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FULL-SEASON ONCE-A-DAY MILKING SYSTEMS: SUCCESSFUL METHODS AND FARM PERFORMANCE

List of contents

1. Introduction

2. Preparations, before the change to OAD.

3. Practices for OAD.

4. Herd performance on OAD

5. Conclusions

Appendix 1: Evidence for good performance from full-season OAD systems (by Colin Holmes and Leo Hendrikse).

Appendix 2: Control of mastitis; principles and comparisons between herds milked TAD or OAD (by Dr Adrian Joe).

1. INTRODUCTION

Many methods and practices used on once-a-day (OAD) farms are the same as those used on twice-a-day (TAD) farms. However, there are some differences.
Methods for which OAD differs from TAD will be described briefly, and methods that are believed to be even more important for OAD than for TAD, will be emphasised.
Finally, some information is presented about the levels of performance that can reasonably be expected from OAD systems.

The information below has been compiled mainly from the collective wisdom of experienced and successful OAD dairy farmers, members of the Southern North Island OAD Discussion Group.

Other valuable sources of information;

- Proceedings of the OAD Milking Conference, 2007; available from LIC, Hamilton.
- Workshop on OAD Milking Systems at the South Island Dairy Event (SIDE), Lincoln University, June 2011. Both are available at:

http://www.dairynz.co.nz/page/pageid/2145867877/Conference_Proceedings

- Farm Facts 4.1 to 4.6, available in the DairyNZ website

- Appendix 1 in this document provides a background and context for OAD as a milking method; its 3 tables showing the physical and financial performance of OAD farms, and a vision for OAD in 2020.

2. PREPARATIONS, BEFORE THE CHANGE TO OAD

Limited data from farms using OAD systems, show that they experienced their largest losses of production in their first season on OAD, of about 15-25% in kg MS per cow and 15% in kg MS per hectare. Careful preparation during the final season on TAD should help to minimise these adverse effects in year one on OAD, including the expected increase in SCC.

Type and age of cows

- As for TAD, high BW cows are also generally best for OAD too (but see Breeding Programmes for OAD cows, in 3 below). Compared with TAD, milksolids (MS) yields per cow are generally decreased on OAD, but this decrease is smaller for Jerseys and J x HF crossbreds than for Holstein Friesians.
- Good udder conformation is especially important for OAD, because with nearly 24 hours between milkings, the udders will be full, heavy and tightly-stretched before each milking. Udders must be strongly attached to the body, with evenly-sized quarters, and well-placed teats that can be milked easily even when the udder is full. **Strong, healthy udders, with low SCCs are a prerequisite for an OAD herd.**
- Cows that have records showing clinical mastitis, and/or high SCC should be culled before OAD begins. One experiment shows that MS production of cows with low SCCs is likely to be less affected by OAD than that of cows with high SCCs.
- In an attempt to identify cows not suited to OAD; OAD could be used for the last months of the final TAD season, and those cows that dry themselves off quickly, and become fat when milked OAD could be culled or sold to TAD herds.

Drying-off at the end of the final season on TAD, mastitis control and culling

- Take this opportunity to eliminate/control/cull any mastitis problems, and cows with weak udders, before OAD begins.
- If there is evidence of a mastitis problem in the herd (e.g. herd SCC above 250,000), serious thought should be given to the use of DCT and Teat-Seal on **all** cows; and the use of Teat-Seal in the heifers, about 4 to 5 weeks before calving for their first time, should also be assessed.
- At the very least, stick to the guidelines given in the SAMM plan, with respect to treatment and culling.
- Including a high % of replacements into the herd will enable more voluntary culling; and 2-year-olds generally have lower SCC than older cows, and higher BWs. But 2-year-olds produce about 25% less per cow than mature cows, and their MS yield is decreased by OAD to a greater extent than is the yield of older cows.

Stocking rate (cows per ha) for the first season of OAD

- In the early part of the first season on OAD, it will probably be necessary to remove 5% to 10% of cows, because they are obviously unsuited to OAD (unless cows not suited to OAD had already been identified and culled in the season prior to the change to OAD). Extra cows should be calved to allow for this expected early culling, or on-selling of unsuitable cows.
- In this first season on OAD, milksolids yield per cow is likely to be lower by 10 to 25%. Consequently, at least for the first year or two on OAD, an increase in cows/ha (by 10 to 15%) is often recommended, to compensate for the expected decreases in pasture eaten per cow and milk produced per cow.
- BUT BEWARE! If the stocking rate is too high in this first season on OAD, this will cause periods of pasture deficit, with consequent decreases in pasture intake and yield per cow; in this case, milksolids yield per cow would be depressed by OAD and by underfeeding.
- Therefore, any increase in cows per hectare should be calculated carefully, to ensure that, first, there will be enough cows on-farm to enable early culling of those that are unsuited to OAD, and also to fully utilise the pasture, but, second, the farm will not be over-stocked.

Milking machine

(On OAD, the udders are likely to be very tight and full before each milking; therefore, during milking, the rate of milk flow through the milking machine will be faster than on TAD. These conditions may necessitate some changes in the machine).

- Cup slip can be a bigger problem on OAD; seek advice from experienced OAD farmers or from milking specialists, about the type of long milk tube, milking cluster and teat-cup liner that have been found to work effectively with cows milked OAD.
- Ensure that the machine's vacuum level is stable, and at the correct level, during the whole milking; the machine must have sufficient reserve air-flow capacity.
- The milk line, milk pump, and the milk cooler and refrigeration unit must all have sufficient capacities to cope with the faster rates of milk flow expected on OAD.

3. PRACTICES FOR OAD

Springer's and colostrum cows

- **When to start OAD** Collect cows and calves on the day of calving, and milk the cows OAD from then on.
- Withholding periods for colostrum cows, expressed as the number of days after calving; Fonterra's rules state that colostrum from each cow should be withheld from the vat for at least 8 milkings, equivalent to 4 days for herds milked TAD.
- Members of the OAD Group generally withhold colostrum from the vat for 4 days (or, on OAD, 4 milkings) for cows, and for 5 days (or 5 milkings) for heifers. (At least one OAD farmer has used the normal TAD withholding period of 8 milkings (or 8 days on OAD) for cows calved in the first week of calving, when most of the herd is producing colostrum; and he gradually reduced this down to a

withholding period of 4 milkings (4 days) for cows calving in the fourth week, when most of the cows will be producing normal milk).

- During the 4 day withholding periods, the colostrum is likely to meet the new-born calves' needs for immune proteins (i.e. in the first day of life, 4 litres of colostrum per calf, preferably from the cow's first and second milkings).
- If colostrum is to be supplied to Fonterra; collect colostrum from the first two milkings, or days, to ensure sufficiently high concentrations of immune globulins.
- While the newly-calved cow still in the colostrum herd, check all quarters/cows with the Rapid Mastitis Test (RMT).
- Do not put a cow's milk into vat unless RMT indicates a low SCC.
- One OAD farmer milks the main herd and switches-off the machine. The freshly calved cows are then collected and milked, followed by the colostrum & sick cows. The milking plant is then washed and finally switched-off for the day.
- It is advisable to inspect newly-calved colostrum-cows twice a day, to minimise losses e.g. from milk fever. If dusting pastures in wet weather e.g. with magnesium chloride, do it twice a day.

Milking methods mastitis and its treatment

Generally these are the same as for TAD; BUT, on OAD, there are 2 potentially important differences:

a) *Just before cups-on, the udders will be even fuller and tighter than on TAD.*

b) *After cups-off, it will not be possible to inspect the teats/udders closely for the next 24 hours, much longer than on TAD. In addition, this longer inter-milking interval may enable mastitis infections to become more firmly established before the next milking. (see details in Appendix Two).*

- **During milking MUST** ensure that teat cups are aligned correctly on the teats, and that they remain firmly in place without slipping.

- **Before cup removal MUST** ensure that all udders/quarters have been thoroughly milked-out and are empty.

- **After cup removal MUST** look for, detect and attend to, any abnormal quarters (e.g. full/hard/hot), even if cups are removed by automatic devices.

- Some farmers strip fore-milk from one (or two) quarters of all cows at one milking (e.g. front right), and rotate around the udder so that, after 4 (or 2) milkings, all 4 quarters of every udder have been checked for abnormalities.

- One OAD farmer, who pressure-washes the teats/udder before cups-on, believes that this helps the cows to milk out more evenly.

- **MUST** ensure that every teat is covered thoroughly with an approved teat spray disinfectant, after every milking; this is probably even more essential than it is on TAD *(and discovery of a teat sanitiser that protects the teats for the full 24 hours, will be of special benefit on OAD).*

- Another OAD farmer reports good results, including reductions in clinical mastitis and animal health costs, after the installation of a new automated cluster/teat cup system. This system sanitises the skin of each teat immediately after the end of milk flow from the cow and then, after cup removal, it also sanitises the inner surfaces of each teat cup liner.

- After every milking, the milk filter should be inspected for any abnormalities. If clots are discovered, the culprit-cows should be identified at the next milking, by inspecting fore-milk from suspect cows. Cows showing abnormalities in their milk should then be tested with the RMT *(it is possible that, on OAD, infected cows produce clots that are more easily detected on the filter).*

Withholding times for milk from a cow after antibiotic treatment

- if a product is not registered for OAD milking, use the number of **milkings** recommended for TAD (e.g. if 48 hours & 4 milkings recommended on TAD, then use 4 milkings, or 96 hours, on OAD); that is, the withholding time on OAD will be twice as long as for TAD.

- However, Pfizer Animal Health Company recently published details about 2 antibiotics, for which the recommended withholding times for OAD are *NOT* twice as long as those for TAD, as shown below;

Lincocin Forte S; 3 tubes at 24 hour intervals; withholding time for OAD = 96 hours or 4 milkings *(for TAD= 60 hours or 5 milkings).*

Orbenin LA; Either 3 tubes at 48 hour intervals; withholding time for OAD = 72 hours or 3 milkings *(for TAD= 84 hours or 7 milkings).*

OR

5 tubes at 24 hour intervals; withholding time for OAD = 96 hours or 4 milkings *(for TAD= 96 hours or 8 milkings).*

- Because, on OAD, antibiotics can be infused only once per 24 hours, it may be advisable to administer more than the minimum recommended number of tubes for effective treatment over a longer period (e.g. instead of 3 to 4 days recommended minimum on TAD, administer for 4 to 5 days on OAD); but seek veterinary advice before doing this.

- Even though the herd is on OAD, some vets recommend that cows being treated with antibiotic for clinical mastitis, should be milked TAD during treatment. This more frequent removal of infected milk from the quarters, and more frequent infusions of antibiotics may assist cure and recovery.

Management of cows in normal lactation (e.g. more than 20 to 30 days after calving)

- Just as for TAD cows, OAD cows need to eat sufficient feed to maintain themselves, and pregnancy, and to produce milk. Underfeeding will depress milk production of

cows, regardless of whether they are milked OAD or TAD. Do not voluntarily underfeed cows milked OAD.

- Grazing management is generally similar to TAD; targets for pre-grazing yields and post-grazing residuals are the same as for TAD.

- Generally, most OAD farmers shift cows onto a fresh area of pasture twice a day; but some shift them only once, and claim useful advantages from this. The herd, and its water supply, should be checked twice a day.

- To ensure good milk production, cows must consume sufficient Metabolisable Energy each day. Therefore the cows must be offered enough pasture each day, and the pasture must be of high quality (i.e. high % of young green leaf, high digestibility, high MJME/kg DM). These factors are essential for all cows; but they may be even more essential for herd milked OAD, to entice cows to continue to eat large amounts of feed without the stimulation provided by the second milking. Therefore excellent management of grazing and feeding is essential for OAD cows, to ensure long productive lactations, and full utilisation of high quality pastures.

- Many herds milked OAD receive supplements; mainly silages, PKE and hay. The responses, in kg MS/ Kg DM fed as supplement, are likely to be slightly lower in cows milked OAD than in cows milked TAD.

- Mating and Fertility; A 4 year trial in Taranaki comparing Holstein-Friesians and Jerseys milked either OAD or TAD showed that OAD reduced the time from calving to conception by 5 days and increased 3-week pregnancy rate by 8%, but with no change in final pregnancy rate. The percentage of Holstein-Friesians cows treated with CIDRs was substantially reduced from 24% for TAD to 5% on OAD, but the corresponding reduction of 7% in Jerseys was not significant.

- Farms that use OAD systems also achieve better than average submission and pregnancy rates, with compact calving periods and a low percentage of empty cows from shorter that average mating periods. (See Table 2 in Appendix One).

- The majority of OAD herds use no inductions, and most use no CIDRs either.

- In a 640 cow Jersey herd in the Waikato, milking approximately half the herd OAD for 2 years, empty rates for those on OAD were 3-4%, but 8-9% for those on TAD.

- Most OAD farmers use Tail Paint to assist with detection of cows on heat; some observe cows and their tail paint for signs of heat only at the one milking per day, while some also observe the cows while they are undisturbed in the paddock.

Genetic Improvement programmes for OAD herds

Most of the group members are farming with high BW crossbred (Holstein Friesian x Jersey) cows (see below for the effects of OAD on different breeds). But some OAD herds comprise mainly Holstein Friesians or mainly Jerseys.
Most members use proven High BW sires; although some have used sires with high OAD BWs.
A successful OAD farmer, now in the 10th year on OAD, milks Jersey cows producing 340 to 370 kg MS/cow. He uses the criteria shown below to choose sires for use via AB;

i. High BW.

ii. Negative values for BV Milk; e.g. from – 300 BV milk up to 0 BV milk (for Jerseys). Small + BV milk values can be accepted if all the traits below are very good.

iii. BV for udder support BV must be always positive i.e. + 0.3 or better.

iv. BV for SCC must always be negative e.g. BV - 0.3; and the bigger the negative value is, the better.

v. BV for protein % must be positive; e.g. BV + 4 or better.

vi. Farmer Traits BVs should all be positive, especially Temperament & Milking Speed.

But other members have tried to use these criteria to select sires for their own herds, and have found that it is difficult to meet them all in one sire.

4. HERD PERFORMANCE ON OAD

Yield of MS per cow for a full lactation

- This is likely to be lower than would have been expected on TAD, especially in the first and second seasons on OAD.

- Jersey cows and older cows generally show the smallest decreases; while Holstein Friesian cows and 2 year olds show the largest decreases. For example, 15% decreases in mature Jerseys; 31% decreases in 2 year old Holstein Friesians (Data from Dr A Winkelman, LIC).

- Limited evidence shows that, on OAD, decreases in yield are smaller in cows with low SCCs.

- These lower yields of MS per cow would be expected to reduce the cow's Feed Conversion Efficiency (kg MS produced per t DM eaten). But, the normal calculations of feed required by TAD cows are likely to overestimate the energy requirement of a OAD cow by up to 5% (because OAD cows spend less time walking and standing on concrete, and more time lying on pastures. Also, they lose less body condition during lactation, and have to regain less condition before calving, a relatively inefficient cycle of loss and subsequent regain of body tissues).

- OAD cows generally do produce extra milk in response to extra feed, especially if their initial intake of ME had been limiting production. Their response, expressed as g extra milk per kg extra DM given, is likely to be slightly lower than would normally be expected from TAD cows.

- After several seasons on OAD, all unsuitable cows will have been culled, and average yield per cow will have increased. These higher yielding cows will of course require more feed, and may also be a bit thinner than they had been in the early years on OAD.

Milk composition

- Concentrations of fat and protein are usually higher by 0.1% to 0.3%, so that MS % is likely to be higher by 0.3% to 0.5%.

- But the concentration of lactose is usually lower by about 0.2%.

- The concentrations of some minor, but potentially valuable, components are also higher in OAD milk; these include immune globulins and lactoferrin. SCC of milk is usually higher in OAD cows than in TAD cows, even in uninfected cows; e.g. by 10,000 to 50,000 in early lactation, and by 50,000 to 100,000 later. Even so, the average SCC of the OAD herds in Table 2, Appendix 1, was lower than the NZ average SCC.

The lactation curve

- The difference in daily yields between OAD cows and TAD cows is largest at the peak of lactation. For healthy, well-fed cows, peak daily yields of between 1.4 and 1.8 kg MS/cow can be expected from OAD cows, whereas 1.8 to 2.2 kg MS/cow daily can be expected from TAD cows.

- Later in lactation the difference in daily yields between OAD and TAD cows is smaller.

- This effectively "flattens" the lactation curve of OAD cows when compared with TAD cows, an effect that may bring extra payment from Fonterra.

Performance of commercial OAD herds; *(see Tables 1, 2 and 3 in Appendix 1).*

- **Table 1** (from Anderle and Dalley, 2007) shows the performance, in 2005/06, of 22 herds that had been using OAD systems for 2 to 4 years. They produced 909 kg MS/ha, 5% less than they had produced on TAD; but their expenditure per farm had been reduced by 26%, so that their surplus on OAD was 16% higher than it had been on TAD.

- **Table 2** (more details on page 77 Dairy Exporter, August 2013), shows the performance of 20 herds that had been using OAD systems for 2 to 8 years. The 15 flatter farms averaged 349kg MS/cow and 1,060kg MS/ha, the 5 hillier farms averaged 297 kgMS/cow and 640 kgMS/ha; the corresponding averages for the NI were 353kg MS/cow and 970 kg MS/ha. In addition, fertility of the OAD herds was much better than the NZ averages, and the SCCs of the OAD herds were slightly lower than the NZ average.

- **Table 3** is a DairyBase Benchmark Group report for the performance in 2011/12 of 27 farms that used OAD systems, probably in their third year on OAD.

- The 27 OAD herds produced 310 kg MS/cow and 788 kg MS/ha, 18% and 25% lower than the corresponding NZ averages. The 27 OAD farms produced $2,051/ha operating profit, 22% lower than the NZ average. But the value of land and buildings for the OAD farms was 17% lower than the NZ average, so that the dairy returns on dairy assets for the OAD farms was similar to the NZ average (6.1% versus 6.2%).

- No attempt was made in any of the three studies to measure the amount of effort and strain, by people and cows that was required to achieve the results shown in Tables 1, 2 and 3. But there is little doubt that, if it was possible to measure this, it would have been smaller for the OAD farms.

5. CONCLUSIONS

- Kg MS per cow and per hectare usually decrease in the first one or two years on OAD. Subsequently, production levels increase again, to be close to or even equal with their previous yields on TAD, after cows that do not suit OAD have been culled.
- Any reduction in Kg MS produced will reduce profit, unless expenditure is also reduced sufficiently to reduce $ costs/kg MS.
- Apart from lower yields of MS initially, and generally slightly higher SCC, all other aspects of performance per cow are improved by OAD (better BCS and fertility; more compact calving; reduced lameness; lower replacement rates possible).
- Farm data, for 2005/06 and for 2011/12, show that farms using OAD systems can be productive and profitable (see tables 1 and 3 in Appendix 1).
- All OAD farmers emphasise the value of the reduced stresses experienced in OAD milking systems. These benefit people and cows, including the employment and retention of good staff, and greater longevity of cows. OAD systems produce more MS per unit of work and stress!
- The genetic merit of cows for OAD will improve slowly, as cows that do not suit OAD are culled from the OAD herds, and High BW replacement heifers are included.

But in 2014, the High BW sires of these heifers have not been identified or proven specifically in OAD herds. This deficiency limits the rate of genetic progress in OAD herds when compared with TAD herds. However, the OAD BW now includes more data from cows milked in OAD herds, increasing its accuracy and reliability.

Appendix 1:

Evidence of good performance from full season OAD milking systems

or " The second milking each day is NOT essential "

By Colin Holmes and Leo Hendrikse

Introduction

This is written to encourage farmers to explore the potential of OAD systems, by studying the data below, and by visiting good farmers who use these OAD systems successfully.

This message applies to the majority of dairy farmers, but most urgently to those who are considering considerable expenditure on a new milking shed, just so that they can continue to milk TAD. These farmers should assess the pros and cons of the alternative, a change to OAD, which will enable them to continue to milk in their existing shed. The message may not be relevant to those who want to produce very high yields per cow; but, in 2011/12, only 28% of all NZ herds produced more than 400kgMS/cow, and 47% produced less than 350 kg MS/cow, a yield already achieved by several OAD herds.

Full-season OAD is just the latest in a series of changes in milking methods, including the elimination of hand-milking in 1910-20s, of post-milking stripping in 1940-50s, and of pre-milking stimulation in 1950-60s. These reduced the labour required for milking, enabling increases in scale and efficiency of NZ's grazing systems.

Full-season OAD milking is an innovation that requires no additional resources, e.g. extra feed, equipment, buildings, capital or staff. Farmers using it effectively can achieve good production, with lower costs of production and less strain on people and cows.

OAD is a perfect fit with NZ's long history of competitive dairy exports, based on low-cost production of high quality milk. This is especially relevant right now, when farm working expenses have increased by 60% since 2002, and respected industry analysts are drawing attention to NZ's recent loss of its low-cost competitive advantage.

Three sets of recent data from farms using full-season OAD are shown below; **they prove, beyond reasonable doubt, that the second milking each day is not essential;** therefore it can be eliminated, with many benefits for people and cows.

These good performances have been achieved in herds that started with cows bred for OAD milking, most of which have completed only a few seasons on their new OAD systems and they do not have access the AB sires proven to be high BW in OAD herds.

Experimental evidence; the average yields for commercial OAD herds shown in Tables 2 and 3 below, of 349, 297and 310 kg MS per cow, are much (30% to 50%) higher than the corresponding 4 year averages of 237 and 222 kg MS/cow from Holstein Friesian and

Jersey cows milked OAD, from the only experimental comparison of OAD versus TAD milking, with grazing cows, carried out near Hawera, in 2000 to 2004.
However, the OAD farmlets were managed at higher stocking rates (+17%) than the TAD farmlets, so that the decreases of 20 to 30% in MS/cow in the OAD herds were caused, only partly by OAD but also partly by the higher stocking rate.
The experimental rules prevented the early culling of cows that were obviously unsuited to OAD. The use of a higher stocking rate and the inability to cull unsuitable cows early, are different from usual practices on OAD farms. They probably contributed to the very low yield per cow for the OAD herds, and to the reported lack of any increase in yield per cow over the 4 seasons; whereas, most OAD farms show steady increases over the first few Years.

These very low yields per cow, and the 20 to 30% decrease in kg MS per cow on OAD, are widely quoted to show the adverse effects of OAD milking. They have probably had powerful deterrent effects on farmers who have been considering a change to OAD. This interpretation is misleading, because the very low yields of the OAD herds were caused not just by OAD milking, but also be the accompanying 17% higher stocking rates. However, the high stocking rates did result in relatively high yields per hectare, 980 and 880 kg MS/ha for the J and the HF cows milked OAD, despite their low yields per cow.
Another experiment, from 2002 to 2004, carried out with Jersey cows selected for high BW and OAD Index, managed at 4.4 cows per hectare, recorded yields of 265 kg MS per cow and 1,160 kg MS per hectare (see page 5 in Proceedings of the OAD Milking Conference, 2007). These data provide an insight into the future potential of OAD systems, when all cows in these systems have been bred and selected to suit OAD.

In future, data from successful commercial OAD farms should be used to demonstrate the real potential performance of full-season OAD systems.

The evidence from commercial farms

Table 1; **22 farms that milked OAD in 2005/06, having changed from TAD 2 to 4 years previously (see Anderle and Dalley; page 34 in The OAD Milking Conference, LIC, 2007).**

All these farms, averaging 140 hectares and 380 cows, changed to OAD in order to further develop the performance of their dairy farms:

	Final year on TAD Average year was 2003/2004	**OAD 2005/2006**	
Kg MS per Hectare	959	909	(-5%)
Farm Working Exps; $ per farm	285,200	212,400	(-26%)
Cash surplus; $ per farm	265,500	307,400	(+16%)
Effort and strain on people and cows	More	Less	

In 2003/04, on average, their last season on TAD, these farms produced more than the NZ average of 889 kg MS/ ha. And in 2005/06, in their 2nd to 4th season on OAD, they were equal to the NZ average of 907 kg MS/ha.
On OAD, MS/ha decreased by 5%, but farm expenditure was reduced by 26%; consequently, cash surplus increased by 16%.

Table 2; Holmes and Hendrikse surveyed the 2011/12 performance of 15 "flat" farms (more than 50% flat) and 5 "hilly" farms (more than 60% "hilly"); all are members of the Lower NI OAD Discussion Group, with 10 farms in their 2nd or 3rd season on OAD, and 10 in their 4th to 8th season on OAD (see the Dairy Exporter; p 77, August 2013 for more details). Both the flat and the hilly farms "imported" about 15% of the total feed needed by their herd, in the forms of grazing-off and supplements.

	15 Flat Farms *133 Hectares*	**5 Hilly Farms** *221 Hectares*	**NI Average** *119 Hectares*
Cows per ha	3.1	2.1	2.8
Kg MS per cow	349	297	353
Kg MS per ha	1060	640	970
			NZ Average
Total mating	11 Weeks	12 Weeks	12-14 Weeks
% empty	6%	8%	10-15%
Season SCC/ml	169,000	192,000	204,000
Effort and strain on people and cows	Less	Less	More

When compared with the NI averages, **the flat farms** produced similar yields of MS per cow, with lower SCC, but 9% more MS per hectare. Fertility was considerably better than the NZ average, but similar to that achieved by the top 25% of all farms. When compared with the NI averages, **the hilly farms** produced less MS per cow (-16%) and per hectare (-34%), with similar SCC. Fertility was better than the NZ average. The majority of these 20 farms, flat and hilly, use no inductions or CIDRs. Some "hilly" farmers commented that their return on capital was higher than they could expect from any other use of their farm.
(The averages values in Table 2 were derived from # Dairy Statistics, DairyNZ, LIC and from Veterinarians; their help is gratefully acknowledged).
(NB; the 4 year experiment, mentioned in pages 10 and 11 above, also showed that cows milked OAD had better fertility than cows milked TAD; specifically, the cows milked OAD had higher 3 week submission rates, higher 3 week pregnancy rates, and more compact conception dates, despite using fewer CIDRs; see page 9 in The Proceedings of the OAD Milking Conference, 2007).

In 2011/13, one member, in the 6th season on full season OAD and with irrigation, produced 1,400 kg MS/ha and 354 kg MS/cow, more than had been achieved previously on TAD. The family has recently purchased and converted a nearby farm to dairying; 700 cows are being milked OAD through a 40 bale herringbone on this new dairy farm.
Most members have experienced higher production losses per hectare (10 to 15%) in the first year on OAD than in subsequent years, probably due to the presence of cows that do not suit OAD, and, in some cases, due also to being slightly over-stocked in year one. The cows that are most obviously unsuitable for OAD milking are generally culled early in year one, but some "slightly unsuitable" cows have to be retained for the first season, to be culled in year two or later.

After the second or third year on OAD, most members are producing 90 to 100% of what they had previously produced on TAD. In addition, data from 3 herds show significant numbers of cows producing more than 400 kg MS, and some producing more than 450 kg MS. Some long-term OAD herds are now producing around 370 kg MS/cow.

Table 3; Data for 2011/12, from a DairyBase Benchmark group of 27 farmers using full-season OAD; they averaged 144 effective hectares, and 366 cows. (*With the % difference between the two averages)*

	Average for 27 OAD farms	***% Diff between the two averages***	**DairyBase Avg for NZ**
Kg MS per cow	310	*-18%*	376
Kg MS per hectare	788	*-25%*	1052
FWE $/Kg MS	3.89		3.95
Op. costs $/Kg MS	4.84		4.73
Payout $/Kg MS	6.73		6.69
Op. profit $/Hectare	2051	*-22%*	2623
Value of land & buildings $/Hectare	25,800	*-17%*	30,980
Dairy return on dairy assets	6.1%		6.2%
Total return on assets	7.6%		6.3%
Total return of equity	8.2%		12.2%
Stress and strain on people and cows	Less		More

No information was available about these 27 farms for # the number of years completed on OAD # the farmers' reasons for changing to OAD # the topography of the farms (hilly/flat) # location, North or South Island.
The value of land and buildings of the OAD farms was 17% lower than the NZ average, suggesting that the OAD farms are located on lower quality land, eg hilly land. Average MS yields by the OAD farms were lower than the NZ averages, by 18% for MS/cow and by 25% for MS/ha. Operating profit per hectare for the OAD farms was lower than the NZ average by 22%.
But, because Value of Land and Buildings for the OAD farms was 17% lower, their dairy return on dairy assets was similar to the NZ average.
The 27 OAD farms in Table 3, showed lower yields of MS, both per cow (-11 %) and per hectare (-26 %) than the 15 flat farms in Table 2; but slightly higher yields of MS both per cow (+4 %) and per hectare (+23%) than the 5 hilly farms in Table 2. Assuming that these same 27 farms were also included in the DairyBase data for the 2 previous years (2009 to 2011), the data show that, over the 3 seasons, the OAD farms achieved increases of 12% in MS/cow, and 9% in MS/ha, and 100% in Op. profit/ha. Over the same 3 year period, the averages for NZ showed similar % increases for MS/cow and/ha, but only a 34% increase in operating profit/ha.
In summary, these 27 OAD farms achieved lower than average production and operating profit per hectare, from land and buildings that was worth less than average per hectare. But they achieved a greater increase in profit since 2009/10, and, in 2011/12, the same % dairy return on dairy assets as the NZ average, with less effort and strain.

The OAD-pioneering Harding family was also achieving close-to-average yields per cow and per hectare, in the 1990s and early 2000s (Massey Dairyfarming Annual, 2002).

General advantages claimed by users of full-season OAD systems
People - less effort and strain; fewer staff required; lower staff turnover and easier to attract and retain good staff.
Cows - less time walking on races/ standing on concrete; fewer lames, small decrease in daily energy expenditure by cows (maybe equivalent to 10 to 15 kg MS/cow?) in better body condition, and more fertile; lower % Empty, after shorter mating periods; zero or minimal use of inductions and /or CIDRs.
Herd - lower replacement rate/ fewer heifers needed; and/or more selection pressure on heifers and cows is possible; increased income from sale of dairy cattle.
Milking Shed - can milk more cows per set of cups, by increasing the duration of the one milking, or more especially, by milking half the cows in the morning and half in the afternoon; can avoid the need for a new, larger milking shed and yards, with associated capital expenditure and increased depreciation.
Size of the Milking platform - can be increased because cows milked OAD can walk to and from more distant paddocks.
Races - less wear and tear.

A vision for use of OAD systems in 2020

- 15% of NZ dairy farmers will be using full-season OAD systems; with their lower costs of production ($/kg MS), these will be achieving better than average production and profit.

- AB sires, proven to be high BW in OAD herds, will be available. Herds milked OAD will be making steady genetic progress, with few heifers that are unsuitable for OAD.

- These OAD farms will experience few problems with recruitment and retention of good young staff, and OAD farms will have become work-places of choice.

- OAD systems will be helping to restore the competitive advantage of NZ's low-cost grazing systems.

Appendix 2

Control of Mastitis; the principles and comparisons between herds milked either OAD or TAD

A presentation by Dr Adrian Joe, On-farm Solutions, Te Awamutu to the OAD Group Field Trip, on 27th June, 2012, on the farm of Kelly and Andrew West

Adrian has been working with mastitis and SCC ever since he graduated, and he was a member of the working group that developed the original SAMM Plan. The main points of Adrian's presentation, as recorded by Colin Holmes and approved by Adrian, are outlined below. (Note; the new Smart SAMM Plan is the most up to date printed source of information about mastitis and its control; http://www.smartsamm.co.nz)

Summary; this excellent talk by Adrian Joe is the only one that I have heard that compared OAD with TAD in terms of mastitis and its control. My over-all conclusions are laid out below:

a) On OAD, udders experience an interval of about 24 hours after the one daily milking (compared with about 8 to 16 hours in TAD cows).

b) During each milking, it is possible for bacteria to be forced up into the teat and into the udder. If these are left in the udder after cups-off, the bacteria can multiply and become established as new infections. On OAD they have a much

longer inter-milking interval in which to multiply and establish themselves in the udder, than on TAD; **Cows milked OAD are probably at more risk from this factor.**

c) On the other hand, teats of OAD cows are exposed to the milking machine and the milking routine only once every 24 hours, compared with twice on TAD. The machine and its use are known to be mastitis risk factors, because they can cause damage to teats, can spread infective bacteria between teats and between cows**. Cows milked OAD are probably at less risk from these sources.**

d) On balance, OAD cows are probably at no greater risk from mastitis than TAD cows, provided that the presence of infective bacteria around the teats is minimised, & that cows are milked out thoroughly at each milking, to remove any bacteria that had penetrated into the teats during milking.

Mastitis in dairy herds is generally caused by bacterial infection; and the probability of infection (incidence of mastitis) is influenced by 5 main factors that can operate independently or in combination with each other.
These 5 main factors are:

- The absence/presence of infective bacteria near the teat- end.
- The health of the cow and her teats.
- The environment to which the teats are exposed.
- Correct functioning of the milking machine.
- The people who milk the cows, their milking methods and hygiene.

All these must all be managed to:

- To prevent any damage to the teat itself
- To eliminate/reduce the number of infective bacteria to which the teat is exposed
- To prevent any bacteria from getting into the teat
- To eliminate promptly any infections that do result from bacteria that do get into the udder.

Mastitis in cows milked OAD or TAD
Probable advantages of milking OAD; because their teats are exposed to the teat-cups for less time per day, cows milked OAD are probably **less** exposed to the " mastitis risks" that can occur **during** milking (e.g. teat damage, or bacterial contamination of teats from milk; and conditions that push milk and bacteria into the teat).

Probable disadvantage of milking OAD; the udder remains un-milked for about 24 hours after the daily milking. Therefore, any bacteria that remain in the udder after cups-off have twice as much time (compared with TAD) to multiply and become well-established in the udder. Therefore cows milked OAD are **more** exposed to the risks from any infective bacteria remaining in the udder **after** the end of milking (e.g. due to incomplete milking, and failure to remove all bacterially-contaminated milk that was pushed up into

the teats during milking by reverse flow of milk caused by sudden changes in vacuum levels in the cups, e.g. due by sudden air leakage into one or more cups, due to faulty cup-removal. These bacteria will probably have come from the udders of other infected cows in the herd).

Taking these advantages and disadvantages for OAD into account, it seems likely that, with good management, mastitis can be controlled so that SCC is below 100,000 all season; with less than 10% of cows showing clinical mastitis in herds milked either TAD or OAD. Plenty of TAD herds are already achieving this, and at least some OAD are now achieving it too.

Dry cow therapy (DCT) and Teat Seal
DCT and Teat Seal are very effective methods of eliminating existing infections. They also protect the teats against invasion by bacteria, and new infections, after dry-off. This is particularly important over the 9 weeks after dry-off, when the keratin plug in the teat's streak canal is still developing; during this period the plug may not give the teat effective protection against bacterial invasion. In some herds, the first-calving heifers are treated with Teat Seal about 4 weeks before they are due to calve; this can be effective in reducing the number of infections in these heifers.

Effective Culling
The cure rates of antibiotic treatments are always less than 100%. In general, these repeat offenders, or cows that require many treatments during lactation, and/or remain infected/high SCC cows after a DCT treatment, should be culled. This helps to minimise the numbers of infective bacteria in the teat's environment; it requires good records of treatments, and their effective use.

The Environment
Mud and muck on teats can increase risk of infections - eliminate/reduce these sources of contamination; e.g. keep concrete and races as clean as possible; disinfect all teats (by teat spray) 3 times per week for 6 weeks before calving (one farmer does this while dry cows graze); remove calves from cows as soon as possible after they have suckled sufficient colostrum (calves can spread bacteria).

The Milking Machine and Milking Routine

Prevent damage to the teat - e.g. due to inadequate squeeze phase by the teat-cup liner (60: 40 is a good pulsation ratio), or by over-milking (sometimes maybe necessary to use fewer sets of cups), or by using an excessively high vacuum level. Inspect tips of teats regularly, these should have a smooth surface and a small neat hole; if not, check the machine and methods (damaged skin increases the risk of bacterial contamination on and into the teat).

Prevent bacterial contamination of teat - this can occur from external sources of bacteria (e.g. muck/mud), or from the milk from the other quarters of the same cow, or from the milk of other cows milked by that set of cups (after milking an infected cow, cups can remain contaminated with bacteria for the next 5 cows; keep a spare set of

clean cups to replace a set that has just milked an infected cow).
Cows known to be infected should be milked separately from the main herd, preferably after them.

Teat Disinfection after cups-off - Disinfect teats thoroughly, covering the whole surface of the teat, by spraying after cups-off; use the correct materials and dilutions to make up the disinfectant spray; write the instructions down clearly for others to see and use; (a survey showed that in 65% of herds, teats were not covered adequately, and in 67% of herds the spray was not made up according to the instructions on the label. Only 12% of herds achieved both good coverage and correct dilution)

Prevent the forcible 'reverse-flow' of bacterially contaminated materials up into the teat - before putting anything into the teat's streak canal, the teat-end MUST be thoroughly cleaned and disinfected, e.g. scrubbing vigorously with methylated spirits impregnated wipes.
Bacteria can also be pushed up into the teat by reverse-flow of milk during milking. Reverse flow can be caused by sudden air leakage into the cups, therefore prevent air leakage; cup slip during milking should a rare event (on fewer than 5 cows out of 100 milked), and vacuum should be shut-off from the cluster before the cups are removed from the teats.

The general attitude of dairy farmers, and the incidence of mastitis in their herds
Adrian recounted the results of a survey in which the farmer's wives were asked to evaluate their husbands in terms of being either "clean or accurate" at one end of the scale, or being "quick and dirty" at the other end. (Note; this categorising of husbands should not be tried at home!) As could be expected, the clean and accurate group generally had lower SCC values than the quick and dirty group. These results can probably be applied to OAD herds and to TAD herds.