Milking smarter

Improving the efficiency of milking – herringbone

DairyNZ

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Disclaimer

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Introduction

Milking requires a lot of labour – up to 57% of time over a season on a New Zealand dairy farm.

Operating your milking facilities efficiently is an important part of maintaining a profitable dairy business, and can reduce stress on staff.

As herd sizes in New Zealand continue to grow, the need for efficient milking becomes even greater.

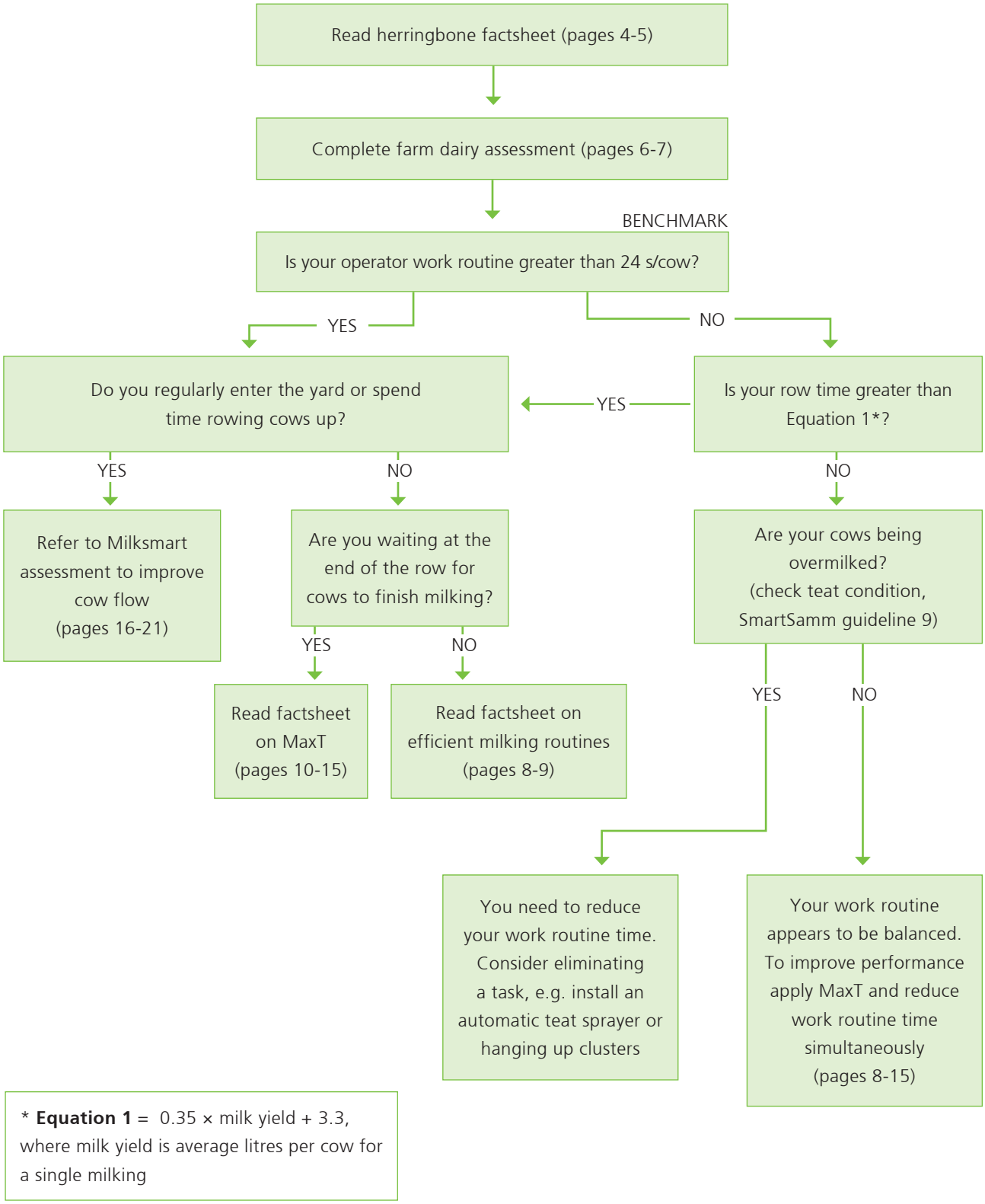
The purpose of this resource is to:

- Guide you through a process to improve your current milking efficiency
- Explain the principles (perfect world situation) behind the operation of herringbone dairies (pages 4-5)
- Benchmark your current milking performance (pages 6-7)
- Explain various strategies that can improve your milking efficiency (pages 8-23).

To use this resource:

- Read the factsheet
- Do an assessment to benchmark your milking efficiency
- Refer to the decision tree diagram
- Consider adopting the suggested changes/strategies.

Herringbone decision tree



* **Equation 1** = 0.35 × milk yield + 3.3, where milk yield is average litres per cow for a single milking

Herringbone factsheet

The herringbone is the most common dairy type in New Zealand. In 2013, 72% of dairies were herringbones. To maximise efficiency in your herringbone it is important to balance three key factors.

To get the most out of your herringbone, it is important to understand the principles that determine its performance. There are three key factors:

- Work routine time of the operator(s)
- Milking time of the slowest cow in the row
- Number of clusters

Work routine

The maximum number of cows milked per hour in a herringbone is determined by the work routine time (WRT) of the operator(s). The work routine can consist of tasks such as: loading the row, teat washing, cluster attachment, cluster removal, teat sanitisation, drenching, row exiting and, importantly, also includes any time when the operator is idle or waiting. The work routine time is the average time it takes per cow to complete these tasks and is measured in seconds per cow. Core components of the work routine such as loading and cupping should remain constant per cow, regardless of the number of clusters in the herringbone. The maximum number of cows able to be milked per hour can be calculated by dividing 3600 (the number of seconds in an hour) by the WRT.

$$\textbf{Throughput (cows/hour)} = \frac{3600}{\text{WRT (s/cow)}}$$

For example, if your work routine time is 24 seconds, then 3600 divided by 24 = 150. So the throughput is 150 cows per hour.

A streamlined work routine can increase the number of cows that can be milked per hour. For a more detailed explanation see the efficient milking routine factsheet.

There are two other factors that influence cow throughput per hour; your work routine can be limited by the slowest cow in the row or by the number of clusters you have.

For more information visit dairynz.co.nz/herringbone-principles

Limits to throughput

The number of clusters and the milking time of the slowest cow in the row determine if the maximum potential throughput set by the work routine can be achieved. This concept is best explained with an example.

Let's assume an operator has a work routine of 24 s/cow and the slowest milking cow in the row takes 8 min (480 s). This means the optimum number of clusters, where the milker has finished their routine as the last cow finishes milking, is 20 (480 ÷ 24) .

$$\textbf{Optimum cluster number (clusters/operator)} = \frac{\text{Milking time of the slowest cow (s)}}{\text{WRT (s/cow)}}$$

Comparatively, if the herringbone had only 16 clusters, the milker would have finished their routine earlier and be waiting for the slowest cow to finish milking. This waiting time would equate to 6 s/cow, which must be added to the core 24 s/cow routine, decreasing throughput to 120 cows/hr (3600 ÷ 30 s/cow).

Alternatively, if there had been 24 clusters, the slowest cow would have finished milking before the milker could remove the cluster meaning she and the rest of the cows in the row are being overmilked (if no automatic cluster removers are installed). So even though there are an additional 4 clusters, throughput would still be 150 cows/hour because this is limited by the 24 s/cow work routine. There will be fewer rows required to milk the herd, but each of these rows will take longer. So there is no net benefit.

Improving milking efficiency on my farm

Most operators know whether they have idle time in their milking routine or are overmilking, but a good place to start is to do a farm dairy assessment. By answering 8 questions, your current performance can be benchmarked and work routine time calculated. If your performance is below the benchmark, your work routine time can likely be streamlined.

Actions

- If your routine contains idle time, where you are waiting for slow milking cows, it can be streamlined by applying a maximum milking time (MaxT). Visit dairynz.co.nz/maxt-herringbone.
- If your routine is resulting in overmilking (or cluster idle time if you have automatic cluster removers), it can be streamlined by using an efficient milking routine and ensuring that the dairy entrance/exit is designed to allow good cow flow. Visit dairynz.co.nz/herringbone-routine and dairynz.co.nz/herringbone-design.
- Enter your farm details into the milking efficiency calculator to see the time savings that could be made by streamlining your work routine or using MaxT. Visit dairynz.co.nz/herringbone-calculator.

Dairy assessment

Completing a farm dairy assessment will enable you to:

- benchmark your farm dairy's performance against others of similar size and type
- provide a starting point against which you measure the effectiveness of implemented efficiency improvements.

Assement can also be done online at: dairynz.co.nz/benchmark-herringbone

Information

Complete the assessment during a normal morning (exclude any sick herd).

1	How many cows milked this morning?	
2	How many milking units (clusters) normally used?	
3	What is the total number of bails (cow spaces) in the farm dairy? (a 20 aside swing-over has 40 spaces)	
4	How many people normally milking in the pit?	
5	This milking started at (time first clusters on)	
6	This milking finished at (time last cluster off)	
7	How many full rows of cows were milked at this milking?	
8	If less than a full row, how many cows were milked in the last row?	

Calculation

Simply follow the questions down and use the information from the opposite page and the answers you create whilst completing the form.

For example: take the answer from Question 6 on the opposite page and rewrite into this box:

6	This milking finished at (time last cluster off)	08:00 hours	→	Q6

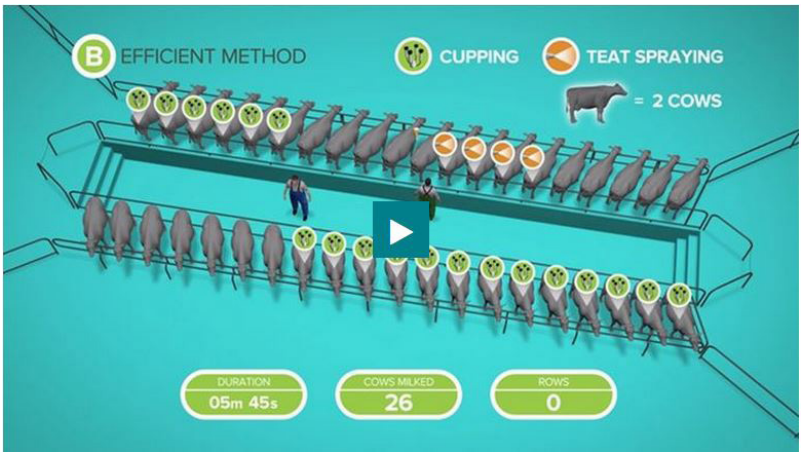
Q6	–	**Q5**	=	**A**	Total milking time (hrs)
Q1	÷	**A**	=	**B**	Cows milked per hour
B	÷	**Q4**	=	**C**	Cows milked per hour per person
3600	÷	**C**	=		Operator work routine time (s/cow)
Q8	÷	**Q2**	=	**E**	
E	+	**Q7**	=	**F**	
A	x	**60**	=	**G**	
G	÷	**F**	=		Average row time (min)

Milking routine factsheet

The milking routine includes all tasks that the milker(s) will carry out within the dairy. An efficient milking routine will increase the number of cows that can be milked per hour by minimising time spent on non-essential tasks or milker idle time.

A more efficient milking also reduces stress and fatigue for the milker(s) and the cows and allows more time for other tasks on the farm.

An efficient milking routine is especially important in large herringbone dairies that require two milkers. The way two milkers work together will determine overall work routine time and the maximum number of cows that can be milked per hour. The most efficient milking routine will be the one in which the head-gate can be released in the shortest time after the row began loading. Two routines are illustrated in an animation found at dairynz.co.nz/herringbone-routine.



There are two distinct routines two milkers can follow; the territorial or zone method in which the pit is divided in two and each milker stays in their respective halves, or the 'bunny hopping' method in which both milkers work together progressing down the pit.

For more information, including an animation, visit dairynz.co.nz/herringbone-routine.

Inefficient routine

The territorial or zone method is considered inefficient. This is because only one milker can begin attaching clusters as the cows are loading, while the second milker (if starting from the back working forward) can't begin attaching clusters until the row is fully loaded. Also, the cows in the middle of the row are the last to have their clusters attached so will likely be the last to finish, preventing the release of the head gate until the majority of clusters have been swung over.

A variation on this method is when dividing the pit in half, one milker starts at the front and the second milker from the middle. This is an improvement on the routine described above because the head gate can be released early. However, the routine can be improved further.

Efficient routine

The 'bunny hopping' method is considered efficient. Milker one walks up the pit with the first batch of cows and begins attaching clusters. Milker two then walks up with the second batch of cows and begins attaching clusters. The milkers continue to work their way down the row in batches of approximately 4-6 cows (determined by the position of the teat spray hoses, if present). This method allows the milkers to reach the point where the head-gate can be released twice as fast as if dividing the pit in half, with the second milker starting from halfway. Releasing the head-gate early minimises the time spent waiting for the row to exit because cows are exiting at the same time as the milkers are swinging over the remaining clusters. This effectively shortens the work routine.

To get the most out of the 'bunny hopping' method a well-designed dairy with good cow flow is required – see the information on dairy design. It is also helpful to be able to see and control the backing gate from multiple points within the pit and have the release cords for any meal feeders divided into sections to aid with cow flow.

The same principles of walking with the first batch of cows and beginning to attach clusters and releasing the head-gate early, also apply to herringbones with one milker.

Actions

- Assess your current milking routine and talk with staff about the pros and cons of different methods.
- Assess your herringbone's bail, entry and exit design using this workbook (pages16-21). More information can also be found at dairynz.co.nz/herringbone-design . Good cow flow minimises time spent entering the yard.

MaxT factsheet

FOR HERRINGBONE AND ROTARY DAIRIES

The MaxT milking strategy can be used by farmers who want to shorten herd milking times without changing shed infrastructure, compromising milk production and quality or udder health.

What is MaxT?

MaxT is a strategy in which cows are milked to a pre-determined end-point – either to a fixed time point, or set milk flow rate threshold. Using the fixed time point the idea is to estimate when approximately 80% of cows would have completed milking and simply to remove the clusters from the 20% still milking. If you have ACR that are unable to apply a maximum milking time, another option is to adjust their low-flow threshold. By default most ACR have a low flow threshold of 0.2 kg/min (or equivalent) which can be increased to 0.4 kg/min, achieving a similar result to the fixed time end-point.

In most cases, milkers don't need to wait for slow milking cows to milk out. Research has shown that the implementation of MaxT can increase the number of cows milked each hour in many New Zealand dairies. The research has also demonstrated no loss of milk yield and no increase in mastitis or somatic cell count.

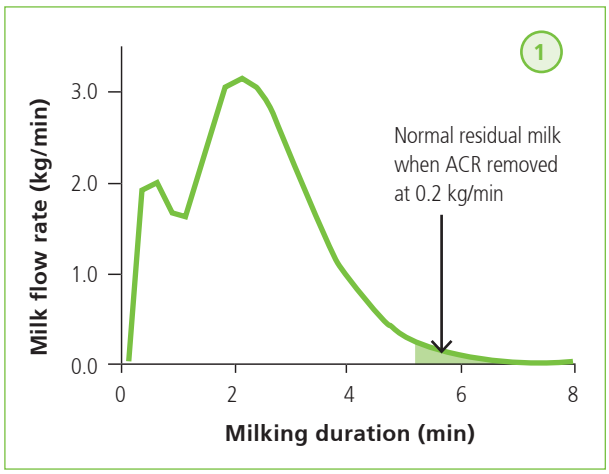
Research results

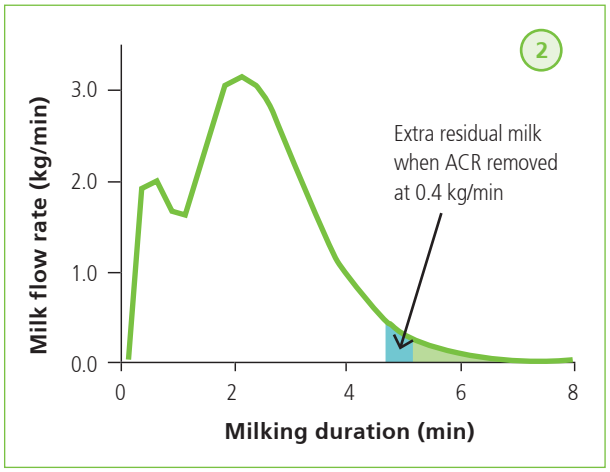
Leaving residual milk in the udder goes against a long held industry belief that it will reduce production and cause mastitis. Firstly, it's important to understand some basic physiology. Milk is held in two compartments of the udder; the cistern (a bag above the teat) holds around 20% of the milk, and the alveoli (the cells where the milk is made) hold the remaining 80%. When clusters are attached, the milk harvested in the first few minutes is from the cistern; then the milk ejection or let-down reflex is triggered. This causes the remaining milk to move from the alveoli into the cistern where it can be harvested by the machine.

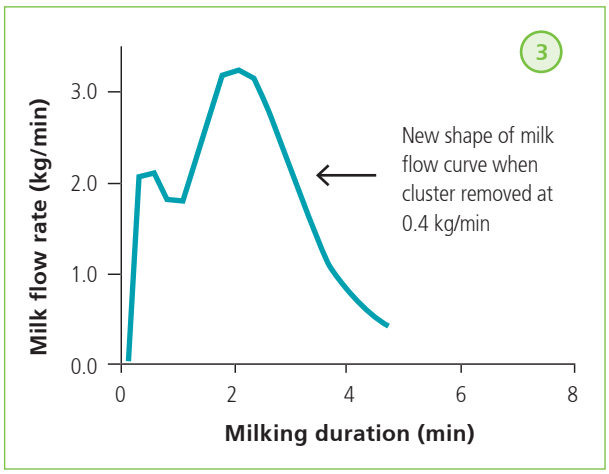
Cows whose clusters are removed early show a greater milk flow rate during the first few minutes of the following milking compared with 'fully milked-out' cows. In other words, there is more milk being held in the cistern from the previous milking ('residual milk'). As this milk is harvested immediately at the next milking, without waiting for milk letdown, there is no net loss in milk production or increase in somatic cell count. Essentially, the residual milk is retained until the next milking when it can be harvested more efficiently.

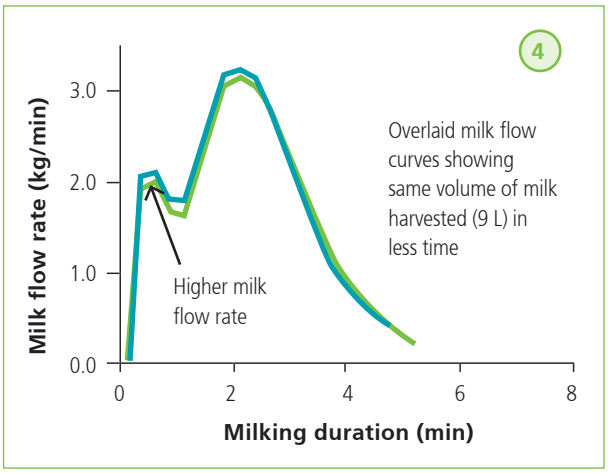
Figures 1 to 4 show the effect of removing the cluster earlier on a cow's milk flow curve. In this example the comparison is of an ACR set at 0.2 kg/min (red) and 0.4 kg/min (blue), but the same principle applies using a fixed maximum milking time. Figure 1 shows a typical milk flow profile when clusters are removed at 0.2 kg/min. In this situation a strip yield or residual milk of 200 mL can be expected. Figure 2 shows an additional 200 mL (for a total of 400 mL) could be expected to be left in the udder when removing the cluster at 0.4 kg/min, with a time saving of 30 s. Figure 3 shows the shape of the new milk flow curve when removing the cluster at 0.4 kg/min and Figure 4 shows the before (red) and after (blue) milk flow curves overlaid. Even though the differences look small, the area under both curves is 9 L, with a 30 s time saving when clusters are removed at 0.4 kg/min. This is due to the greater milk flow rate at the start of milking and a higher maximum flow rate.

For more information, including animations, visit dairynz.co.nz/maxt-herringbone.









Can MaxT help me?

MaxT can be implemented in any dairy type but it will not suit all situations. Whether it works will depend on the rate limiting factor. MaxT improves milking efficiency by helping to reduce row or rotation times. This means the operator(s) must be able to speed up their work routine for MaxT to improve efficiency – typically done by eliminating idle time from the work routine. This is easiest to achieve in dairies with a low cluster-to-operator ratio and can result in savings of over an hour per milking.

In a herringbone, if the time it takes you to complete your routine is shorter than the milking time of the slowest cow, you will be 'idle' or waiting. This is often the case in dairies with a low cluster to operator ratio or around peak lactation. In a rotary, operators have traditionally set platform speed so that 10% of cows 'go-around'. This normally results in platform speeds slower than efficient operators can attach clusters at, i.e. idle time. Using MaxT to minimise idle time will help milk the herd in a shorter time.

Table 1 shows the effect of applying a fixed maximum milking time for a 770 cow herd in a 40-aside herringbone with a herd average milk yield of 12 L/cow (e.g. a morning milking). A reduction in herd milking time of over 70 min can be achieved for two operators. This is simply because there is so much idle time in a 30 s/cow work routine.

Table 1. The effect of two end-of-milking criteria on milking efficiency for herringbone dairies.

End-of-milking criteria	Waiting for slow cows	MaxT
Row time	11 min	7.4 min
Operators	2	2
Work routine time per operator	33 s/cow	22 s/cow
Cows milked per hour	220	324
Cows milked per operator per hour	110	162
Herd milking time	3:40	2:28
Saving		72 min

Table 2 shows the effect of increasing ACR threshold to 0.4 kg/min or applying a fixed maximum milking time for a 770 cow herd in a 50-bail rotary with a herd average milk yield of 12 L/cow (e.g. a morning milking). When increasing ACR thresholds it is important to simultaneously reduce rotation time.

Table 2. The effect of two end-of-milking criteria and platform speed on milking efficiency.

End-of-milking criteria	Normal	ACR Threshold		MaxT
		0.4 kg/min	0.4 kg/min	
Rotation time	9 min	9 min	7.5 min	8 min
Go-around cows	12%	4%	16%	0%*
Available cupping time	12.1 s	11.3 s	10.4 s	9.6 s
Cows milked per hour	298	319	345	375
Herd milking time	2:35	2:24	2:13	2:03
Saving		11 min	22 min	32 min

** 23% would have 'gone-around'*

Practical implementation

It is recommended that the herd cell count should be below 200,000 cells/mL because it is a higher priority to improve this before focusing on efficiency. It's also important to identify any elite cows (yield >30% above herd average), as you may want to mark these and cup them early in a herringbone or let them 'go-around' in a rotary. Similarly, if there are any cows, typically older animals, with odd shaped udders that have issues with milking out, you may want to treat them separately. It's not desirable to under milk cows to a significant amount (i.e. leaving litres in the udder).

- Start by using the milking efficiency calculator. By entering some basic farm details you can select different end-of-milking strategies and assess which strategy best fits your individual situation. Visit dairynz.co.nz/herringbone-calculator.
- MaxT is easy to apply in a herringbone; simply perform the normal routine and don't wait for the last 20% of cows to finish milking, e.g. don't wait to remove the last 8 clusters in a 40-aside. Visit dairynz.co.nz/maxt-herringbone.
- In a rotary, the appropriate MaxT time for the herd is determined by the herd milk yield for the fortnight. This can be looked up from the MaxT table – it's easiest to do this from peak lactation when the yield is known. This then becomes the rotation time. Visit dairynz.co.nz/maxt-rotary.
- Some models of automatic cluster removers can be set to a maximum milking time. Increasing the low flow threshold from 0.2 to 0.4 kg/min will achieve a similar result. If you are unsure how to change your ACR threshold, contact your ACR manufacturer.
- An efficient work routine, cupping technique and dairy design help to realise the full benefit of MaxT. Visit dairynz.co.nz/cupping and dairynz.co.nz/herringbone-design.

Calculating MaxT

FOR HERRINGBONE AND ROTARY DAIRIES

MaxT is determined using Table 1, which is based on the average yield of a group of cows at that milking. Basing the MaxT on the average yield is important. For labour productivity benefits, cows that have an individual yield that is higher (or lower) than the average, need to conform with the time taken to milk out the majority of their herd mates.

Individual cows producing 30% more than the average yield are classed as 'elite' and may be significantly under-milked if subjected to the same Max T as the group. However, it is also counterproductive to set MaxT based on a high yield that is not achieved by most cows in the herd. A good solution is to give 'elite' cows a separate MaxT based on their individual yield.

Calculating MaxT – Basic steps for all dairy types

Step 1. Determine the mean daily milk yield per cow

The aim of Step 1 is to determine the average yield (litres) per cow per day. To do this, calculate the average milk yield in litres of the highest producing group of cows for a milking. Milk statements or a prediction of expected yield at peak are needed. Calving pattern will have some bearing on the correct yield to use. Refer to Table 2.

For example: In a seasonally calving herd, if the cows have a fairly uniform milk production, the average yield per cow per milking of the herd can be used as the basis for determining MaxT. In early lactation use the average yield expected at peak. After peak, use the average yield figures calculated from the daily bulk milk tank volume.

Step 2. Work out the am and pm milk yield

The MaxT for the AM and PM milking may be different if the yield expected at these two milkings differs. Table 3 shows the litres of milk that can be expected at AM and PM milkings over a range of different daily yields and inter-milking intervals.

Using Table 3:

- Identify the average milk yield per cow for the herd (from Step 1).
- Identify relevant milking interval for your operation.
- Read off the average yield that is expected for the AM and PM milkings.

Step 3. Determine MaxT for am and pm milkings

Look up the MaxT applicable for the AM and PM milk yields using Table 1. This is the longest time that a cluster should be on a cow, with the possible exception of 'elite' cows. Check fortnightly for changes in production and adjust the Max T accordingly if required.

Step 4. Identifying 'elite' cows (optional)

Don't assume that a high yielding cow must be excluded from MaxT. Many 'elite' cows with exceptionally high production will often milk-out within the allocated MaxT based on the average yield. This is because these cows also tend to have high milk flow rates.

As a general rule an 'elite' cow is defined as one that has a milk yield (litres) greater than 30% above the group average yield. These cows can be identified from a recent herd test or using milk meters. Some farmers may wish to make exceptions for 'elite' cows, excluding them from the MaxT milking regime, or giving them a separate MaxT of longer duration. If this is so, it is advisable to exclude their yield results from the mean milk yield calculation for the rest of the herd.

NB. Information in Table 1 and Table 3 is derived from Australian research. New Zealand research to date supports Australian findings and suggest these figures are just as relevant of New Zealand herds.

For more information visit dairynz.co.nz/calculating-maxt

Tables for calculating MaxT

Table 1. Estimator of maximum milk out times.

Yield per milking (l)	**MaxT** (min:sec)	**MaxT** (decimal minutes)	**Yield of 'elite' cows**
7	04:51	4.8	9+
8	05:20	5.3	10+
9	05:48	5.5	12+
10	06:15	6.3	13+
11	06:42	6.7	14+
12	07:07	7.2	16+
13	07:32	7.5	17+
14	07:57	8.0	18+
15	08:21	8.3	20+
16	08:44	8.4	21+
17	09:07	9.2	22+
18	09:30	9.5	23+
19	09:52	9.8	25+
20	10:14	10.2	26+

Table 2. Herd groups used in setting MaxT.

Calving pattern	**Stage of lactation**	**MaxT to be based on…**
Seasonal	Lead up to herd peak	Average yield per cow per milking expected at peak
	Peak and post - peak	Average yield per cow per milking
Split calving	Lead up to peak	Average yield per cow per milking of the most recently calved group, expected at peak
	Peak and post - peak	Average yield per cow per milking of the most recently calved group
Year round	Mixed (early & late)	Average yield per cow per milking of the most recently calved group, expected at peak.

Table 3. Morning and afternoon yield (estimated from daily yield at different milking intervals).

Daily milk yield (L/day)	**Milking Intervals** (hours) *(from start of milking)*									
	8	**16**	**9**	**15**	**10**	**14**	**11**	**13**	**12**	**12**
	evening	morning	evening	morning	evening	morning	evening	morning	evening	morning
8	3	5	3	5	3	5	4	4	4	4
9	3	6	3	6	4	5	4	5	5	5
10	3	7	4	6	4	6	5	5	5	5
11	4	7	4	7	5	6	5	6	6	6
12	4	8	5	8	5	7	6	7	6	6
13	4	9	5	8	5	8	6	7	7	7
14	5	9	5	9	6	8	6	8	7	7
15	5	10	6	9	6	9	7	8	8	8
16	5	11	6	10	7	9	7	9	8	8
17	6	11	6	11	7	10	8	9	9	9
18	6	12	7	11	8	11	8	10	9	9
19	6	13	7	12	8	11	9	10	10	10
20	7	13	8	13	8	12	9	11	10	10
21	7	14	8	13	9	12	10	11	11	11
22	7	15	8	14	9	13	10	12	11	11
23	8	15	9	14	10	13	11	12	12	12
24	8	16	9	15	10	14	11	13	12	12
25	8	17	9	16	10	15	11	14	13	13
26	9	17	10	16	11	15	12	14	13	13
27	9	18	10	17	11	16	12	15	14	14
28	9	19	11	18	12	16	13	15	14	14
29	10	19	11	18	12	17	13	16	15	15
30	10	20	11	19	13	18	14	16	15	15

On and off the platform

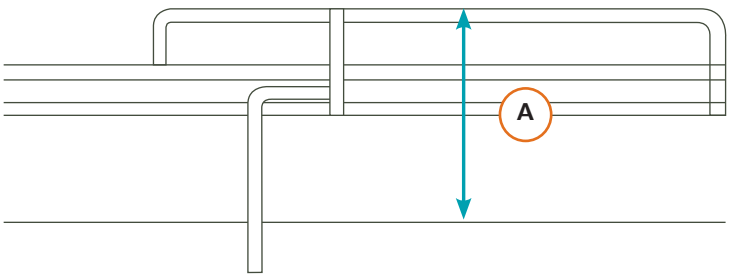
Use this resource to assess the setup of your dairy. Where your specifications differ significantly from the guideline figures, consider whether this is affecting cow flow, and if so devise a plan to take remedial action.

Bail entry

The bail entry should allow cows to move freely into the bail area without fear or discomfort. It should allow 2-4 cows to queue in front of the milking bails.

	QUESTION	MY FARM	COMMENT
1	Are there any visual distractions adjacent to the bail entry? *Guide: Visual distractions will affect the flow of cows entering milking area and should be screened.*	YES / NO	
2	Can 2-4 cows line-up before the start of the milking bails?	YES / NO	
3	What is the lead-in breast rail height? (A) *Guide: A lead in rail at 900mm -1000mm high is preferred.*	m	
4	Are there any aspects of the entry design that could cause pain/injury/stress to the cows? *Examples: Vertical pipes, open hole/leg trap, damaged pipe-work.*	YES / NO	
5	How is the last cow held in place? *Guide: A rotating back rail is preferred – not chains.*		
6	Is there a nib wall/bar at the edge of the pit? *Note: A nib helps provide a feeling of security to cows.*	YES / NO	
7	Is the concrete surface slippery	YES / NO	
8	Is the entrance and bail area well lit? *Guide: Even lighting and absence of shadow is preferred.*	YES / NO	

Lead-in rail height:



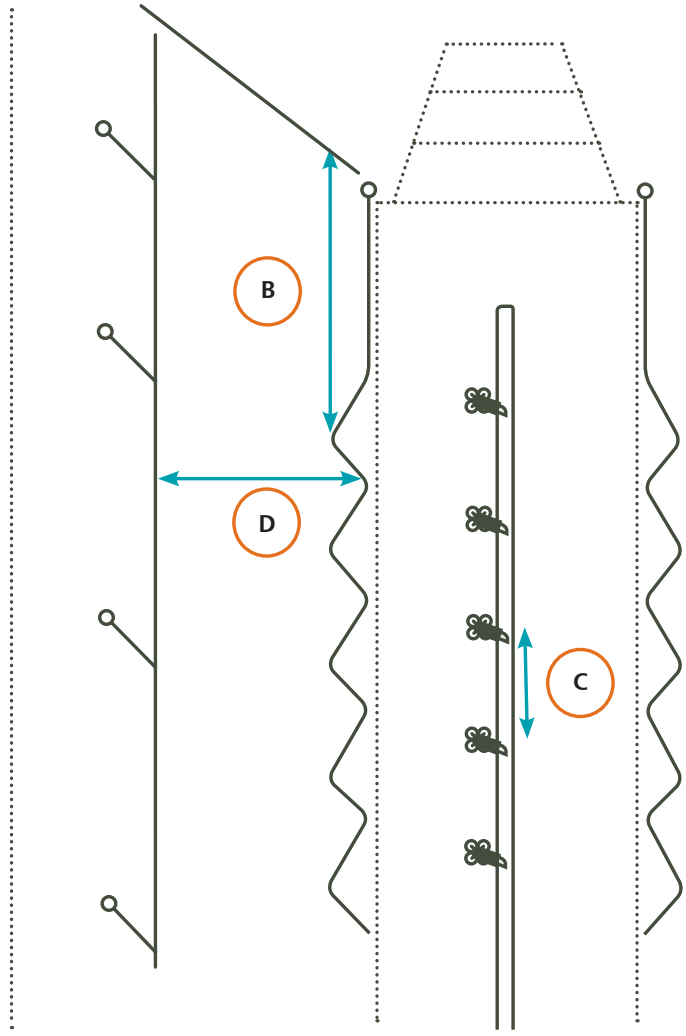
For more information and photos visit dairynz.co.nz/herringbone-entry

Herringbone bail area

The bail area should be adjusted to allow the largest animals to stand comfortably in the milking position and able to be modified throughout the season to accommodate change in body condition.

	QUESTION		MY FARM	COMMENT
1	What is the rump rail design, zigzag or straight?			
2	If zig zag, how large is the first bail space? *Guide: Measure parallel to pit from gate to tip of the first zig-zag. Advised cluster spacing + 200mm.*	B	mm	
3	What is the cluster spacing? *Guide: The wider the better for cow flow. 700mm or more.*	C	mm	
4	What is the gap between rump and breast rail? *Examples: From 1450mm (600mm cluster spacing) to 1050mm (900mm cluster spacing)*	D	mm	

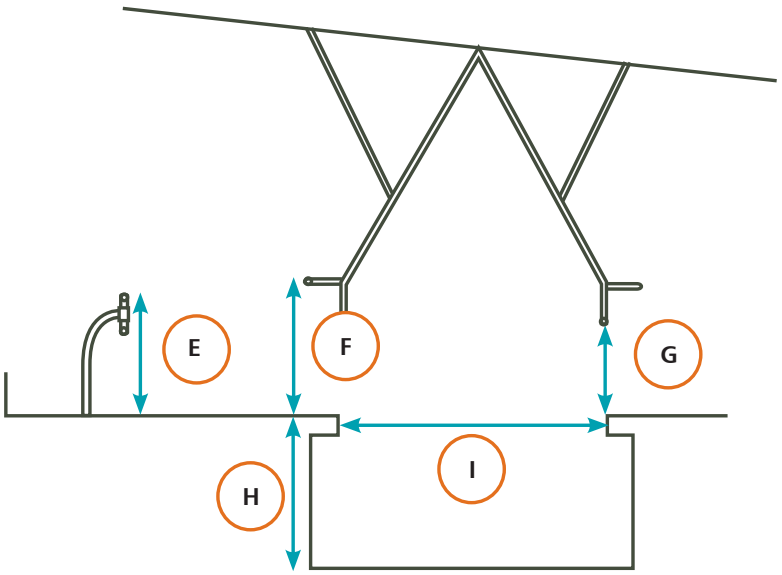
Key herringbone measurements:



For more information and photos visit dairynz.co.nz/herringbone-bail

	QUESTION		MY FARM	COMMENT
5	Is the breast rail adjustable? *Guide: The breast rail should be adjustable to allow a comfortable space depending on cow size and condition.*		YES / NO	
6	What is the breast rail height? *Guide: Friesian 760mm, Jersey 700mm to top of pipe*	E	mm	
7	Are controls for gates, feeder, wash down etc conveniently placed?		YES / NO	
8	Can the cows in yard be seen easily from the pit? *Guide: A mirror is helpful to avoid the need to step up into yard.*		YES / NO	
9	Is the bail area noisy at your farm? *Guide: Aim to create a quite calm environment. Cows are upset especially by loud unexpected noises.*		YES / NO	
10	What is the height to the top of the rump rail? *Guide: Approx 900mm high.*	F	mm	
11	What is the height to the bottom of the kick rail? *Guide: 200mm below the rump rail.*	G	mm	
12	What is the depth of the pit? What is the width of the pit? *Guide: Recommended depth of pit is 850 – 950mm*	H I	mm mm	

Key herringbone measurements:



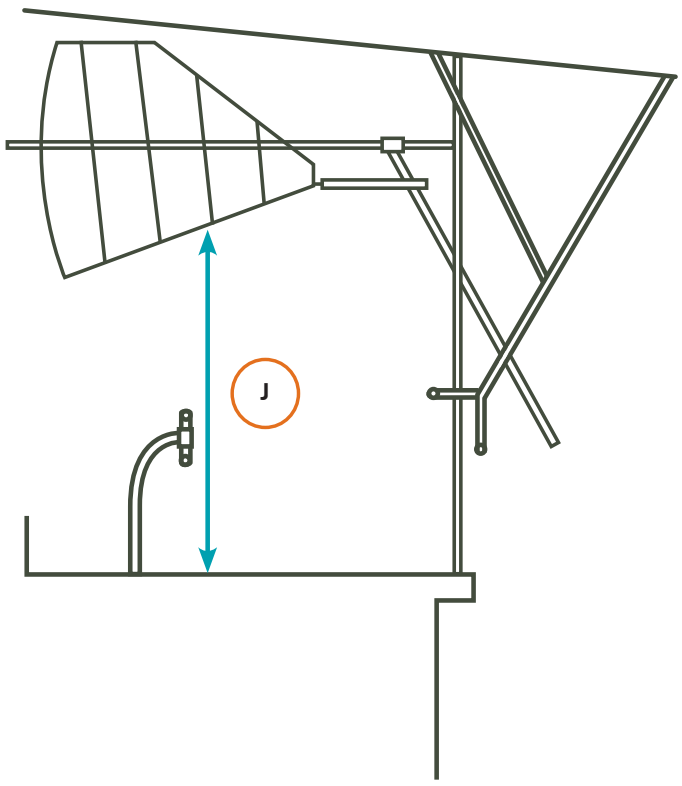
For more information and photos visit dairynz.co.nz/herringbone-bail

Herringbone head gate

The head gate should separate cows easily, be aligned with the angle at which cows are standing to be milked and allow the cows to exit freely without fear of injury.

	QUESTION	MY FARM	COMMENT
1	What type of head gate is used? *Example: Pendulum, scissor, curtain or swing. It should be easy to operate and easy to separate cows.*		
2	Does the head gate align with the angle at which cows stand to be milked?	YES / NO	
3	What is the clearance with head gate open? (J) *Guide: Clearance should be at least 1400mm above concrete measured in line with breast rail.*	mm	
4	Is there a vertical pipe at head of the first cow? *Note: Pipes cause distress if close to eyes and cow may not know when head gate is opened.*	YES / NO	
5	Is the exit narrower than the bail width? (Rump to breast rail) *Note: Preferred option is to have no narrowing on the exit, especially anything that can impact on cows' hip bones.*	YES / NO	

Key head gate measurements



For more information and photos visit dairynz.co.nz/herringbone-exit

Herringbone exit

The exit should be able to hold a minimum of half a row of cows, be constructed using non slip concrete and be free of obstacles/distractions that will interrupt flow.

	QUESTION	MY FARM	COMMENT
1	What is the area of herringbone exit concrete? *Guide: A minimum at least ½ a row of cows at 2m²/cow.*		
2	Describe the angle of turn at the exit? *Guide: It is preferred that the exit has a gentle turn to give good cow control.*		
3	How far is the distance from the head gate to end wall/ barrier? *Guide: The advised minimum distance to any barrier from the head gate is 3m.*	m	
4	Is the concrete surface slippery?	YES / NO	
5	How steep is the slope at the exit? *Guide: Less than 3% is preferred.*	%	
6	Are there any obstacles or distractions in the exit area? *Guide: Distractions are likely to slow cow flow.*	YES / NO	
7	Does the exit race go away from bail area without going past the main yard? *Guide: Cow flow through the dairy is better if cows leave towards feed without walking back past the main yard.*		

For more information and photos visit dairynz.co.nz/herringbone-exit

Tips to improve cow flow

General

- Maintain races to avoid bottlenecks, sharp corners, steep areas, poorly drained areas, and unsuitable surfaces
- Eliminate all parts of the farm dairy that can hurt cows, e.g. protruding hinges, sharp edges. Keep pipe rails on the cow side of posts wherever practical
- Set up the yard entry race so stones do not get on to yard
- Use steps rather than steep ramps. As a guide – 800mm long and 120mm–150mm high
- Eliminate slippery surfaces everywhere
- Delay moving the backing gate until about two rows or two rotations have been milked to allow the cows to sort themselves out into their milking order
- Other than in an emergency do not enter the yard
- There should be no stray voltage at any position likely to affect a cow. If in doubt, get it tested and faults corrected. Identify other factors causing discomfort that may be confused with stray voltage, e.g. faulty milking machine settings
- Where practical, even out the lighting and minimise shadows
- Keep noise to a pleasant low level avoiding any jarring high-pitched sounds. Cows find milkers shouting and whistling equally stressful
- Given the opportunity, spend time with the cows, moving quietly through them aiming to reduce their flight zones
- Always consider possible changes to people behaviour needed to minimise the effects of design faults, e.g. timing of actions, quiet talking, moving slowly
- Use improved training methods so cows are not scared of getting hurt and move confidently.

In the dairy

- Lower the breast rails until they are under the shoulders of the bigger cows (760mm to top of breast rail for Friesians, 700mm for Jerseys)
- Ensure the first cow has plenty of room (200mm more than the cluster spacing)
- If practical, extend the lead-in on the breast rail sides and elevate to around 900mm-1000mm so that 2-4 cows can line up ready to walk forward but not settle into their milking position
- Make sure the head gate lifts high enough to clear the cows – 1400mm high roughly in line with the breast rail
- Shift the vertical pipe supporting the head gate to be in line with the pit edge and fit a ‘deflector’ at about 900mm high so no cows bump into it
- Cut out any vertical pipe supporting the head gate if close to the first cow’s head. Instead, support from wall and roof
- Open head gates earlier and teach milkers how to operate them better
- If the cluster spacing is wide enough, i.e. more than 650mm, fit a zig zag rump rail and align the milking machine inlets so clusters hang evenly
- Set up backing gate controls with a pull cord along most of the pit and operate little and often
- Close to the dairy, shield the view out from the yard so cows have no distractions.

For more information visit: dairynz.co.nz/moving-cattle, dairynz.co.nz/dairy-environs and dairynz.co.nz/tracks-yards

Using the milking efficiency calculator

FOR HERRINGBONE AND ROTARY DAIRIES

The Milking Efficiency Calculator was designed to allow you to estimate improvements that can be made to your milking efficiency by changing your milking routine, applying a maximum milking time (MaxT) or increasing automatic cluster remover thresholds in herringbone and rotary dairies.

The calculator can be used in two ways. By entering your current details, the calculator will predict a herd milking time. If this number is significantly less than your current herd milking time it highlights that improvements to your milking routine can be made, e.g. cow flow. Use Milksmart resources for possible solutions. Secondly, you can use the calculator to estimate the size of the improvement to milking efficiency you can make by modifying your milking strategies (e.g. MaxT).

Download the calculator from dairynz.co.nz/herringbone-calculator.

- Start by selecting the rotary or herringbone worksheet in the bottom left hand corner.
- Enter in your farm details in the dark grey boxes (herd size, shed size etc.). Note you may need to click "enable editing" in the yellow ribbon across the top of the window.
- All the dark grey boxes in the left hand column must be filled in. Roll the mouse over the cell (red triangle) for a more detailed explanation of each box.
- Select the post-milking strategy you use at each milking. If you operate a rotary dairy, give your average rotation time.
- The light grey boxes in the middle and right hand columns are a prediction of key measures for the morning and afternoon milkings. Focus on the cows/operator/hr as this determines the total labour hours.

Understanding the results

Start by doing a quick logic check of the results – are there any improbable results? e.g. a herd milking duration of 10 hours. If so, check the input boxes. Note that the number of operators is predicted by the model and cannot be entered. In the herringbone, the model estimates a cow milking time based on the milk yield for each milking as determined by what has been entered in box c) and d). It then compares the time it will take an operator to complete the tasks, as determined by boxes b) and e). If this time is greater than the milking duration of the slower cows, then it assumes a second operator is required. If you believe the model is overestimating the number of operators, then this indicates you may be overmilking cows, or you can adjust the core work routine down until you get the desired result. In the rotary, a similar process occurs, comparing the cupping time and the rotation time entered.

The model determines a maximum potential using the values that have been entered, so it is likely that your actual performance will be slightly lower e.g. due to empty bails in a rotary. If the actual performance is well below what the model has predicted, then it is possible that poor cow flow may be reducing efficiency. See the Milksmart assessment form (pages 16-20) to help diagnose design problems.

Next, explore different end-of-milking strategies (and rotation times for rotaries) to determine if your milking efficiency can be improved further. The graphs at the bottom of the page give you an indication of the range in potential performance for a number of situations. Pay particular attention to the yellow box - total labour hours. This is a combination of the estimated time to milk the herd and the number of operators required.

Suggested things to try:

Herringbone

- If the model has estimated there is significant idle time, try changing the end-of-milking strategy. Applying MaxT or increasing the ACR threshold will help reduce idle time. Note that for MaxT, the model assumes that the slowest 20% of cows will have milkings shortened. This may result in another operator being added. In practice, it is likely to be more appropriate to only shorten the slowest 10% of cows rather than adding another operator. Or, if you believe that the operator's milking routine can be streamlined as well, then adjust this value down to remove the additional operator. Compare the number of total labour hours in your new scenario compared to what you started with. Refer to the factsheets on MaxT and efficient milking routines for more information.

Rotary

- Start with the end-of-milking criteria. If using ACR milk flow rate thresholds, then select a rotation time in which about 15-20% of cows are going-around. Then check the number of operators required. If reducing the rotation time has meant an additional cupper is required then consider whether cupping technique can be improved (reduce box e), or increase the rotation time slightly as it is unlikely the increase in throughput will justify adding another cupper. If selecting MaxT as an end-of-milking criteria then select a rotation time in which 20% of cows will have their milkings shortened i.e. not allowed to 'go around' on a second rotation. The number will go red if go-around cows are greater than 20%. As with the previous example, it may make sense to shorten the milking duration of less than 20% of the cows if it avoids needing another operator. Compare your new scenario's total labour hours with what you started with. Refer to the factsheets on MaxT and 'go-around' cows for more information.

Finally, try out the new scenario at the next milking. The great thing about these changes is that you can get immediate feedback on its success.

For more information and to download the calculator visit dairynz.co.nz/herringbone-calculator

Notes

dairynz.co.nz