THE FUTURE OF NZ DAIRY FARMING SYSTEMS:
SELF MANAGING COWS WITH ACCESS TO PARTIAL HOUSING

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Abstract

The changes in New Zealand dairy farming systems are advancing at a great rate as farmers react from environmental and public pressure. With New Zealand's temperate climate and knowledge of pasture based grazing systems, a unique 'hybrid' dairying system is emerging. This shift is being led by leading farmers using partial housing systems to improve environmental and animal welfare standards while increasing profitability.

This 'hybrid' system combines an animal shelter with a pasture based grazing system. A 'hybrid' system eliminates many of the historical issues faced with either traditional pastoral grazing systems or a total housing system (common in the Northern Hemisphere).

Farmers have begun to realise that stock will seek shelter if given a choice therefore an Open Gate Farming System (OGFS) is emerging. Freely allowing cows access to partial housing, decreases soil damage, reduces lameness, lessons animal maintenance energy requirements (from temperature stress), and lowers environmental impacts.

Basic dairying issues

Dairying is a significant contributor to the New Zealand economy. However the dairy industry currently faces many issues on several fronts as a consequence of intensive farming: public perception, animal welfare, financial viability, and environmental pressure.

- Environmental degradation

It is well known that dairying in New Zealand has had a detrimental effect on the environment. Key water quality issues for dairy farmers are the significant amount of excess nutrients, nitrogen (N) and phosphorus (P), that leach or runoff into waterways. The MfE (2007) reports that N and P levels continues to rise, with 39% of monitored groundwater sites in New Zealand having nitrate levels above natural background levels. More concerning is that there are areas where nitrate concentrations exceed the drinking water standard of 11.3mg/L (MfE 2007).

- Public perception and animal welfare

With increased food tracing, testing and accountability, the public is becoming more and more aware of where its food is coming from. Animal welfare is of growing concern to an increasingly urbanized global market, where consumers are more distant from the farm, and demand improvement in animal welfare standards (Clark et al (2007).

Awareness of how primary production animals are treated (such as poultry and pigs) and whether or not this is humane continues to be in the media. Both local and overseas consumers expect ‘clean and green’ high quality New Zealand products from an environmentally and animal friendly agricultural industry.

All of these demands are placed on top of the dairy industry that expects farmers will continue to adapt and improve farm systems to meet and exceed these standards. Questionable farming systems that do not provide the basic animal rights (such as shelter, or sufficient space for natural movement) will enviably be stopped. According to Clark et al (2007), there are two distinct welfare issues that face New Zealand dairy farming; 1) what the public perceives as a problem, and then 2) the cows real perspective. The requirement that cows experience the five freedoms: freedom from thirst, hunger and malnutrition, discomfort; pain; injury and disease; fear and distress; and freedom to express normal behavior (Webster 2000). This perception classifies an idealized existence for farmed animals – descriptions such as natural and grass are seen as “good”, while intensive and high output is “bad” (Webster, 2000). Good farming practices will satisfy both public perception and the cows’ real needs.

- Economic climate of farming today

Over the past 20 years inflation adjusted dairy land price has increased from $14,300/ha to $32,300/ha (LIC, 2005 and DairyNZ 2013). Over the same period, wages, pasture and feed supplementation plus electricity costs have all increased. Farm working expenses (FWE) now average around $4.30 to $4.50 per kg of milksolids (MS) and coupled with the extra costs incurred to service the higher average debt levels, many farmers need good milk prices to build resilience and strength into their businesses (Mackle, 2013).

The level of farm debt servicing is about twice today what it was a decade ago. But what people need to understand is that the distribution of that dairy farm debt is not uniform. About 20 % of farms have virtually no debt, another 20 % carry 45 % of the debt. So the level of payout forecast is more significant for those carrying a lot of debt obviously (Mackle, 2013). Due to this increasing cost structure, more profitable dairy farming systems need to be implemented.

Current Farm Systems

Grazing systems

New Zealand has been renowned for its traditional pasture based dairy farming. The public likes to see cows grazing grasslands displaying natural behaviour. Intensification on pastoral land has continued to increase to the detriment of the soils. Walking cows too far, exposing cows to weather changes or even big feed variations of energy, DM, protein or quality will upset the cow. Cows using too much energy for either cooling or heating themselves or energy lost in walking or searching for feed, all suppresses milk production.

In striving for increased profitability, national average stocking rates have increased from 2.10 cows/ha in 1982/83 season to 2.85 cows/ha in 2012/13 season (DairyNZ 2013). This means that over the past 30 years the average carrying capacity has increased from 945 to 1,283 kg LWT (assuming 450 kg cows). With the higher stocking density there is increased risk of greater stock/hoof treading pressure causing damage to soil structure, particularly on sensitive soil types or where winter grazing pressures are high (Drewry et al, 2000; Singleton et al, 2000. Drewry et al. (2004) demonstrated a linear decrease in pasture yields of 1-2% for every 1% unit decrease in soil macroporosity values.

Luxton (2005) estimated that in order to achieve the typical feed production target required that 180,000 MJ ME/ha must be utilized annually but that current production was "perhaps" 125,000 MJ ME/ha leaving a 55,000 MJ ME/ha shortfall. Translating this to pasture yields, 15t DM/ha is the target but only about 10.5 t DM/ha is currently produced on farm therefore the cows full potential is not being reached under the normal grazing system. Interestingly, a 'yield limitation' for ryegrass/white clover pastures of 15 t DM/ha was identified as constraining future increases in pastoral based systems (Hodgson 1989), but their actual production potential is 20 t DM/ha (Clark *et al*. 2001).

Milk yields can be increased by focusing on maintaining pasture quality, e.g., increasing quality from 10.5 to 11.5 MJ ME/kg DM increased overall daily cow intake from 12.0 to 17.1 kg DM/d with subsequent increase in milk solids from 237 to 535 kg MS/cow (Kuperus 2003). The national average milksolids production is only 346 kg MS/cow/year, whereas cows are capable of producing 700 kg MS/yr (de Wolde, 2007).

Managing the major events that happen on farm is not the biggest challenge for farmers, but rather rectifying the small misjudgements that constantly happen. Examples of these are grazing to lower than desirable residuals; unsettled cows walking across paddocks when cold or wet; not finding somewhere dry to lie down or seeking shade on a hot day; effluent being sprayed in the wrong place on the wrong day. It can be hard for a farmer to react quickly to changeable conditions. The extent of these mistakes is now magnified because of the higher carrying capacity and is reflected in dropped production and/or soil/pasture damage.

Housing systems

Fully housed cows systems, very common in the Northern Hemisphere, are relatively new in New Zealand but are increasing in numbers especially in the South Island (Photo 1). Farmers believe that they can better protect soils, have more control over climatic events and achieve higher per cow production (700kgMS/cow) (de Wolde, 2007; Piddock, 2014).

Photo 1: Example of European free-stall barn.

If pastures are not subjected to physical damage during wet periods or over grazing during dry periods, there is the potential for higher pasture DM yields. There is also the option of growing higher yielding crops such as maize or lucerne for a 'cut and carry' regime thereby achieving higher DM production/ha than a traditional system. Clark et al (2001) reported that there is the potential of growing 45t DM/ha from a maize-winter crop combination.

However, housed cows are not what the public world wide wants to see plus these cows are more labour intensive. Treating lame cows is one of the most demanding health issues to be approached on farm, presenting a massive drain on resources as it is expensive in both time and physical effort (XL Vets, 2005). In an UK study of 53 dairy farms, the best 20% had 0-14% lame cows and the worst 20% had 35-54% lame cows (Whay *et al.* 2003). DairyCo (2009) reported that 25% of British dairy herds are lame at any one time and pointed to common areas of improvements such as ensuring easy flowing walkways, good ventilation, and light and airy sheds with comfortable cubicles being important requirements.

Other major issues of housing cows are the large capital investment for building the large structures plus ancillary requirements for feed storage and effluent management facilities. This farming system has higher on-going cost structure with its reliance on imported feed.

'Hybrid' Partial Housing

The future of NZ farming will be combining the best of both the traditional grazing and cow housing systems into a new 'hybrid' system (Photo 2). It has been apparent over the last 10 years that some leading New Zealand farmers are already benefiting from the use of partial housing in a combined 'hybrid' system.

Cows given shelter from adverse climatic conditions (be it heat or cold stress) allows less energy to be used in maintaining body temperature meaning more energy is allocated to MS production. Having cows off paddocks also prevents wet soils from being damaged meaning there is more pasture grown.

Photo 2: Example of partial housing animal shelter.

A recent RedSky farm performance analysis of top performing farmers (DBOY, 2013) has highlighted the potential of the ‘hybrid’ system approach to dairying (Table 1). These two award-winning farmers have been using partial systems for nearly ten years now and have been able to increase their MS production and profitability to a level far above the national average. It is interesting to note that under either high-input or low-input systems that the ‘hybrid’ partial housing system is successful and profitable.

Table 1: Finalist results for 2013 Dairy Business of the Year (data from DBOY, 2013).

Parameter	Farmer A (Otago)[1]	Farmer B (BOP)[2]	NZ Average
Stocking Rate (cows/ha)	3.4	2.5	3.1
Milk production (MS/ha)	1563	1140	1614
Milk production (MS/cow)	454	462	396
Pasture harvested (t DM/ha)	15.9	11.7	15.6
Pasture (% of total feed)	88.6	90.1	82.5
Cost of production ($/kgMS)	$3.19	$3.62	$4.07
Labour efficiency (cows/FTE)[3]	230	161	141
Return on capital (%)	9.5%	8.2%	5.7%

[1] S. Korteweg, Supreme Winner, HR Award, Southland/Otago Best Farm
[2] M & L Parnwell, D Mathis, Bay of Plenty Best Farm, Environmental (low input)
[3] Cows milked per full-time equivalent

While the figures in Table 1 demonstrates what can be achieved with ‘hybrid’ systems data on how is scant. Results from Preston Wills (2013) shows how improvements in several stock reproductive and health areas translates to greater milk production (Table 2). Two animal shelters were built during the 2007/08 season which coincided with a “100-year drought”, a third shelter was erected in 2010/11. The 2012/13 season featured a nationwide drought.

Table 2: Key performance indicators for stock reproduction, animal health and milk production before and after partial housing introduced to farm (from Preston Wills, 2013)[1].

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Reproductive/Health progress							
3-week submission rate (%)	75	76	86	81	85	90	92
6-weeks in calf (%)	66	59	69	68	66	76	79
Empty rate (%)	6	7	3	3	3.5	3	2
Somatic cell count[2]	240	228	242	239	208	197	131
Production/Feed performance							
MS/cow (kg)	310	289	330	353	370	409	417
MS/ha (kg)	907	847	972	1,042	1,093	1,209	1,235
DM feed (kg/ha)[3]	14,260	10,820	12,430	14,300	15,260	14,500	15,480
FCE (g MS/kg DM)[4]	64	78	78	73	72	83	80

[1] Ballance Farm Environment Awards Supreme Winner for the Waikato
[2] SCC in August ('000)
[3] Pasture production (measured on farm) plus imported supplementary feed.
[4] FCE = Feed conversion efficiency

Environmental benefits

Adopting the partial housing approach to farming has obvious benefits for pastures and soils as has been outlined above. Along with these benefits of removing stock from paddocks there is also a reduction in the number of high-risk urine spots and its consequence impact on nitrogen leaching. Using animal shelters that contain and store manure, until land applied evenly during periods of low risk, has huge environmental advantages.

Recent research at the Massey No. 4 Dairy Farm has demonstrated a 50% decrease in N leaching with on /off duration-controlled (DC) grazing management (Christensen et al, 2012). DC grazing management involves standing the cows off pasture to ruminate and rest rather than allowing them to remain in the paddock after grazing. To meet animal welfare expectations an adequate partial housing structure should be available to off paddock cows.

Open gate approach.
We have demonstrated that the 'hybrid' farming system is already working very successfully in different parts of the country. The next step looking to the future is to acknowledge that cows know best as to what suits them, in effect it is moving towards self-managing cows.

Some 'hybrid' system farmers are progressing even further by allowing cows to be more self-managing in an open gate farming system (OGFS). The OGFS approach means that cows are moving themselves rather than requiring labour to move them. Farmers will give cows' choice as to when they can graze, for how long, where they can lie, when and where they can get shelter. Cows will then have the opportunity to return to the hub of the farm (the animal shelter near the milking shed) when they desire. There will not be closed gates on the herd for any more than short time periods (milking, AB, calving, etc) or in extreme weather periods.

Technologies such as Batt-latches can be employed to great effect. This does not mean the cows have the run of the entire farm but do have constant access between either paddock or shelter. Farmers using the OGFS will change the way they treat cows. Feed supply will still be controlled by the farmer, but they will rarely have to move cows. However, famers will have to be more proactive as unsettled cows will return to the animal shelter early.

Leading farmers that have started down the OGFS are experiencing great results. As soil damage is minimal, pasture production increases provides extra feed so cows are fully fed and can achieve their potential in milk production. Cows with access to shelter when faced with climatic extremes of being either too hot or too cold, use less energy warming or cooling their core temperature and are therefore subjected to less stress. If cows are able to amble along races at their own pace, they are less likely to succumb to lameness.

Pasture quality will still be controlled by cows returning to a few under-grazed paddocks sooner. If the resulting extra feed grown is widespread then this feed can be harvested or grazed with extra stock. On farm experience is showing this increased yield is ongoing for several years and requires adjustment by the farmer. A Bay of Plenty farmer was able to keep all his replacements at home after the third year of practising OGFS.

On the larger farms where there is the need to reduce stock walking distances, the furthest paddocks on the periphery of the property can be used as 'cut and carry' cropping blocks. These cropping blocks are then ideal areas to receive the organic matter and nutrients from the manures generated in the animal shelters.

Conclusions
The public is becoming more and more aware of where food is coming from. As New Zealand's primary industry, dairying standards need to be superior. Export markets and the urban population will continue to demand improvements in farm systems. Consumers expect high quality products from an environmentally and animal friendly agricultural industry. These 'hybrid' systems are already exceeding standards in these areas.
The use of partial housing is allowing advances in animal management such as self-managing cows with OGFS. The OGFS is beginning to be implemented on leading farms showing increases in profitability and animal welfare while reducing environmental impacts. With pressures on New Zealand dairying coming from both the general public and regulatory bodies, these OGFS are seen as being a better way forward than traditional grazing or fully housed systems.

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