The challenges of animal wintering from a sustainability perspective

D.E. DALLEY*

DairyNZ, P.O. Box 160, Lincoln University, Lincoln 7647, New Zealand
*Corresponding author: dawn.dalley@dairynz.co.nz

ABSTRACT

Winter represents an important time for South Island dairy herds. The task of improving body condition of cows during winter poses a number of challenges in this environment. Under current forage crop based wintering systems, many cows fail to achieve body condition score targets and there is increased potential for nutrient leaching and the loss of soil structure and health.

In addressing the poor cow performance and to minimize the environmental impact of current systems, farmers are looking to alternative wintering systems. Consequently off-pasture systems to manage feed supply and provide shelter in winter are becoming more common to remove the need for grazing forage crops and limit effluent discharges into the environment. While many farmers have viewed such systems as a solution to their wintering issues, rapid implementation and lack of readily available information on best practice management has resulted in sustainability issues unique to these new systems.

This paper examines the challenges of wintering in the southern South Island and outlines how the dairy industry is working to provide sustainable options for the future.

Keywords: winter, dairy, environment, welfare.

INTRODUCTION

The South Island of New Zealand has seen significant growth in dairy farming over the last 15-20 years. At present, the South Island dairy industry farms 35% of New Zealand's dairy cows and produces 40% of the nation's milk (DairyNZ, 2010). Due to both the availability and affordability of the land for dairy farm conversions, especially in Southland and Otago regions, there is still great potential for further expansion in this industry.

For southern South Island farmers animal wintering provides a number of challenges not encountered in other dairy regions of New Zealand. The main animal wintering issue is the inability to grow sufficient pasture during winter to meet the daily feed energy requirements of current dairy farms. Winter pasture growth is usually less than 10 kg dry matter (DM)/hectare/day (D. Dalley, Unpublished data), which makes pasture based wintering an impractical option due to the area of land required to accumulate sufficient pasture to meet herd feed requirements. This is also a period when the heavy southern soils become waterlogged making grazing difficult and costly on subsequent pasture production. In addition to damaging pasture, grazing wet soils increases the risk of nutrient and soil loss into waterways and reduces feed utilisation resulting in cows consuming insufficient energy to achieve their pre-calving body condition score targets.

As a consequence alternative wintering systems such as grazing forages and off grazing practices, such as stand-off and housed systems have been adopted. Typically dairy wintering systems in the southern regions of the South Island are based on grazed forages such as kale, swedes and more recently fodderbeet, which provide large quantities of high quality standing feed on a relatively small area (E. Chakwizira, Personal communication). The sustainability of these types of wintering systems is increasingly being questioned in terms of consistently providing for animal needs and ensuring good animal welfare standards. Consequently off-pasture management systems such as stand-off/feed pads and housed systems are becoming more common. The particular system a farmer selects will be determined by their individual circumstances. All systems have an equal opportunity for success or failure (Dalley, 2010).

Regardless of the choice of wintering system chosen, the system must maintain or improve the profitability of the farm business at the same time as achieving environmental, animal or social goals (Riemersma *et al*., 2007). This paper will address the concerns associated with the sustainability of current dairy cattle wintering practices used in the southern South Island. It will focus specifically on the environmental and animal welfare impacts, and the feed supply and profitability of forage grazing and off-pasture wintering systems. The paper will also outline a dairy industry initiative aimed at providing sustainable solutions to farmers.

Environmental impacts

In contrast to the volumes of research on the impact of grazing pasture on water quality, there are few reported studies that document transfer of nutrients and faecal microorganisms (FMO) from winter forage crops to waterways or document the

environmental impact of off pasture systems. R. Monaghan (Personal communication) reported that most losses to water from grazed winter forage crops are mainly dissolved nitrate-N and are transported via leaching rather than overland flow. Losses appear to be exacerbated by the high density of urine patches associated with high stocking rates on crops, low plant growth rates and the influence of heavy soil drainage systems such as, mole-drains. As a consequence, Nitrogen (N) leaching losses per hectare from grazed winter forage crops are high relative to losses measured under pasture. Winter losses therefore comprise a disproportionately large contribution of total dairy system losses, relative to the area occupied by winter forage crops. Some improved management practices such as the use of minimum and no-tillage practices to establish crops coming out of pasture and the use of nitrification inhibitors may help to reduce these losses. The role of winter forage crops as a source of phosphorous (P) and sediment loss to waterways is less clear, with some conflicting findings evident in the two published field studies (Drewry & Paton, 2005; Houlbrooke *et al*. 2009). The importance of grazed winter forage crops as a source of faecal microorganism contamination of water is even more uncertain given the paucity of data available.

High stocking densities when grazing standing crops can result in considerable physical damage to soil, because grazing typically coincides with periods when soil water content is high. Little information is available on the effects of continuous cropping and winter grazing on soil quality and the long-term productivity of dedicated dairy support units, however, research (Beare & Tregurtha, 2004) on arable cropping farms in Southland has shown that winter grazing with cows can markedly reduce soil quality and subsequent crop performance.

Soil damage associated with winter grazing of forage crops can be viewed as short term if cropping is part of a pasture renewal programme and land is cultivated in the spring before pasture species are re-established. To minimise long-term soil damage it is recommended that paddocks are only cropped consecutively for two years and are then returned to pasture (Houlbrooke *et al.*, 2009). Consequently only 10-20% of the farm should be cropped each year. When paddocks are subjected to repeated winter forage cropping and grazing, as is sometimes the case on dairy support blocks, this damage is likely to be cumulative and may approach thresholds where future productivity is compromised. Soils are at the greatest risk of damage have a high structural vulnerability index (Hewitt & Shepherd, 1997). Increased susceptibility to phosphate and sediment losses in overland flows as a result of the deterioration in the physical quality of soils needs to be considered when cropping rotations are planned.

The potential of using off-pasture systems to reduce nutrient and sediment losses to water are also not clearly defined. Although well-designed and managed stand-off pads and housing systems can capture the herd's excreta during the wettest, and thus riskiest, time of the year, this containment can introduce additional inefficiencies associated with storing and re-applying the effluent to fields when conditions permit. Losses from ammonia volatilisation and emissions of the greenhouse gas methane from stored effluent and applied manures and slurries are examples of this. Methods of effluent handling and storage have a large influence on such losses. Currently, there are very little New Zealand-specific data available that quantify the magnitude of these potential losses (R. Monaghan, Personal communication). Nevertheless, provided appropriate effluent management systems are in place, it can be assumed that stand-off and housed approaches to wintering cows will result in less treading damage to soils and lower losses of nutrients and faecal microorganisms to water. One unintended consequence of these systems is odour from effluent storage ponds and during the application of sludges and slurries to land. Based upon farmer experiences elsewhere, the tactical use of off-pasture systems is expected to provide greater flexibility for protecting soils and pastures from cow treading damage during wet periods.

Animal husbandry and welfare

Whichever wintering system is used, all have associated risks for animal welfare. Housing systems in particular pose risks associated with stress from inadequate lying times (G.A. Verkerk, Personal communication). There is extensive international literature (Bowell *et al*. 2003; Hristov *et al.*, 2008) describing risk factors that need to be considered to ensure delivery of good cow welfare in stand-off and housed systems and much of it is transferable to the New Zealand situation. The general perception of society is that animals wintered outdoors on forage crops have a lower standard of welfare than those housed indoors. This is not always supported in the literature (Stewart *et al*., 2002). Housed animals are exposed to a different set of risks, particularly when the farm management team has no experience managing cows in such systems. The South Island has a higher risk of cold stress during June, July and August (Bryant *et al*., 2010b). While this can largely be mitigated by extra feeding of cows to increase energy intake, opportunity to achieve this is dependent on the actions of the farmer. Poor performance of cows on forage crops is primarily a result of insufficient dry matter allocation (Judson &

Edwards, 2009), with crop utilisation being of secondary importance.

Webster *et al.* (2008) reported that a combination of wind chill and wetness resulted in a number of behavioural and physiological responses in dairy cows. When exposed to a week of cold windy and wet weather outdoors cows spent more time standing and less time lying than cows housed indoors in a barn (Webster *et al.*, 2008). Cows outdoors spent less time eating than those indoors with the biggest difference occurring between 24:00 h and 08:00 h. Cows in higher body condition score were less susceptible to the effects of the stress and this provided an effective management option to reduce the negative impact of winter weather conditions in grazing animals.

The increased use of off-grazing systems has created a new set of challenges in ensuring that animal welfare is not compromised during the winter period. In a recent review of animal welfare risks in off-grazing management systems (G.A. Verkerk, Personal communication), important design features to protect animal welfare included space allowances, bedding systems and feeding area design. Stocking density is negatively associated with feeding activity, lying time and overall animal welfare and positively associated with the risk of mastitis. Consequently the space allowance per cow in off-grazing systems should increase as the duration of time spent in these systems increase. Better thermal comfort, improved feed utilisation and decreased energy expenditure from walking all contribute to the lower feed requirement of cows wintered off pasture and crop (de Wolde, 2006).

Labour

Any decision about the sustainability of a wintering system, should consider the social implications for those working on the farm, in particular, the quantity and quality of labour that will be required, and how the staff will be managed. The type of wintering system employed will dictate the knowledge and skill base required of farm staff as well as affecting the policies and operating procedures that need to be implemented. It will also influence how the present and future employees view the desirability of working on that farm. Past trends and future labour forecasts suggest that increasing numbers of people will be required to work on New Zealand dairy farms, while availability of skilled labour for dairy farming is likely to decline (Bennett, 2009; G. Taylor, Personal communication). In this climate, it is important that farmers use staff efficiently and create desirable working conditions that attract and retain staff (Riemersma *et al*. 2007; G. Taylor, Personal communication).

Feed supply

A combination of forage crop, silage and hay/straw should be fed to meet the energy requirements of the dry cow and to maintain a nutritionally balanced diet. The amount required will be influenced by age and body condition of the herd, environmental conditions and feeding practices. In most cases 10.0–12.5 kg DM *eaten* (not offered; 115-144 MJ ME) per day will suffice, of which 50-60% should be forage brassica, 30-35% silage or baleage and the remainder as hay or straw (Nichol *et al*., 2003). Anti nutritive factors such as high nitrate concentrations and S-methylcysteine sulfoxide (SMCO) in the feed, rapid intake rates and low dry matter content of forage crops necessitate the requirement for a fibre source to slow the rate of crop intake and keep cows satiated for longer. Typical indoor silage allowances are 8-10 kg DM/cow/day (85-105 MJ ME; de Wolde, 2006).

Higher feed utilisation and lower energy demand (Bryant *et al*., 2010a) where cows are kept on feed pads or in housing will allow cows to achieve target body condition scores at calving from lower daily dry matter intakes. The BCS in which a cow calves, the amount of BCS she loses post calving and nadir BCS are all associated with milk production, reproduction and health (Roche *et al*., 2009).

Profitability

Wintering is a large contributor to farm working expenses in the South Island. Accurate data are difficult to acquire because winter grazing costs often get recorded with costs of young stock grazing, bought in feed, freight and support block management. Nevertheless, wintering costs are estimated to comprise 20% of farm working expenses (Dalley, 2010). Forage crops are generally considered to be a better economical option for wintering cows, however their profitability is highly dependent on yields which vary greatly depending on crop management, soil condition, and weather. Costs of off-pasture management systems are variable. Guaranteed sources of supplementary feed and bedding materials at affordable prices must be available for stand-off pads and most types of housing to be economical. These systems have the advantage of allowing more days in milk contributing to a higher milk revenue (de Wolde, 2006). There is significant capital cost associated with building and maintaining these systems and their long-term profitability has not been established in New Zealand.

Beukes *et al*. (2010a) used a modelling approach to examine the cost effectiveness, exposure to climate induced risk, and major economic drivers of four selected wintering strategies:

1. Brassica system: Grazing a forage brassica crop on support land.
2. All pasture system: Grazing pasture on support land.
3. Stand-off system: Grass silage that is made on support land is fed to cows on a stand-off pad where effluent is captured.
4. Housed system: Grass silage that is made on support land is fed to cows in a housed facility where effluent is captured.

The Housed system had the highest mean ± standard deviation operating profit over 35 independently simulated climate years ($743 ± 122/ha), followed by All pasture ($681 ± 197/ha), Stand-off ($613 ± 135/ha) and Brassica ($599 ± 212/ha). The Housed system was also the least exposed to climate induced risk with a coefficient of variation of profit of 16% compared to 35% of the Brassica system. The four systems demonstrated different financial strengths and weaknesses but overall profitability was similar. The Brassica system is a high risk system from an environmental perspective and the All pasture system an unlikely alternative because of scarcity of suitable land. Both the Housed and Stand-off systems appeared to be cost effective alternatives that allow high control over cow feeding, body condition and comfort during winter.

Industry response

The dairy industry has responded to concerns over the sustainability of current wintering practices by investing in a four year programme of work to increase the adoption of wintering systems that reduce the environmental impact, are cost effective, practical to implement as well as meet the needs of the animals and providing reliable sources of high quality feed. Through detailed monitoring of commercial farms, controlled research on demonstration farms and input into regional policy processes the project aims to ensure current wintering systems operate in a profitable and sustainable manner, and with changes to wintering systems on individual farms being based on the best option for each particular situation.

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