SHORTER MILKING TIMES

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Introduction

Managing larger herds has lead to longer milking times, more pressure on staff and less time on pasture for cows. DairyNZ has been researching ways to reduce the time it takes to milk the herd and still achieve high standards of milk quality and animal health. While many factors influence milking efficiency, the milking duration of individual cows, in particular the slower milking cows, can have a major impact on overall milking time. In herringbone dairies, row times are often set by the slowest cow, with farmers having to hold up the entire row until that cow is milked out. There are also consequences for subsequent rows as a delay in attaching a cluster to a cow in one row leads to a delay in removing clusters from the other cows in that row while the opposite row is loaded, leading to substantial over-milking, a risk factor for maintaining good udder health. In rotary dairies slow cows usually complete a second rotation or in some cases, operators will stop or slow the platform which reduces efficiency.

For a growing number of rotary operators (54%) and a smaller number of herringbone operators (11%) the decision to remove a cluster is made using an automatic cup remover (ACR). However, on the majority of farms the decision regarding when a cow has finished milking is made by people with varying levels of skill and experience. Approaches to reducing the impact of slower milking cows on herd milking time include raising the ACR milk flow rate threshold setting (Rasmussen, 1993), establishing a maximum milking time (Clarke et al., 2004) or removing these cows from the herd.

Increasing the ACR milk flow rate setting

The operating principle for ACR is to detach the cluster once milk flow has decreased below a preset level or switch point (kg/min). An additional adjustment, usually called the ACR delay time, determines how long (s) the cluster remains attached after the switch point is reached. In New Zealand is common to set the ACR to activate at 0.2 kg/min, however internationally there is a trend towards higher flow rate settings (Stewart et al., 2002), particularly in herds milked three times daily. This follows research which has shown that increasing the ACR threshold level from 0.2 to 0.4 kg/min reduces milking duration, without affecting milk yield, milk composition, or the incidence and prevalence of clinical and sub-clinical mastitis (Rasmussen, 1993). Subsequent reports have cited field experience in commercial dairies indicating that increasing the ACR setting from 0.32 to 0.59 kg/min, or to an even higher threshold of 0.82 kg/min, can decrease milking duration while maintaining the quality and volume of milk harvested (Reid and Stewart, 1997; Stewart et al., 1999; Stewart et al., 2002).

MaxT milking

MaxT milking is simply removing clusters from cows after a pre-determined maximum time has elapsed. This approach uses time rather than flow rate as the main criterion for deciding when a cluster should be removed. If ACR are installed, a combination of MaxT and flow rate settings can be used (depending on the capability of the equipment). In other words, clusters are removed by the ACR when the flow-rate setting is reached, but if clusters are still attached when the MaxT time is reached the ACR is activated and the cluster removed.

To set a maximum cups-on time (MaxT), the average yield per cow per day (L) and milking interval are used to determine the duration to harvest the milk at the morning and afternoon milkings (see Appendix 1). Eighty percent of the herd should have completed milking within this time, while the remaining 20% of slow milking cows have the cups removed once MaxT is reached. Exceptions can be made for high yielding cows (30% or more above the herd average). In Australian studies, slow milking cows in late lactation had the maximum milking duration reduced by up to 34%, without affecting production, somatic cell count (**SCC**) or clinical mastitis (Clarke et al., 2006). Subsequent studies showed leaving residual milk did not affect SCC but that high SCC cows had higher residual yield regardless of whether or not their milking had been shortened (Clarke et al. 2008).

New Zealand research

MaxT milking and changes to ACR threshold settings have been studied by DairyNZ to determine the suitability of these approaches for New Zealand dairy herds. The first experiment was conducted at the DairyNZ Lye Farm in 2007/08 using 20 sets of identical twin cows. Twin-pairs were assigned to one of two treatment groups: cups removed at a milk flow-rate of 0.35 kg/min (Control) and cups removed at a flow-rate of 0.35 kg/min or a maximum time, whichever came first (MaxT). The study began at peak lactation when the cows were producing 2.2 kg milksolids (MS) (24.1 kg milk) and continued until dry-off (26 weeks). Although on average 30% and 28% of the MaxT milkings were shortened at the morning and afternoon milkings, respectively, the average milking duration did not differ between the groups (Control 5.8 min ; MaxT 5.7 min, SED = 0.14 min). There was no effect of treatment on total milk, fat and protein yield (Table 1). The average somatic cell count (SCC, Control 193,000 cells/ml; MaxT 213,000 cells/ml), rate of clinical mastitis (Control 0.059 cases/100 cow days; MaxT 0.058 cases/100 cow days) and proportion of quarters infected with either minor or major pathogens (Control 31.4% quarters; MaxT 25.1% of quarters) did not differ between Control and MaxT groups.

Table 1. Total milk yield, fat, protein, milksolids, and somatic cell count for Control (cups removed at threshold milk flow of 350 ml/minute) and MaxT treatment (cups removed at a milk flow-rate threshold of 350 ml/minute, or maximum time, whichever came first) groups for 26 weeks, commenced when the cows were an average of 68 (SD 7) days in milk.

Parameter	**Control**	**MaxT**	**SED**	**P-value**
Total milk yield (L)	3,116	3,099	68	0.807
Total fat (kg)	146	147	3	0.714
Total protein (kg)	115	116	3	0.776
Total milksolids (kg)	262	261	5	0.779
SCC (cells/ml)	193,000	213,000	0.05	0.585*

- Determined using log-transformed data

In the following season (2008-09), a 35-week trial starting at the beginning of lactation was carried out at the Westpac Taranaki Agricultural Research Farm (Hawera). Cows were assigned to one of 4 treatments on entering the milking herd: ACR200 (ACR threshold of 200 ml/min), ACR400 (ACR400 threshold of 400 ml/min), MaxTEarly (ACR 200 ml/min or a maximum cups-on time, whichever came first) and MaxTPeak (ACR 200 ml/min until peak lactation and then ACR 200 ml/min or a maximum cups-on time, whichever came first). MaxT was calculated based on historical average peak production data, giving milking times of 7.5 min and 5.4 min for the morning and afternoon respectively. Both MaxT milking and ACR400 decreased average milking duration, particularly in early lactation (Table 2). Pre-peak lactation, 55% (morning) and 70% (afternoon) of the MaxTEarly group were reaching the calculated maximum milking time, indicating a much greater proportion of milkings were shortened than expected. This declined to 29% (morning) and 58% (afternoon) post-peak lactation. Australian guidelines suggest that only 20-30% of the herd should have their milking duration shortened. Even though more cows were impacted by MaxT than expected, the total milk yield, total milksolids yield, incidence of CM and teat condition did not differ among the four treatments (Table 3). Pre-peak residual milk (remaining in the udder post-milking) was highest for MaxTEarly and lowest for ACR200 (1.2 kg vs. 0.2 kg $\pm$ 0.292, respectively) but after peak, the treatments had no effect on the completeness of milking out.

Table 2. Average milking duration (min) for cows milked with four different end of milking criteria.

		Treatment[1]					
		ACR200	**ACR400**	**MaxTEarly**	**MaxTPeak**	**SED**	***P***
Week 1 - 15	a.m.	8.05 ^{a}	7.38 ^{b}	6.93 ^{b}	7.92 ^{a}	0.238	<0.001
	p.m.	6.58 ^{a}	5.78 ^{b}	5.29 ^{c}	6.38 ^{a}	0.187	<0.001
Week 16 - 35	a.m.	6.85 ^{a}	6.14 ^{b}	6.34 ^{b}	6.31 ^{b}	0.169	<0.001
	p.m.	5.60 ^{a}	4.91 ^{b}	5.06 ^{b}	5.05 ^{b}	0.116	<0.001

$^{a-c}$Means in the same row with different superscripts are different ($P < 0.05$).
[1]Treatments: ACR200 = ACR setting of 0.2 kg/min; ACR400 = ACR setting of 0.4 kg/min; MaxTEarly = ACR setting of 0.2 kg/min or maximum machine on time of 7.5 min (morning milking) or 5.4 min (afternoon milking) whichever comes first; MaxTPeak = ACR setting of 0.2 kg/min for weeks 1-15 then ACR setting of 0.2 kg/min or maximum machine on time of 7.5 min (morning milking) or 5.4 min (afternoon milking) whichever comes first.

Table 3: Milk, fat, protein and lactose yield (kg/cow), proportion of cows with at least one case of clinical mastitis (CM) and SCC ($\log_{10}$) in cows milked with four different end of milking criteria during week 1 to 15 (before cluster attachment was restricted to a maximum time for MaxTPeak cows), week 16 to 35 and over the entire experimental period (week 1 to 35) (From Jago et al., 2010).

		Treatment[1]					
	Item	ACR200	ACR400	MaxTEarly	MaxTPeak	SED	P-value
Week 1 - 15	Milk	1247 [ab]	1284 [b]	1203 [a]	1308 [b]	38.41	<0.05
	Fat	57.8	58.2	54.9	58.9	1.75	0.38
	Protein	46.0 [ab]	47.1 [b]	44.4 [a]	48.0 [b]	1.31	<0.05
	Lactose	61.2 [ab]	63.2 [b]	59.2 [a]	64.4 [b]	1.9	<0.05
	CM[2]	0.16	0.25	0.21	0.22	0.044[6]	0.54
	$Log_{10}SCC$[2]	1.90 [a]	2.11 [b]	1.96 [a]	1.92 [a]	0.07	<0.05
		(79,430)	(125,825)	(91,201)	(83,180)	(1,169)	
Week 16 - 35	Milk	1810	1854	1773	1838	48.08	0.38
	Fat	87.3	87.5	84.8	86.3	2.17	0.61
	Protein	69.0	69.9	67.2	69.7	1.63	0.38
	Lactose	83.6	85.2	82.0	84.9	2.34	0.50
	CM[4]	0.04	0.11	0.04	0.05	0.025[6]	0.173
	$Log_{10}SCC$[2]	1.91 [a]	2.10 [b]	1.94 [a]	1.93 [a]	0.07	<0.05
		(81,283)	(125,892)	(87,096)	(85,114)	(1,169)	
Week 1 – 35	Milk	2992	3119	2968	3137	80.86	0.08
	Fat	142.2	144.9	139.2	144.7	3.68	0.38
	Protein	112.6	116.3	111.2	117.3	2.79	0.09
	Lactose	141.7	147.6	140.6	148.8	3.95	0.09
	CM[4]	0.18	0.32	0.23	0.25	0.046[6]	0.18
	$Log_{10}SCC$[2]	1.90 [a]	2.09 [b]	1.95 [a]	1.92 [a]	0.07	<0.05
		(79,430)	(123,020)	(89,130)	(83,180)	(1,169)	

[a-c]Means in the same row with different superscripts are different ($P < 0.05$).

[1]Treatments: ACR200 = ACR setting of 0.2 kg/min; ACR400 = ACR setting of 0.4 kg/min; MaxTEarly = ACR setting of 0.2 kg/min or maximum machine on time of 7.5 min (morning milking) or 5.4 min (afternoon milking) whichever comes first; MaxTPeak = ACR setting of 0.2 kg/min for weeks 1-15 then ACR setting of 0.2 kg/min or maximum machine on time of 7.5 min (morning milking) or 5.4 min (afternoon milking) whichever comes first.

[2](per mL) back transformed SCC in brackets.

[6]Average standard error of the mean.

The SCC was higher for the ACR400 group compared with the other three treatment groups. This result is difficult to explain and is not supported by recent published research (Rasmussen, 1993; Clarke et al., 2004; Billon et al., 2009). It is unlikely to be caused by residual milk as this was greater in the MaxTEarly treatment, and recent research also indicates that a small amount of residual milk does not affect SCC (Clarke et al., 2006). To explore this result further a short term study was conducted using early lactation cows during the 2009-10 season. In a cross-over design, 160 cows were milked with ACR set to either 0.2 kg/min or 0.4 kg/min for a 3 week period at each threshold. Milking time was shorter when the ACR was set at 0.4 kg/min with no significant difference in production, residual milk, and no effect on SCC (Table 4).

Table 4. The effect of ACR flow-rate thresholds on mean milking duration, production, post-milking strip yield and somatic cell count (SCC)

	ACR 0.2 kg/min	ACR 0.4 kg/min	SED	Sig.
logSCC	1.79	1.81	0.021	NS*
Milking duration (min)	6.82	6.04	0.044	<0.001
Daily milk yield (kg)	16.97	16.77	0.088	<0.05
Daily milk fat yield (kg)	0.78	0.77	0.007	NS
Daily milk protein yield (kg)	0.65	0.64	0.003	<0.05
Post-milking strip yield (kg)	0.19	0.35	0.071	<0.001*

* Determined using log-transformed data

Case study farms

Farm 1: Lincoln University Dairy Farm

The Lincoln University Dairy Farm applied MaxT milking in early November 2008/09 and initially decreased the daily time spent milking declined by 37-48 min. Staff were hesitant to implement the faster milking speeds in the first week and, overall, milking times failed to reach the MaxT target. No effect was apparent on bulk milk SCC (Figure 1), and there was no increase in the incidence of CM (Figure 2).

Sending cows around for a second rotation on the rotary platform had very little effect on the overall milking duration. In a single week, approximately 5% of the herd was sent around twice, without affecting the number of cows milked per minute for the same period. The most important factor in decreasing milking times in a rotary is the actual speed of the platform. It will be important to establish the critical proportion of the herd that could be sent twice around without greatly affecting efficiency.

This information may be crucial in improving adoption on commercial farms despite there being strong evidence that shortening the milking duration on these cows will not adversely affect udder health. If 3-5% of the herd could be sent around twice, rotary-shed farmers may have greater confidence that this system of milking will not increase bulk SCC or clinical mastitis.

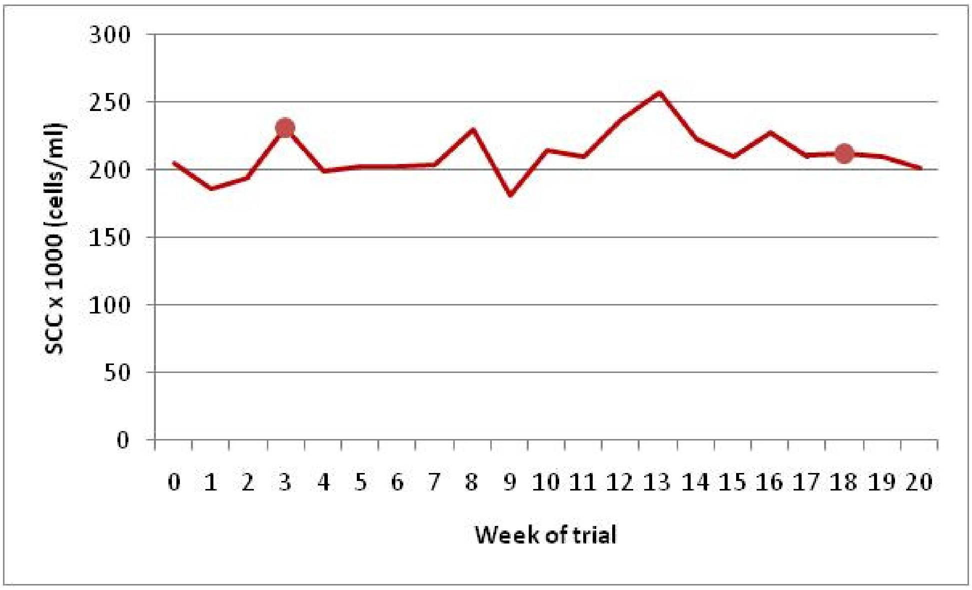

Figure 1. Weekly average of bulk milk SCC. Bold points indicate the start and finish of the MaxT implementation period

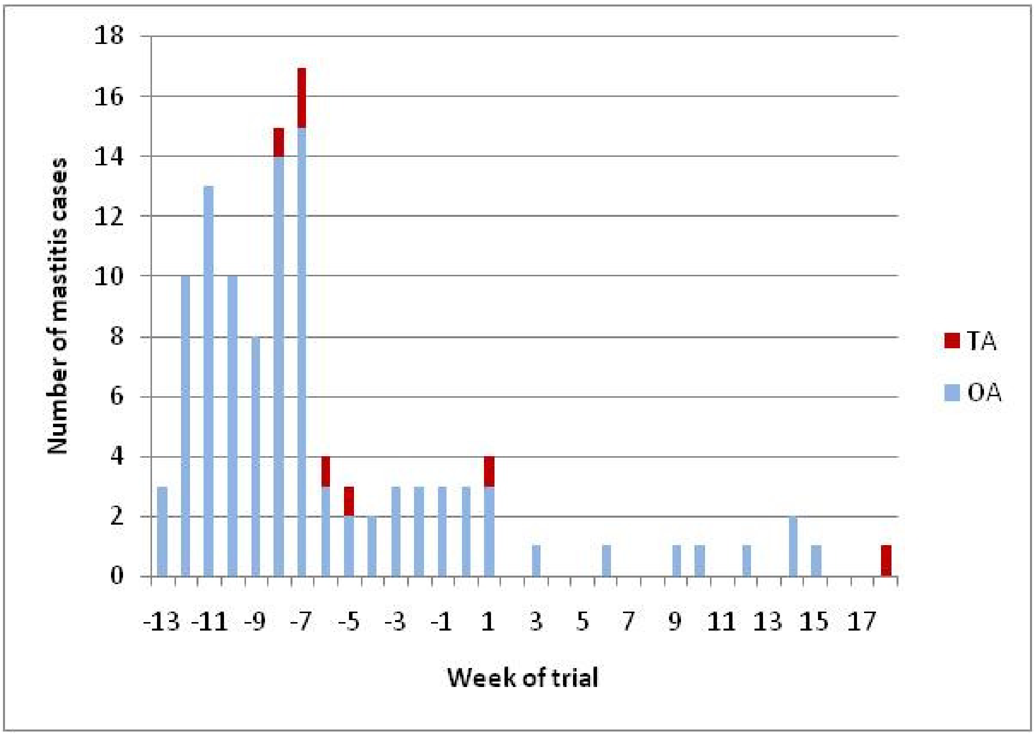

Figure 2. Total number of new cases of clinical mastitis by week detected from start of lactation for twice around (TA) (n=25) and once around (OA) (n=656) cows. Arrows indicate start and end of MaxT

Farm 2: Gordon David, Waikato

Farm details

95 ha effective, 288 cows, system 1 (<4% imported feed), 24-aside herringbone

Staff

Gordon is a sharemilker, Joanne works off-farm but milks every second weekend when Kerry (full-time worker) is off.

Background

Gordon has been sharemilking on the property for a number of years. Slow milking cows were causing long milking durations even though they were typically managed by getting the cups on earlier and using weights. If slow cows were still milking when the majority of the row had finished, cups would be weighed by hand until the cow was fully milked out before releasing that side. At the start of the 2009/10 season, Gordon decided not to wait and these cows were released with some residual milk. He did not calculate MaxT *per se*, but simply did not worry about under-milking a proportion of his herd.

Time savings

Gordon achieved time savings of around 15 minutes per milking, resulting in 1 hour labour saving (2 staff at each milking) per day. The greatest savings were at peak lactation. Gordon more readily adopted the MaxT approach than other farm staff. Those milking infrequently found it most difficult to adopt.

Barriers to implementation

Mastitis was the main concern. A couple of slow milking cows got clinical mastitis and were culled. His advice to farmers is to not take into account the figures for any cows with repeat mastitis and to 'just send them off' as they are costing money in the long term. The SCC for this herd has always been below national average, with no exception this season.

Impact on production, SCC or cases of CM

"No" for production or SCC, but 2 cases of CM were attributed to under-milking.

Has anything changed as a direct result of MaxT?

Gordon said that his perspective of when to take the cups off slower milking cows changed when he tried MaxT milking. He believes 'it is the way to go'. There was no change to the start times but Gordon used the time after the morning milking to have "longer breakfasts", but this included spending more time on administration. They finished earlier in the afternoon, allowing more leisure time for staff.

What advice would Gordon have for farmers wanting to use MaxT?

Gordon intends to continue MaxT milking next season and has been active in telling other farmers about the benefits of MaxT. His advice is to cull cows that are problematic with mastitis and "just do it" (MaxT). For him, the cows need to fit the system, not vice versa, so if a cow is unsuitable for MaxT then he would simply cull her from the herd. With an in-calf rate of 95% he certainly has the flexibility of selective culling!

Farm 3: Sharn and Billy Roskam, Winton

Farm details

182 ha effective, 599 cows, system 2 (4-14% imported feed), 36-aside herringbone, no in-shed feeding.

Staff

Sharn and Billy are sharemilkers, employing between 1-2 part- and full-time staff. In the 2009-10 season they were rostered for 18 AM milkings and varied PM milkings per 4 weeks.

Background

Sharn and Billy have been sharemilking on this farm for 2 years. They decided to implement MaxT milking after learning of the trial work that was being carried out at DairyNZ. They started focussing on the milking times of the slower milking cows and implemented MaxT in late December 2009.

How was MaxT implemented?

A wrist watch was used to time the milking time of the last cow cupped in a row. MaxT was easier to implement for Sharn than for Billy and other staff. She only took several days to adapt to releasing cows with some residual milk. Her greatest motivation was to exit the shed earlier! Billy took about 1-1.5 weeks to adapt. He had more concerns regarding SCC and CM.

Time savings?

Maximum time savings were in the order of 45-60 min per milking (up to 4 hours of labour saved daily with 2 staff required per milking). For some milkings row times were around 6-7 minutes which was much quicker than the guidelines suggested were achievable for their shed type and resulted in much greater time savings than was assumed using the guidelines. They used MaxT creatively, and in late lactation were using MaxT at the PM milking, but were taking slightly longer at the morning milking to properly milk out their slower milking cows. This was in part due to lifestyle: take things easy in the morning, working fast in the afternoon for more leisure time. They marked slow milkers on the legs with blue bands and spray paint. As these cows entered they were given preferential cupping (early) and slow quarters were weighted.

Impacts on production, SCC or clinical mastitis

Originally there were concerns regarding SCC and CM, especially from Billy. Sharn watched SCC for first couple of days, and was satisfied with Bulk Milk SCC; Billy took longer to be convinced. It was more stressful in the beginning for Billy, seeing cows exiting with some residual milk. For both, it became very natural to release a proportion of cows with residuals. Although milking was very fast in the PM, they had what they called "MaxT" nights; if wanting to finish earlier due to functions etc, they "MaxT'd" it, working as fast as they possibly could. Both now have no concerns regarding SCC, CM or production when cows are not milked out fully. For them, part of the success requires knowing the cows. By using MaxT they became more aware of which cows and what quarters were affecting their milking times. Marking cows was of great assistance.

What has changed since implementing MaxT?

Billy and Sharn have become more aware of what affects cow flow in the dairy as a result of MaxT, and enjoy milking more. The start times in the mornings were not altered as Billy felt that the additional time could be spent doing other work on the farm. The start time for the PM milking also remained the same resulting in an earlier finish and increased leisure time for all.

Any advice to other farmers?

Their advice to farmers is to give it a go. They would suggest "cold turkey" – apply the MaxT times and persevere with it. They feel it is important to learn to identify those slow milkers and get the cups onto them sooner.

Conclusions

The research conducted by DairyNZ supports earlier work undertaken in Australia and indicates that both MaxT and increases in the ACR flow-rate threshold are powerful strategies for improving milking efficiencies with minimal affects on production or udder health. Dairy farmers wanting more information on this research or incorporating MaxT milking into their milking routine, please contact: jennie.burke@dairynz.co.nz or jenny.jago@dairynz.co.nz

Acknowledgements

The contribution of staff at Lye Farm (DairyNZ, Hamilton), Westpac Taranaki Agricultural Research Farm, the Lincoln University Demonstration Farm and case study farms is gratefully acknowledged. We thank John Williamson and Jacqueline McGowan for technical assistance during the experimental studies. This research was funded by DairyNZ on behalf of dairy farmers.

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Appendix 1. Calculating Max T

Max T is determined using Table 6, which is based on the average yield of a group of cows at that milking. Basing the Max T 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 counter productive to set Max T 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 Max T based on their individual yield.

Calculating Max T - 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 7.

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 Max T. 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 Max T for the AM and PM milking may be different if the yield expected at these two milkings differs. Table 8 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 8:

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 Max T for am and pm milkings

Look up the Max T applicable for the AM and PM milk yields using Table 6. 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 Max T. Many 'elite' cows with exceptionally high production will often milk-out within the allocated Max T 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 Max T milking regime, or giving them a separate Max T 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 Tables 6 & 8 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.

Tables for calculating Max T

Table 6. Estimator of maximum milk out times

Yield per milking	**Max T (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+
21	10:36	10.6	27+
22	10:57	11.0	29+
23	11:18	11.2	30+

Note: The shaded sections of the table indicate yields at which there is limited data available on which to base the expected Max T. Modelling has been used to predict suitable Max Ts.

Table 7. Herd groups used in setting MaxT

Calving pattern	Stage of lactation	Max T 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 8. Morning and afternoon yield (estimated from daily yield at different milking intervals).

daily milk yield (L/day)	Milking Intervals (hours from start of milking)									
	10	14	11	13	9	15	8	16	12	12
	evening	morning	evening	morning	evening	morning	evening	morning	evening	morning
8	3	5	4	4	3	5	3	5	4	4
9	4	5	4	5	3	6	3	6	5	5
10	4	6	5	5	4	6	3	7	5	5
11	5	6	5	6	4	7	4	7	6	6
12	5	7	6	7	5	8	4	8	6	6
13	5	8	6	7	5	8	4	9	7	7
14	6	8	6	8	5	9	5	9	7	7
15	6	9	7	8	6	9	5	10	8	8
16	7	9	7	9	6	10	5	11	8	8
17	7	10	8	9	6	11	6	11	9	9
18	8	11	8	10	7	11	6	12	9	9
19	8	11	9	10	7	12	6	13	10	10
20	8	12	9	11	8	13	7	13	10	10
21	9	12	10	11	8	13	7	14	11	11
22	9	13	10	12	8	14	7	15	11	11
23	10	13	11	12	9	14	8	15	12	12
24	10	14	11	13	9	15	8	16	12	12
25	10	15	11	14	9	16	8	17	13	13
26	11	15	12	14	10	16	9	17	13	13
27	11	16	12	15	10	17	9	18	14	14
28	12	16	13	15	11	18	9	19	14	14
29	12	17	13	16	11	18	10	19	15	15
30	13	18	14	16	11	19	10	20	15	15
31	13	18	14	17	12	19	10	21	16	16
32	13	19	15	17	12	20	11	21	16	16
33	14	19	15	18	12	21	11	22	17	17
34	14	20	16	18	13	21	11	23	17	17
35	15	20	16	19	13	22	12	23	18	18