Maximum Milk Out Times (MMOT)

1. Introduction

The purpose of this Quick Note is to describe the basics of Maximum Milk Out Times milking regimes.

2. Interpretation and relevance to Australian conditions

Most dairy farms are keen to find ways of reducing the time it takes to milk. MMOT is a low cost way for many farms to reduce their milking times. It is particularly suited to dairies where the milkers are limited in what they can do by the time it takes for cows to milk out.

3. Relationship to CowTime goals

MMOT is one way to make milking times shorter. The MMOT requires clusters to be taken off cows when they have finished milking **OR** when a maximum time related to their milk yield is reached. Research has show that the implementation of MMOT can increase the number of cows milked in an hour in the vast majority of Australian dairies. Apart from the time savings, the research has demonstrated no loss of milk yield and no increase in the risk of mastitis or somatic cell count. In most cases milkers do not need to wait for slow milking cows.

4. How to apply MMOT

The MMOT milking regime can be described as one where cows are milked to one of two predetermined end points:
♦   to a predetermined flow rate end point, **or**
♦   to an end point where a maximum allowable milking duration is reached.

The flow rate end point ensures that the majority of cows are not over-milked, whilst the maximum milk out time ensures that slow milking cows do not unduly slow milking times.

MMOT is determined using Table 1, which is based on the average yield of a group of cows at that milking. Basing the MMOT on the average yield is important. To get the 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. The impact of MMOT on the whole herd has been the focus of much of the research - testing the impact of applying one MMOT time (based on average yield of the group) across the whole herd (made up of individual cows with different individual yields). Guidelines on setting MMOT based on various groups within herds are given in Table 2.

Individual cows producing 30% more than the average yield are classed as 'elite' and may be significantly under-milked if subjected to the same MMOT as the group. It may be preferable to give these cows a separate MMOT based on their individual yield.

Steps in applying MMOT

Step 1 Determine your mean daily milk yield
Determine 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.

Step 2 Determine the litres of milk per cow on average for morning and evening milkings
The MMOT 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 can be expected at AM and PM milkings over a range of different daily yields and inter-milking intervals.

Step 3 identify the MMOT for your milking
Having identified how much milk per cow is expected at a milking, consult Table 1 to find the appropriate MMOT. This is the longest time that a cluster should be on a cow, except for 'elite' cows.

Step 4 Identifying 'elite' cows (optional)
Some farmers may wish to make exceptions for cows they consider 'elite' and exclude them from the MMOT milking regime. If this is so, it is advisable to exclude their yield results from the mean milk yield calculation too. As a general rule we define an 'elite' cow as one that has a milk yield greater than 32% above the group average yield.

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However, exempting a large number of cows is counterproductive. Many 'elite' cows with exceptionally high production will often milk-out within the allocated MMOT based on the average yield. This is because these individual cows also tend to have high milk flow rates.

How to work out the time while milking?

A simple timer can be used to indicate the amount of time that has passed. These can be used just to display the time that has passed or some can sound an alarm when the set MMOT has been reached. The exact method of working out the time that has passed is really up to the milker. The important thing is to have an accurate idea of the time that a cluster has been on a cow.

How do you know that a MMOT regime is working?

There are three characteristics of herds where MMOT regimes are working well:

♦ Daily milk yield should be maintained.
♦ Not more than 20% of cows in the MMOT group should be cut short at a milking.
♦ Milking times (from first cups on to last cups off) should be reduced.

Daily milk yields should be maintained following introduction, although you may see a slight shift of milk from the AM to the PM milking in herds with an uneven inter-milking interval. To check that MMOT regime is providing a benefit - record the time you start and finish for the four milkings prior to changing to MMOT, and record the litres in the vat for these two days. This will give you figures for:

♦ the average time for AM and PM milkings and,
♦ the average production per day (litres).

Change to MMOT and again monitor milk production and the time taken for four MMOT milkings.

Compare the average AM and PM milking times and the litres produced against your earlier figures. Yield should not have changed by more than what you would normally expect between days and you should notice some saving of time in the milkings where MMOT was being implemented.

5. Potential challenges with implementation

Although the research has been quite comprehensive, there are still situations in which it would be prudent to show caution before applying MMOT. These are:

♦ herds with a high BMCC of over 400,000 cells/ml.
♦ high production herds (average group milk yields of over 20 litres per milking).
♦ applying MMOT based on average group yield prior to peak lactation. In these situations we recommend setting the MMOT based on the expected average milk yield that the group will achieve at peak.

6. Robustness of this information

The information presented in this Quick Note is supported by Australian research and industry experience.

7. References and further reading

Clarke, T., Cuthbertson, E.M., Greenall, R.K., Hannah, M.C., Jongman, E.& Shoesmith, D. (2004) Milking regimes to shorten milking duration. Journal of Dairy Research 155 (15): 445-448

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Table 1. Maximum Milk Out Times Table

Estimator for MMOT and 'elite' cows			
Yield per milking	MMOT (min:sec)	MMOT (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+
24	11:39	11.6	31+
25	12:00	12.0	33+
26			34+
28			36+
30			39+
32			42+
34			44+
36			47+
38			49+
40			52+

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

Table 2. Herd groups used in setting MMOT

Calving pattern	Stage of lactation	MMOT 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. **AM & PM yield**
(estimated from daily yield at different milking intervals)

Estimator for evening & morning milk yields from daily milk yield										
daily milk yield (L/day)	**Milking Intervals**									
	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
36	16	21	17	20	14	23	12	24	18	18
37	15	22	17	20	14	23	12	25	19	19
38	16	22	17	21	14	24	13	25	19	19
39	16	23	18	21	15	24	13	26	20	20
40	17	23	18	22	15	25	13	27	20	20
41	17	24	19	22	15	26	14	27	21	21
42	18	25	19	23	16	26	14	28	21	21
43	18	25	20	23	16	27	14	29	22	22
44	18	26	20	24	17	28	15	29	22	22
45	19	26	21	24	17	28	15	30	23	23
46	19	27	21	25	17	29	15	31	23	23
47	20	27	22	25	18	29	16	31	24	24
48	20	28	22	26	18	30	16	32	24	24
49	20	29	22	27	18	31	16	33	25	25
50	21	29	23	27	19	31	17	33	25	25