed now and in the future. If you have a feedpad already, make sure it is integrated well.</p>

Depletion of feed on a feedpad can be quite abrupt and may cause a mass movement of cows. This could result in long queues at the dairy if not managed appropriately. Note that some motivated cows will leave prior to the feed becoming completely depleted due to a reduced willingness to eat feed that has been picked through by other cows.

Cows will leave a feedpad with a concrete floor to access a comfortable loafing area for rumination. You can direct the cows to a paddock to loaf or provide a loafing area next to your feedpad.

The important thing to remember is that feedpads can act as a break or can be used to supplement a break.

Decision	Think about the impact...
Associated loafing area – yes or no?	<p>No - you can use the feedpad to put out supplement. Cows will eat a bit then have to move to access a loafing area. The feed may not be depleted.</p> <p>Yes - Your feedpad can also act as an additional break/feed allocation where cows eat and loaf (and eat and loaf!) until the feed is depleted before moving off to the next pasture break.</p>

Feedpads and the location of comfortable loafing areas have an impact on how cows traffic around the system and also on their intake. The trick is to ensure allocations, no matter where they are located are consumed by the cows to maintain production.

Feedpads can act as a break or can supplement a break.

Assume you are trying to feed your cows 18 kg DM outside of the dairy. When you have lots of grass you may provide the cows with three breaks (each of 6 kg DM/cow) throughout the 24-hour period.

When you don't have enough grass you have to ask the question – how will I supplement the cows? If you have a feedpad you can put the supplementary feed there – rather than in the paddock.

Now you may choose to provide your cows with 12 kg grass and 6 kg supplement/day. There are two options depending on your set up:

Option 1.**Feedpad has a loafing area associated with it.**

You could provide the cows with two breaks of pasture during each day. Each break is 6 kg. Since your feedpad has a loafing area, the third break of grass is now replaced by an allocation of 6 kg on the feedpad - effectively three breaks of 6 kg (2 of pasture, 1 of supplement).

In this case, the feedpad is acting as a break and just like pasture breaks, the cows will be unlikely to leave this area prior to the feed being depleted.

Option 2.**No loafing area associated with the feedpad.**

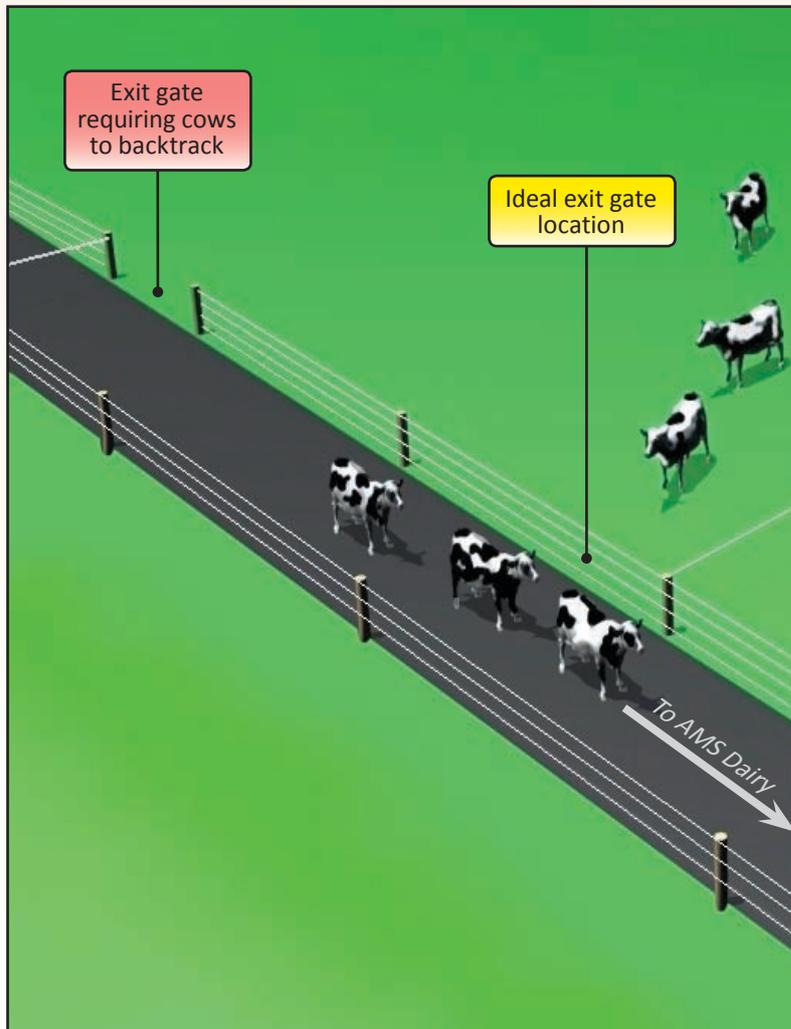
Your only option is to supplement each of the pasture breaks with feed on the feedpad. You would provide your cows with three breaks of grass (each of 4 kg DM/cow) and put 6 kg of supplement on the feedpad (per cow).

The cows will stop at the feedpad on the way out to each pasture break and spend approximately 2 hours eating here prior to going to the paddock.

Cows will not stay on the feedpad until all of the supplement is consumed as they are not comfortable with lying or standing on concrete for more than a couple of hours so they seek the comfort of a paddock to loaf and ruminate.

Gate position and cow movement

This gate location means cows have to backtrack to exit the paddock.



Whilst the scenario shown left may not look particularly confusing to you the farmer, cows will struggle. You may come in the next morning to find 80% of the herd has not trafficked from the paddock during the night!

Decision	Think about the impact...
Position of gates	Take particular care to minimise any backtracking cows may do when trying to exit a paddock.
Orientation of pasture breaks	A poorly oriented pasture break within a paddock can have an enormous impact on voluntary movement of cows from a paddock.

On AMS farms, the infrastructure and management action must work together to ensure the system works well regardless of 'people'.

Distance from paddock to dairy

Be aware that if your furthest paddocks are more than one km from the dairy, voluntary cow movement may be affected.

If you suspect that cows will not move from a paddock due to distance, here is a strategy to try. Have cows traffic to the dairy during the night (they will willingly do this) and then have them move out of the paddock during the day. This way you will be around to encourage them to move during working hours.

Accurate pasture allocation

Why is accurate pasture allocation so important?

In a pasture-based AMS, access to feed is a key driver of cow movement. Accurate pasture allocation is the tool you use to ensure the predictability of cow traffic.

Your skills in allocating pasture become a critical factor in the success of the system.

Key issue	Think about the impact...
Time spent on pasture management	<p>Some time savings made in regard to milking and bringing the cows up to the dairy will be spent monitoring, managing and allocating pasture – expect to spend between 2-4 hours per week.</p> <p>If you already spend this amount of time, you should expect no change.</p> <p>If you do not already do this you are likely to see an improvement in the pasture utilisation levels - and as a direct result, a reduced cost of milk production.</p>

Inaccurate allocation of feed could severely and negatively impact on milking frequency, daily intakes and production levels.

Normally, cows will not walk out of a paddock until they have depleted the feed in that paddock. The point at which feed-depletion encourages cow traffic varies between cows and is known to be influenced by:

- stage of lactation
- health status
- oestrus (heat)
- confidence/experience in the system.

Anecdotal evidence suggests that inaccurate pasture allocation has a large impact on how regularly cows move around the system and therefore how often they are milked.

Key issue	Think about the impact...
Over allocation	Cows will stay in the paddock to continue harvesting during periods of over allocation. Over-allocation of pasture results in lower voluntary visitation to the dairy and reduced milking frequency.
Under allocation	Under-allocation of pasture will result in higher milking frequencies and higher voluntary visitation rates but reduced intakes, reduced litres harvested per minute and ultimately reduced milk production.

The on farm impacts of inaccurate pasture allocation are quite different between conventional and automatic milking systems.

Inaccurate pasture allocation	The impact...
Conventional farm	The effects of inaccurate pasture allocation in a conventional dairying system result in overgrazing, reduced feeding levels and/or wastage of pasture through over-allocation. This impacts on pasture re-growth and quality.
AMS farm	In an AMS the cows will move out of the paddock prior to overgrazing and will stay in the paddock to continue harvesting during periods of over allocation.

Accurate pasture allocation does cost time but the pasture utilisation and cost of production ‘rewards’, far outweigh the time cost. The cost of inaccurate pasture allocation will likely impact more on milk production (through a reduced milking frequency) than it would in a conventional system.

It is anticipated that those AMS farms that do not practice accurate pasture allocation will see:

- reduced per-cow performance
- potentially an increased incidence of mastitis due to irregular milking intervals and low frequencies of milking
- reduced voluntary movement and increased fetching.

These impacts may be incorrectly attributed to the automatic milking unit.

Milking more frequently won’t necessarily produce more milk.

If cows are milked at a higher **milking frequency**, particularly through early lactation, an increase in milk production might be expected. This will only be the case if milking frequency in the conventional system was the factor limiting production.

If intakes and rate of mobilisation of body reserves are the key factors limiting production, then increases in production will be minimal if milking frequency alone is increased.

Key issue	Think about the impact...
Overgrazing	Not so much of an issue with AMS as cows are generally much more inclined to move out of the paddock before they over-graze the pasture.
Undergrazing	If you over allocate you risk wasting pasture. This impacts on pasture re-growth and quality. You may need to send cows back to the same break to avoid this.

AMS itself is unlikely to result in a significant increase in **milk production**. If any increases in production are realised they will most likely be through increased feed consumption and/or increased milking frequency.

A distributed milking pattern

What type of milking pattern is achievable?

The two extremes of feeding regimes that can be successful with an AMS are a complete TMR system with no grazing and a complete pasture-based system with conserved pasture being the only supplement available to the cows.

Most Australian systems will fall somewhere between these two extremes and seasonal conditions will often determine where individual farms sit within the spectrum at different times of the year.

It is important to note however, that the behaviour of cows fed a Total Mixed Ration (TMR) versus pastured cows is very different and has an impact on milking patterns. These different behaviour patterns affect the trafficking of cows around the system.

The cost of capital outlay with an AMS usually means that a high machine utilisation rate is required as a driver of farm profit.

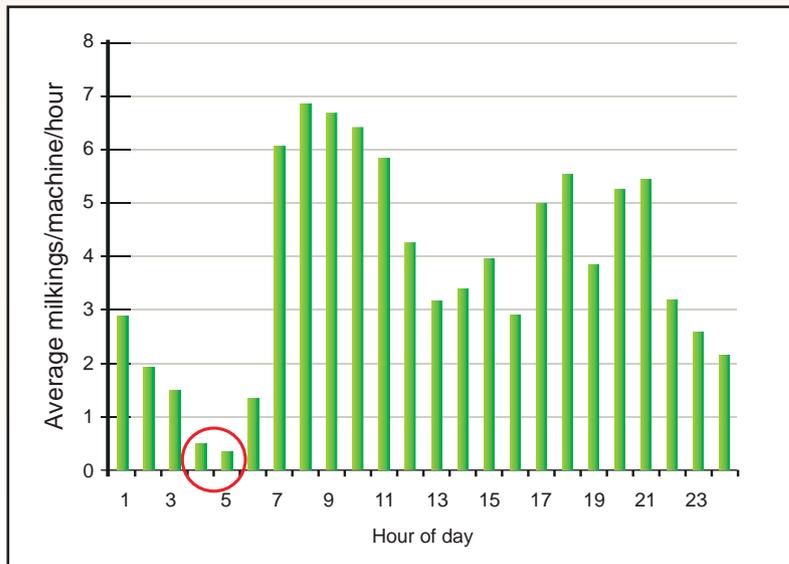
Don't forget though that levels of utilisation will vary depending on the type of system you operate and the daily consistency with the number of cows in milk and average stage of lactation. Have realistic expectations about what is achievable.

Approach to feeding	Impact on cow behaviour
TMR cows	<p>Cows in a TMR system tend to be very continuous about their activities; they eat, drink, loaf and ruminate throughout the whole 24-hour period.</p> <p>There does not tend to be a strong rhythm or cycle to the days' activities.</p> <p>In an indoor system high robot utilisation can be achieved consistently throughout a 24-hour period.</p>
Pastured cows	<p>Cows are very rhythmical with their activities with grazing bouts and rumination bouts.</p> <p>A number of factors influence the timing of their activities including:</p> <ul style="list-style-type: none"> • time of day - timing of new pasture breaks opening • sleep periods during the early hours of the morning. <p>In a pasture based system - cows are more inclined to have a defined sleep period during which a very low number of milkings is achieved.</p>

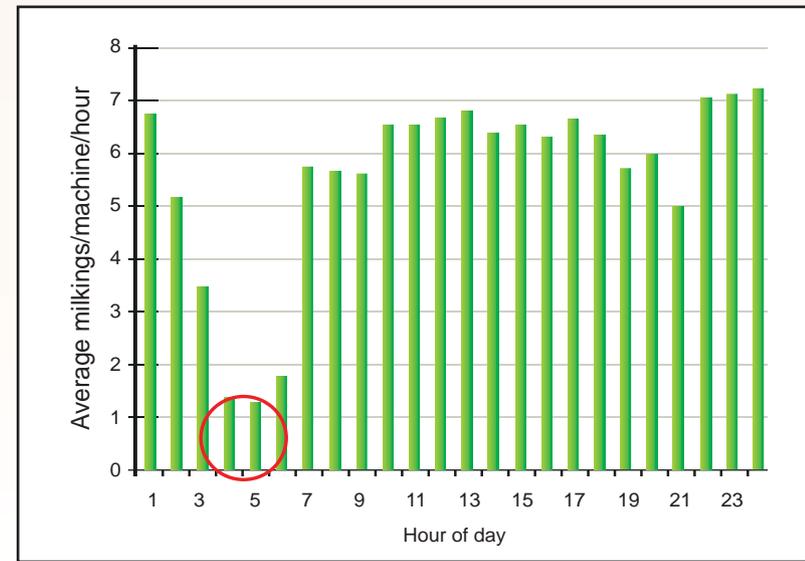
Whilst the throughput during 'sleep' time can be increased by offering additional incentives leading up to that time, it is difficult to achieve high robot utilisation consistently throughout a 24-hour period.

These graphs based on results from the Camden AMS research farm show that even at different times of the year, herd sizes, stage of lactation etc, only low throughput was achievable in the early hours of the morning. Compare this with graphs from a Dutch, barn style TMR farm on the next page.

To date the best known way of reducing (although not eliminating) the dip in the visitation curve during 'sleep' time is to provide the cows with three breaks of pasture per day instead of two. Work carried out in NZ has shown that by providing the cows with three pasture breaks instead of two, the total number of cows milked from midnight to 7 a.m. could be doubled.

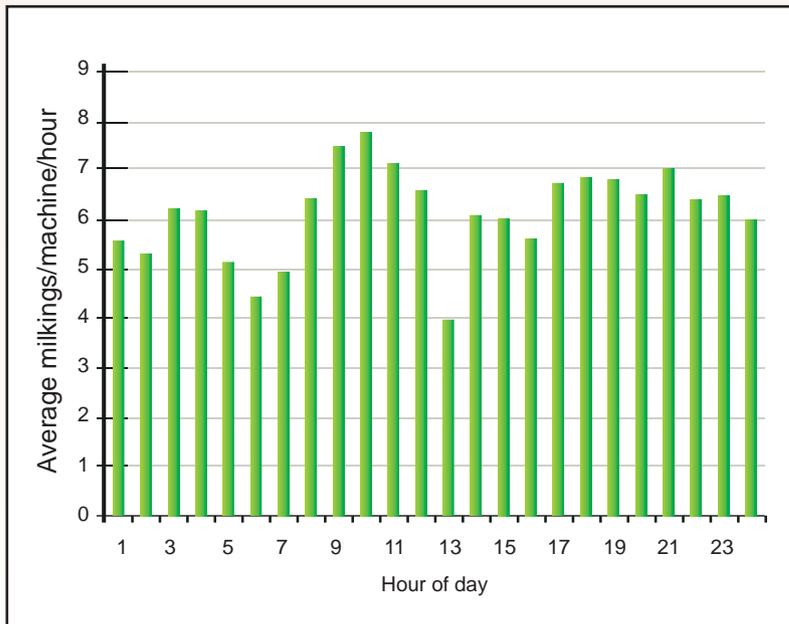


Pasture based AMS: Milking distribution curve for a **low use period**.

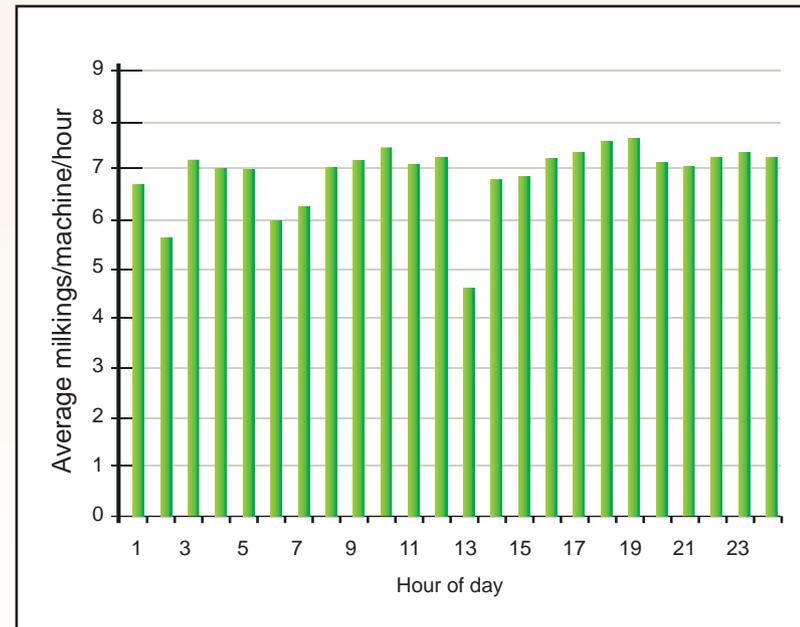


Pasture based AMS: Milking distribution curve for a **high use period**.

Don't forget that if you have a pasture based system, it is not realistic to expect to achieve milking distribution curves like the example below.



Dutch TMR AMS farm:
Milking distribution curve for a **low use period**.



Dutch TMR AMS farm:
Milking distribution curve for a **high use period**.

A typical European system involves cows being housed indoors and fed a TMR diet. A well designed barn will minimise walking distances and allow easy access to the milking units. Cows will be provided with loafing areas or stalls and a feeding area.

In an Australian context, cows are offered pasture with supplementary feed made available as required — supplemented with approximately 1.5 to 2.0 tonne of concentrate per cow per year. In this scenario it is assumed that cows would be milked about twice a day and would produce about 7,500-8,000 litres per cow per year.

See below for potential machine utilisation levels during periods of high throughput.

The two biggest factors affecting machine utilisation are number of cows in milk and the herd average milking frequency. Thus the utilisation levels shown above would not be achievable throughout the year unless a year-round calving system was in place and the number of cows in early, mid and late lactation was relatively even at any point in time.

This would result in very low levels of fluctuation with regard to number of cows in milk and total number of milkings per day.

Ensure that your expectations of machine utilisation are realistic for the type of system that you plan to operate.

What's realistic?	Typical European Indoor System	Australian Pasture-Based System
Average machine utilisation	90%	80%
Number of milkings per AMS unit per day	170	150
Milk harvested per AMS unit per day (litres)	2,300	2,000

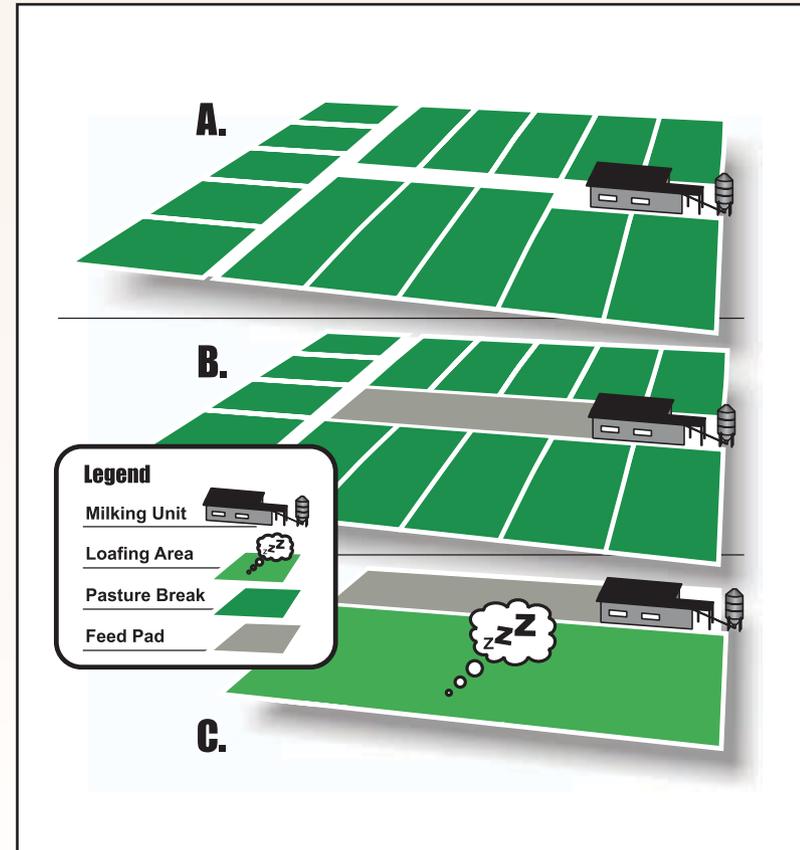
AMS in pasture based systems – Australian conditions

Farmers moving to automatic milking systems in Australia should continue to maximise their pasture utilisation as it still remains the cheapest source of feed. The on-going impact of drought means that many will also consider a feed pad and associated loafing area to be essential too.

Research undertaken at Camden has been aimed at understanding how an AMS can be managed under Australian conditions. The broad options for Australian automatic systems are:

- A.** Pasture based system – no feed pad
- B.** Pasture based with feed pad
- C.** Australian style intensive feeding

Many farms could expect to change between systems at different times of year or from year to year depending on climate, input prices and milk prices so infrastructure needs to allow the necessary level of flexibility.



Experience at Camden suggests that a set up that allows for three pasture breaks a day provides the most flexibility and can help ensure good cow traffic around the farm. Having a feed pad also increases your options and is considered highly desirable in times of drought.

Pasture based system - no feedpad

If the system does not incorporate a feedpad, supplementary feed can be provided in the paddock.

If pasture is allocated in small 'portions' (30-50% of the desired daily intake made in any one paddock) when cows have depleted this feed source, they will move out of the paddock. This will create an opportunity for cows to be milked at regular intervals.

Accurate pasture allocation is essential to ensure that the amount of available pasture is 'just right' to encourage cows to walk out of the paddock in search of more feed within an appropriate time interval.

Over allocation and under allocation of pasture is likely to impact on milking frequency and machine use efficiency.

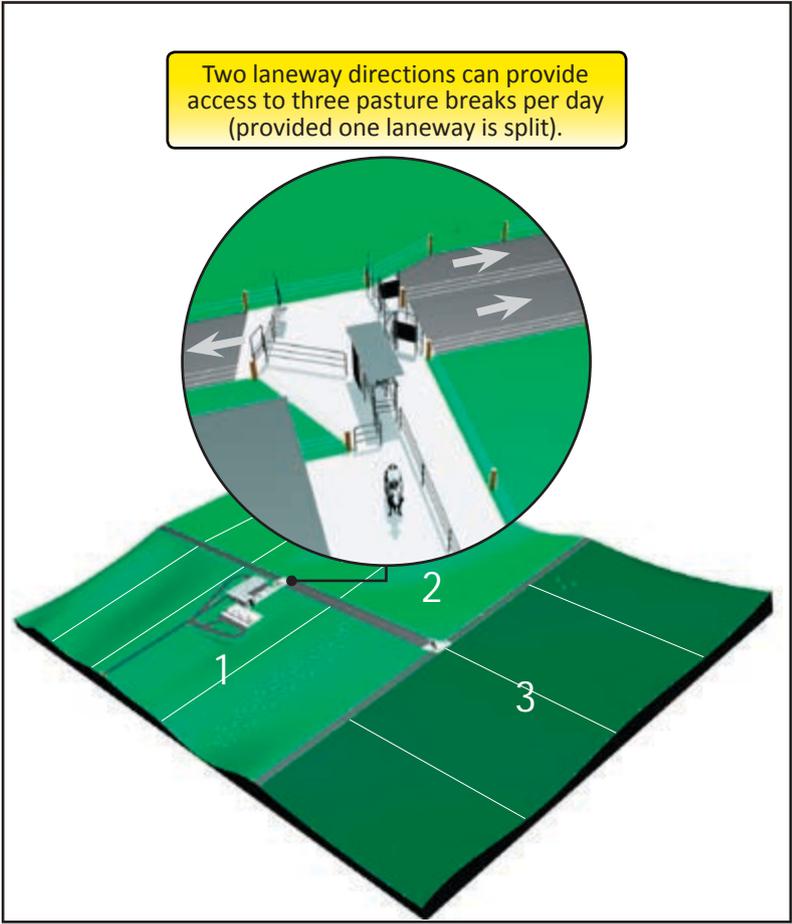
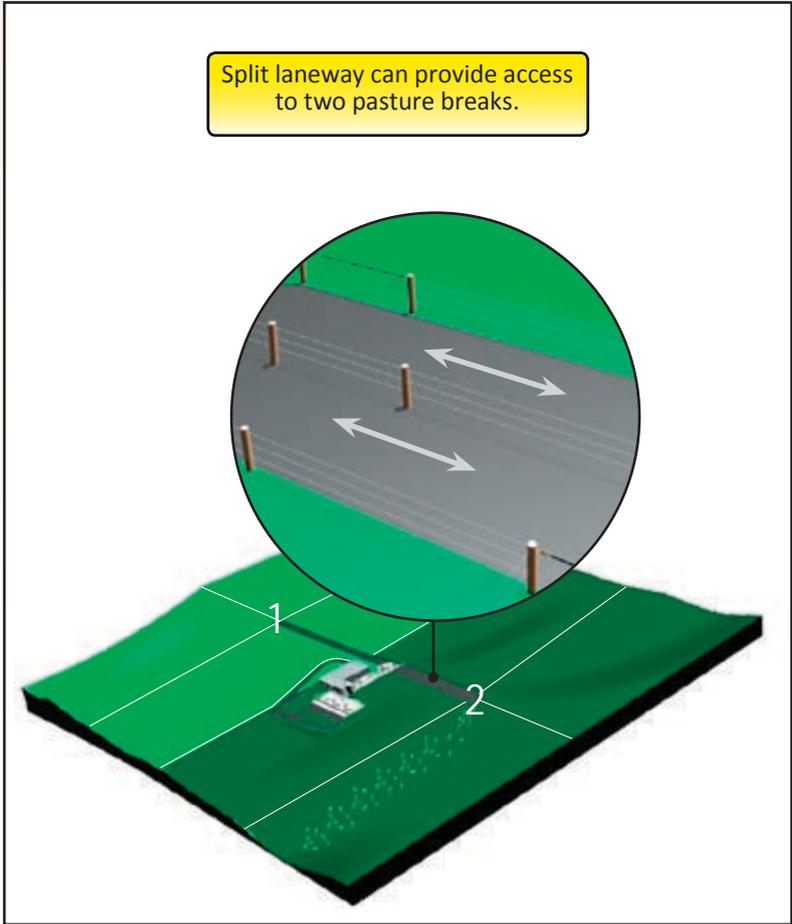
Farms can be set up to offer two or three new pasture allocations each day.

Be aware that offering three breaks encourages more cow movement around the farm and potentially, more traffic through the milking unit.

Three breaks a day results in a more even machine use (distributed) pattern over a 24-hour period.

Laneway set up	Access issues...
I want to work with what I've got...	<p>In this case your current layout determines how many pasture breaks you can have.</p> <p>If you currently have only one central laneway and you are not keen on changing the set up, then two pasture breaks is the only option.</p> <p>If your current layout has more than one key laneway then it may be possible to adopt a 'three break' system.</p>
I don't mind spending to get the laneways right...	<p>Here, the first task is decide how many pasture allocations you wish to have and then determine the layout that best achieves this.</p> <p>If you currently have a central laneway but don't mind taking on the re-development challenge, it is possible to create a 'three break' layout.</p>

Traffic is controlled using automatic drafting gates – cows are directed to holding yards, new pasture breaks or back to the same paddock after passing through the milking unit.



Pasture based system with feedpad

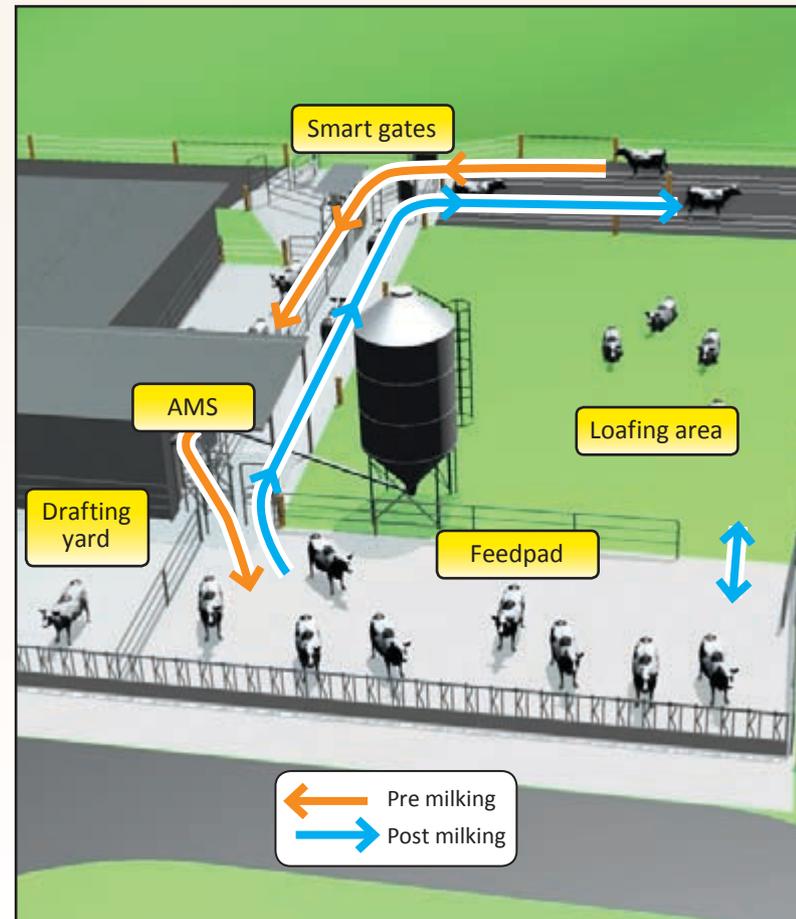
A feedpad with provision for loafing effectively acts as a third 'break' of feed i.e. two pasture breaks plus feedpad access. Note though that if there is no loafing area, then the feedpad will only be able to be used as a supplement to the given pasture breaks of the day.

The management of cow traffic depends on your set up.

- If you have a feedpad but no associated loafing area, be aware that cows will tend to leave a feedpad to access a comfortable loafing area for rumination.
- If your feedpad does have a loafing area associated with it, the management strategy to encourage cow movement will need to be different. In this case, the feedpad could be set up allowing cows to move from the loafing area to the feeding area via one-way gates. Cows could then move through a drafting gate to gain access to the loafing area after feeding.

Setting up entries and exits so cows can have access to feedpads before and after milking provides the greatest flexibility.

Access to feed pre-milking will mean intake is not limited by how often the cow is milked.



Above: The coloured lines show an example of the pre and post milking pathways cows can take to access the feedpad and paddocks.

Australian style intensive feeding

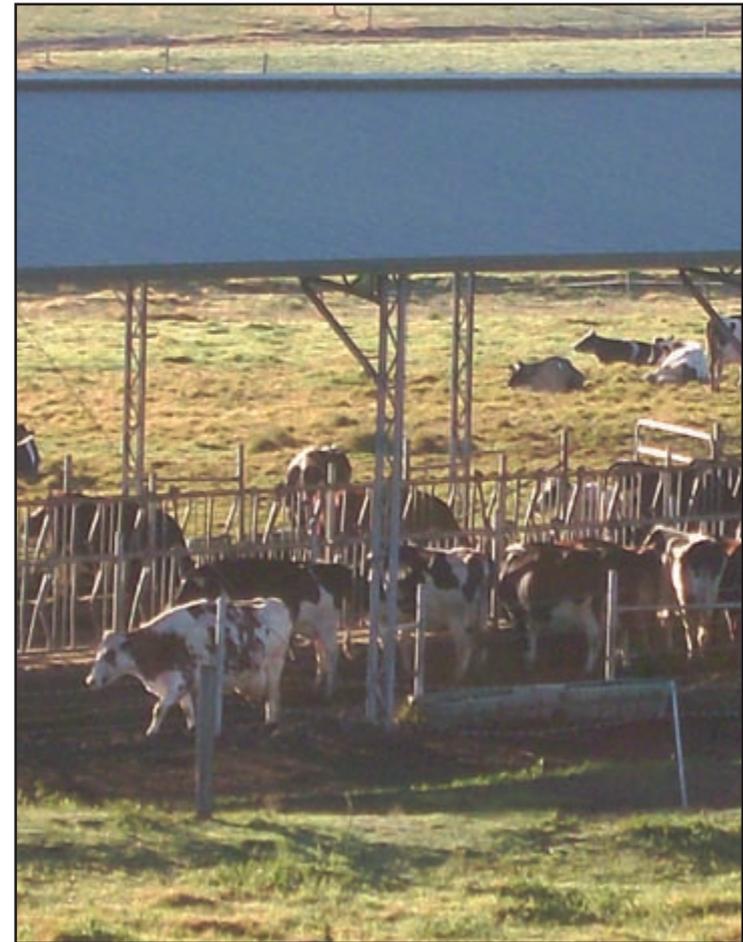
In an Australian style intensive feeding system, the feedpad, loafing and milking units are all in the same area.

Cow traffic can be controlled using one-way gates placed between the feeding and loafing areas.

In a semi-controlled cow traffic system, cows have free access via one-way gates from the loafing area to the feeding area. After leaving this area, cows pass through an automatic drafting gate and are drafted either to milking or to the loafing area if they do not have milking permission.

An alternative approach involves locating drafting gates prior to the feeding area. This way cows can be drafted through the milking unit prior to gaining access to the feed area or directly to the feed area if they don't have milking permission.

A well designed intensive feeding system can allow for grazing if conditions are right.



Above: Cows can be seen loafing in the background in a dry paddock adjoining the feedpad.