OAD MILKING WITH OAD COWS

THE FUTURE FOR NZ'S LOW-COST GRAZING SYSTEMS

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Conclusions

- The major changes in milking methods over the past 100 years [Appendix 1 & 2], required bold decisions at the time; but gave rise to huge increases in farm efficiencies.
  Bold decisions about OAD systems are required now; it is an "innovation" with the potential to maintain NZ's key ability to produce milk at low costs/kg MS.
- Full season OAD enables systems to be less demanding and less complicated. It reduces some of the difficulties created by TAD milking; the long distances walked daily by cows ; the huge costs in labour and capital expenditure required to milk TAD; and thin cows.
- OAD systems are being operated on a wide variety of farm-types, from flat/irrigated to hilly/dry-land, with or without supplements; many are still in their early years on OAD.
- The main disadvantage of OAD, in experiments and in the initial years on OAD farms, is the lower yield of MS/cow. But a number of well-established OAD herds are now showing improved yields [340 to 400 kg MS/cow; 1,000 to 1,250 kg MS/ha] after several years of selection and culling.
  The incidence of mastitis is not increased, but Black Mastitis can be an intermittent problem.
- Advantages of full-season OAD; less strain and stress on cows and people; improved fertility; more compact mating and calving; fewer empty cows. Fewer lame cows; lower replacement rates and/or more voluntary culling; more dairy stock to be sold. Fatter cows [although this advantage decreases as MS yield/cow on OAD increases with selection and culling]. More cows can be milked per person, and per set of cups; potential for reduced capital costs. Milking cows can be grazed on more distant areas, or on hilly areas.
- Financial analyses for 22 farms suggest that, after the change to OAD, Farm Working Expenses, $/kg MS, decreased by 26%, but milksolid production per farm decreased by only 6%. Farmers who changed to OAD in order "to free up more time for themselves", showed smaller financial gains than farmers who changed to OAD in order to achieve "further farm development and to push back the boundaries".

- Short periods of OAD have been used widely on TAD farms for many years, mainly in later lactation, but recently, even in early lactation. New research shows that, for well-fed HF cows, even a short period of OAD, beginning after calving, can decrease daily yield not only during the period of OAD, but also for the remainder of lactation. The quantitative applicability of these results to farms well-stocked with J and HF x J cows needs to be tested.
- Short periods of more frequent milking, TAD or milking 3 times in 2 days, are being used on some full season OAD farms, eg, for the mastitis cows in order to assist with their treatment and recovery.
- Good planning and management of the transition from TAD to full season OAD is essential.

1. OAD and NZ'S ability to be globally competitive

The New Zealand Dairy Industry processes and exports 95% of its milk on the global market; therefore it must sustain its competitive ability.

In the past, this has been based on the low cost of production achievable by increasingly efficient grazing systems, together with steady increases in milking efficiencies and cows milked per person [Appendix 1 and 2]. But, over the last 20 years, more and more farm inputs have been used by many farming systems. These inputs include extra feeds, machinery, feeding facilities and cow barns. They usually result in increased milk production, but costs per kg MS are usually increased too, eroding NZ's ability to be competitive. And operation of these "high-input" systems is more demanding and complicated.

The current high global milk price will stimulate increased milk production and increased demand for cattle feeds in other countries, including the USA; the global market will remain competitive.

Once-a-day milking for the whole season (full season OAD) is the one current "innovation" that offers the potential of lower costs of production per kg MS, without extra inputs , and provided that reasonable MS yields per cow can be maintained. It eliminates one whole milking operation every day, along with all the labour, and cow-walking involved, thereby continuing the steady increases in milking efficiencies of the past 100 years.

2. Summary of full-season OAD's advantages and disadvantages

Full-season OAD milking can be seen as a way to mitigate the main constraints imposed by TAD milking in large grazing systems. These include:

- The huge work-load required for TAD; its inconvenient, inflexible scheduling; and the capital cost of the large milking facilities needed.
- The limitation imposed on daily feed intake per cow by grazing, even when pasture supply is plentiful, and magnified during pasture deficits; and thin cows.
- The necessity for cows to walk long distances every day.

Disadvantages of OAD, with cows selected on TAD

Lower MS yield per cow; by 15 to 25%, at least in the first year on OAD. This expected decrease in MS/cow (and the associated decrease in feed demand/cow) can be offset in the short term by milking more cows, at a higher stocking rate. But, several OAD farms have now increased their yields to 330 to 400 kg MS/cow after 3 to 8 years of selection of cows suited to OAD, and of culling cows unsuited to OAD.

Increase in SCC and mastitis; all the experiments showed increased SCC in OAD cows, but without an increase in infection. Many OAD herds are consistently achieving low to average SCC. But, several OAD herds have reported that cows that become infected can show stronger clinical symptoms; and some have experienced intermittent, but increased, cases of Black Mastitis.

These may be due to the longer (~ 20 hours) interval between milkings allowing any undetected, early-stage infections to become more established, with increased inflammation before detection at the next milking, by which time the infection will be more resistant to treatment. Excellent early detection of all incipient infections, and their prompt treatment, at every milking is even more essential on OAD than on TAD.

On the other hand, the incidence of mastitis does not appear to be increased on OAD. This may be partly because the teats are exposed only once per day, not twice, to the milking process which can itself increase the risk of damage to teats and of new infections.

Some OAD herds are now using increased milking frequency (3 milkings in 2 days, or TAD) as part of the treatment and recovery plan for clinically infected cows.

Advantages of OAD

- Less demanding and less complicated , for people and cows
- Less stress and strain on cows and people. Healthier cows; happier cows and people.
- Reduced, and less inconvenient hours of work, and/or reduced staff required.
- Increased number of cows milked/person, and milk produced/person.
- Increased number of cows milked per set of cups; can reduce capital expenditure on milking facilities.
- Because cows must walk to and from the milking shed only once per day, cows can be grazed on, and milk can be produced from land that is inaccessible to cows milked TAD.
- Cows with fatter body condition; however this benefit decreases as yields/cow on OAD increase with selection of cows suited to OAD.
- Fewer- than-average lame cows.
- Better-than-average fertility and mating performance; fewer empty cows, more compact calving pattern with fewer late calving cows.
- Consequently, fewer cows that must be culled (involuntary culling).
- Either more voluntary culling or a lower replacement rate. (these last four points will yield significant long-term benefits, that have not been measured in experiments)
- More dairy animals for sale; increased income from stock sales.
- In several case-studies, the value of the benefits has been greater than any loss of income from reduced milk production. " For those farmers who adopted OAD to free up their time, they tended to have minimal changes in stocking rate and other farm practices, and consequently financial gains were not as great as those [achieved by farmers] seeking further farm development. Those farmers who made the change [to OAD] as a result of trying to step forward and push the boundaries have seen a dramatically different outcome" [see Anderle and Dalley, 2007, in 3 below]. Success on OAD will probably require even more skill than is required for success on TAD.

Management of the transition from TAD to full season OAD; Milk yield per cow will decrease after the changeover; good management of the transition is essential, but has not been studied. Some points are;

- Careful financial planning to cover the effects of any short-term decrease in income.
- Mastitis and SCC; the change to OAD should not be made if the herd has problems with mastitis: eliminate the problems on TAD before changing to OAD.
- The effects of OAD on Jerseys and HF x J crossbreds are smaller than those on HF cows. Semen from sires proven to be superior for the production of their daughters milked OAD, is slowly becoming available; its use in seasons before the change to OAD would provide young cows suited to OAD, before the changeover.
- Culling those cows that are unsuited to OAD in the one or two seasons before the change to OAD full-season; these cows can be identified by milking the herd OAD for a period in late lactation during the preparatory years.
- For 1st year on OAD, increase number of cows to calve by about 10% compared with TAD; this will enable the cows that are obviously not suited to OAD, to be identified as early in lactation as possible, and sold to TAD herds.

3. Full-Season OAD: Evidence from Experiments and Farms

Valuable sources of information about OAD are:-

- Proceedings of the OAD Milking Conference, 2007; (for summaries of research, and data from case study forms)
- Clark et al 2006. A farmlet-systems experiment
- Davis et al 1998. A review of research on the effects of OAD on milk yield and composition
- Phyn et al 2010. A review of research on the effects of short-term OAD in early lactation

Some examples of data and conclusions are given below. But anyone seriously interested in OAD should get a copy of the OAD Conference, and read it from cover to cover.

Note: all but one of the experiments on OAD have used cows selected and bred for TAD; inevitably these included some cows that do not suit OAD. The results of these experiments are unlikely to be directly applicable to established OAD herds.

(a) **Data reported by 18 OAD farms in the North Island, 2009/10 (8 farms in their 1st year on OAD, 8 on hilly farms, 3 with partial irrigation. (From the N.I. OAD Discussion Group).**

Kg MS/cow	280	(233 to 390)
Kg MS/ha	800	(512 to 1,200)
Average SCC	209,000	(112,000 to 300,000)
Mating period, weeks	11	(8 to 13)
Empty cows, %	8	(3 to 13)
Farm working Expenses $/kg MS	2.50	(1.8 to 3.6)

The group includes a wide range of farm systems:

- Two farmers, 7 & 8 years on OAD, with 450 and 750 cows respectively: on dry land in summer – dry areas. Both have obviously been consistently profitable in recent years, despite their moderate levels of production; 280 to 300 kgM/cow; 700 to 900 kg MS/ha, and because of their efficient systems and low costs.
  At a recent Field Day on one of these farms, its 2009/10 Dairy base data showed an operating profit of $1,670/ha, higher than the district average of $990/ha, despite the district's higher average yields , 340 kg MS/cow and 1,050 kg MS/ha.
- A farmer with irrigation, in the 3rd year on OAD with 580 cows, produced over 330 kg MS/cow and 1,200 kg MS/ha, only 5% less than the farm's previous best TAD year, and with lower costs/kgMS.
- A farmer in Tasmania with 1,100 cows on 240 irrigated hectares, in the 2nd year on OAD on a new dairy conversion with only small amounts of grain fed; expects to produce 290kg MS/cow and 1,350 kg MS/ha, and is targeting 1,500 kg MS/ha with 300 kg MS/cow for next season.
- Several new OAD conversion farms on sheep farms.

(b) **The first OAD experiment in NZ, at Massey University (Holmes et al 1992) (Note: this experiment was prompted by the experiences of the OAD pioneers, the Harding family (Hardings, 2002)**

g MS/cow
S% in milk
C / ml)00)00
t dry-off:
WT kg
ody condition score
verage pasture eaten
g DM/cow per day)

(At dry-off, there was no difference in bacterial infections between the two groups)

(c) **A three year farmlet-systems study with Friesians and Jerseys in Taranaki (Clark et al 2006)**

	Friesians		Jerseys	
	OAD	TAD	OAD	TAD
Cows/ha	3.5	3.0	4.2	3.6
Kg MS/cow	237	336	222	278
Kg MS/ha	879	1051	979	1045
Days in milk	230	244	229	242

- OAD increased % of fat and protein in milk but decreased % of lactose
- OAD reduced yield/cow by more in Friesians than in Jerseys
- OAD reduced yield/cow by more in 2 year olds than in older cows

(d) **Responses to extra ME; and effects on body condition score (see Dalley p49 in OAD Conference, 2007; and personal communication, Dr C Phyn)**

- In early lactation, cows ate slightly less feed and lost slightly less BCS than TAD cows.
- Extra high quality supplement resulted in extra milk production by OAD cows.
- Availability of high quality pasture and/or supplement in summer is crucial, if large decreases in yield are to be prevented in later lactation.

- On OAD, cows are, on average, fatter in early lactation, and fatter and heavier at dry-off than TAD cows. But, on OAD, those that suit OAD and maintain reasonable yields do not gain so much LWT and condition as cows that are not so well suited to OAD (from studies in NZ, Ireland and France)

(e) **Mating and fertility in Friesians and Jerseys on TAD or OAD (same experiment as In [c] above; see Dalley et al, page 9 in OAD Conference 2007)**

	Friesians		Jerseys	
	OAD	TAD	OAD	TAD
CIDRs used (%]	5	24	6	9
% of cows mated in 3 weeks	90	79	94	90
% of cows pregnant in 3 weeks	42	37	50	39

- Also, after 3 years, the mean calving date of the OAD herd had advanced [earlier] by 7 days, compared with a TAD/OAD herd.

(f) **Reproductive data for the Bateup farm, 2002/04 (Dalley et al, p13 in OAD Conference, 2007]**

	2002/03		2003/04	
	OAD	TAD	OAD	TAD
mated in 3 weeks	99	88	97	85
not pregnant after 10.5 eks mating	3	8	4	9

(g) **Welfare of cows; and happier cows (Tucker et al p14; and Gatley , p55; both in OAD Conference 2007)**

- OAD cows lie down for longer (by 1.5 hours per 24 hours)
- OAD cows took longer strides, indicating healthier hooves
- Still some concern about discomfort in early lactation due to udder distension in OAD cows
- Farmer opinions; OAD cows and people are happier

(h) **Mating and fertility in 33 herds; A. Evans, South Wairarapa Veterinary Services**

	5 OAD herds	28 TAD herds
npty	10% (6-12)	14% Average 5 – 26 (Range)
-calf in eks	66% (65-68)	56% Average (42-74) Range

(i) **Mastitis, SCC and lameness (Dalley et al p 28 in OAD Conference, 2007)**

- In uninfected cows, OAD cows had higher SCC than TAD cows, by about 100,000 in late lactation
- OAD cows in Taranaki experiment showed SCC of 100,000 to 150,000 in the first half of lactation and around 200,000 towards the end; but on average the SCC was still 50,000 below company average
- Cows milked TAD then OAD, had SCC around 100,000 in the first part of lactation; then increased to around 200,000 in later lactation on OAD
- Disinfectant teat spray after every milking is even more essential than on TAD
- Must be very observant to detect every infected quarter and treat them promptly
- Rakaia Island, OAD herds; reported about 0.3% cows with Black Mastitis; but lameness was almost eliminated, compared with 5% on TAD previously

(j) **Effects of OAD on people (Tipples et al, p23 in OAD Conference]**

- Advantages for employer: reduced staff turnover, absenteeism and accidents; enables adoption of new staffing strategies; extend the happy working life of farmers
- Advantages for staff; shorter, or more acceptable working hours; better family life, more balanced lifestyle

(k) **Effects of OAD on financial performance (Anderle and Dalley; p34 OAD Conference, 2007)**

- Farm accounts for 22 OAD were analysed; for their final year on TAD, and for the subsequent years on OAD

- After changing to OAD, MS produced decreased by 6% (by 54 kg MS/ha), but Farm Working Expenses decreased by 26% (by $0.58/kg MS)
- Expenditure on wages, supplements and annual health decreased by 30%, 22% and 13% respectively
- Those who changed to OAD in order to free up more time, and made minimal other changes to the system show little improvement in financial performance
- Those who changed to OAD in order to improve their farm performance, and made other appropriate changes to the system, did show improved financial performance
- The case study farm's EFS, $/ha, increased on OAD despite the decreases in MS/cow and MS/ha (the change to OAD coincided with decreases of 100 ha and 300 cows in farm size). The accountant commented on the dramatic increase in profit after the change to OAD [the case study farmer, John Saywell, is a speaker at this workshop.]

4. 3 Milkings in 2 Days, at Intervals of 18 Hours, used Strategically or Full-Season

This can be used, either by TAD farmers, to reduce milking frequency, or by OAD farmers, to increase milking frequency, depending on the type of constraint for which 3 in 2 is being used as a remedy.

Boyce outlined the use of 3 in 2 during emergencies, in situations where OAD was not practicable. He concluded that 3 in 2 will continue to be a useful option for some farms in some special circumstances. However, he also stated that the times of work demanded by 3 in 2 were not compatible with the normal lives of most people!

Note; on Rakaia Island's OAD farm, the Turners' are planning to introduce 3 in 2 milking for a group of older, high yield cows in order to increase total milk production by the otherwise OAD herd [see their paper in this proceedings].

5. Short/Medium Term Strategic use of OAD, Including its use for half of Lactation

(See Reveley, p 39 in OAD Conference (2007) for its use in response to a wide range of limiting factors, at any stage of lactation and for any period. Also see Phyn et al (2010) for a review of experiments into the effects of short periods of OAD in early lactation)

The earliest experiments were reported in 1965 and 1978, for short periods of OAD in late lactation (see Copeman & Napper, 1982). These showed decreases in milk

fat production of 18 to 35% during the period of OAD, with no carry-over effect because cows were dried-off soon after the experiments ended. These amounted to 5 to 8% of total lactation yields. However, in late lactation, in a real farm system in dry conditions, only two options may be viable; either to dry-off, with no further milk produced, or to milk OAD with selected cows for a limited period. In this situation, OAD can enable the production of some more milk, while also saving some body condition and pasture.

Reveley listed the current strategic uses of short-term OAD:

- During the colostrum period
- During the first 4 to 6 weeks of lactation
- In TAD farms, any period of feed deficit
- For lame cows until recovery season, especially 2 year olds
- During the second half of the lactation
- In the later part of lactation, as pasture growth decreases.

He described the effects in the early stages of a 3 week period of OAD, in a previously TAD herd facing a feed deficit; first, milk yield per cow decreases; SCC rises initially & then decreases; and rate of loss of live weight & condition by the cows is reduced . Then,, after returning to TAD following the 3 weeks on OAD, milk production will subsequently return to the level that would have been expected, if the herd had been milked TAD & well fed during the 3 weeks.

(Note: This conclusion, from on-farm experiences, where many factors limit milk production of different times of lactation, disagrees with the conclusions from recent short term OAD experiments, reviewed by Phyn et al (2010)].

Reveley (2007) also showed improved production by cows that were milked TAD until December & OAD thereafter, when compared with cows milked OAD full season. However, he mentioned the possibility that some of the improvements in animal health & reproduction expected on full season OAD may not be achieved on TAD/OAD systems.(Note: The NI discussion group includes a farmer who produced 420 kg MS/cow & 1200 kg MS/ha in a TAD/OAD system, with the change on 1st December).

One of the studies in Taranaki demonstrated that 2 year olds that survived for 5 lactations on OAD, were able to produce 450 to 500 kg MS/cow in their 5th lactation, equal to the yields of their herdmates milked TAD for the 5 lactations [Reveley,2007]. The review of experimental results (Phyn et al, 2010) concluded:-

- Short periods of OAD depress milk production during the period of OAD, **and** for the remainder of lactation [a carryover effect]
- The total loss of milk resulting from a short period of OAD is smaller if the period of OAD is carried out later in lactation.

- A graph showed the estimated % of total loss of milk solids yield expected from any period of OAD started at calving. This indicated total losses of about 6%, 11% & 14% from post-calving periods of OAD lasting 2, 4, 6 weeks, and 25 to 30 % from full season OAD.
- These immediate and carryover effects appear to be due to decreases in both the number of milk secretory cells & in their secretory activity per cell due to the period of OAD. This may involve the switching-off of genes that would otherwise have promoted increased numbers of secretory cells, and their activity per cell.

The implications of these latest results, for grazing farms on which many factors can limit milk production, in particular feed intake

At least one very experienced & successful farmer milks OAD until half-way through calving; he is convinced that he, his cows & their production benefit from this method, with no subsequent loss of production. In his system, which has a relatively high stocking rate & moderate yield per cow, production in the second half of lactation is probably limited mainly by feed supply & feed intake per cow.

In grazing systems with relatively high stocking rates, feeding little supplement & with moderate yields per cow, milking present-day cows with high genetic potential for milk production, milking TAD generally results in thin cows, and the risk of poor fertility and mating performance.

A short period of post-calving OAD may prove to be an effective method for reducing the cow's genetic/phenotypic potential for milk production, by switching-off genes that promote secretory cell activity. Theoretically, this would prevent the loss of too much body condition in early lactation, improve fertility & enable the cows to be milked for longer lactations without needing supplements, and without becoming too thin.

6. Use of OAD to remedy problems caused by TAD; and use of TAD to remedy problems caused by OAD

Periods of OAD milking are use on many TAD farms, as discussed above. However it is becoming apparent that periods of TAD milking, or 3 in 2, are being used on some OAD farms, to assist with mastitis treatment, or for selected groups of potentially high yield cows.

The OAD case-study farms in this session, Doug and David Turner, and John Saywell provide illustrations of these developments.

Appendix 1: An historical perspective of changes in milking methods in NZ

- The cow is designed to be suckled by the calf, 8 to 12 times per day
- 1800s to 1910: Hand-milking TAD, with continuous manual contact with teats; about 20 cows/herd
- 1920s: Machine-milking TAD; but with manual stripping pre & post, plus teat wash & stimulation; milked in walk-in, reverse-out bales; about 30 cows/herd
- 1940s: Machine-milking TAD; most still using full manual routine as above, but stripping being eliminated; milked in walk-through bales; about 50 cows/herd
- 1980s: Machine-milking TAD; elimination of manual contact with teats from most routines. In herringbones, some new rotaries & some older walkthroughs; about 140 cows/herd
- 2011: Machine-milking, 95% TAD, 5% OAD, no manual contact with teats. In herringbones & rotaries; with a few robotic milking systems; about 400 cows per herd.

These changes have enabled steady increases in the number of cows that can be milked & managed per person; the consequent increases in kg milk solids produced per person have been hugely important to the continuing efficiency & competitiveness of NZ grazing systems (Woolford, 1986; Holmes, 2002). But, the capital cost of large modern milking sheds is considerable; OAD milking can reduce the size and capital cost of the milking shed required.

Appendix 2: The elimination of stimulation from milking routines, 1950-1980; and lessons for the elimination of one milking per day (OAD) now

Appendix 1 shows that over the period 1940 to 1980, stripping, washing & stimulation of the teats were all eliminated from the majority of milking routines (in 1962, 36% of farms used the full strip, wash and stimulate routine, but in 1983, only 4% did; Woolford, (1986).

During the 1960s, new herringbone milking sheds, with batch-milking, began to replace the old walk-through sheds, with their individual cow-milking. Farmers immediately discovered that they could not achieve their new herringbone shed's potential for faster milking, unless they spent less time working with each cow.

Consequently they began to minimise & finally to eliminate manual contact with the udder during milking (see Woolford's data for 1962 & 1983 above). This dramatic change was directly contrary to the then current research results. Experiments in 1958 & 1965 showed that 30 to 45 seconds of stimulation per cow at each milking resulted in an extra 18 to 32% of milk fat per cow (Phillips, 1978).

However, a similar experiment in 1974 showed that stimulation of teats caused only 0% or 7% extra milkfat production by Friesian cows or Jersey cows (Phillips, 1978).

The causes of these important & rapid changes in the cow's response to stimulation have not been documented fully, but a plausible explanation was given by Phillips [1978].He suggested that the cows that required stimulation & would have showed large increases in production if stimulated, were culled because of their low production without stimulation. Similarly, sires, whose daughters required stimulation, were culled because of their daughter's low production without stimulation. These resulted in genetic changes in NZ's herds that made it possible to milk them without manual stimulation.

In 1986, Dr Murray Woolford wrote "Milking less frequently, and applying (genetic) selection pressures for production may eventually generate a national herd which does not demand the enormous labour input to milking required at present." The extension of this to the effects of OAD milking has already been supported by the results of several-established OAD herds that have shown steady increases in yield up to 350 to 400 Kg MS/cow, on grazing plus silage.

NZ dairy farmers would never have discovered that they did not need to stimulate cows at every milking, UNLESS they had actually stopped stimulating,as they did. Similarly, NZ dairy farmers will never discover the full potential of OAD milking, until a sufficiently large number of farms stop milking TAD! Until then, it will be difficult for the industry to initiate and operate the genetic improvement programme required to breed cows that are best suited to OAD milking.

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