

# FACTORS TO CONSIDER WHEN EVALUATING THE SUCCESS OF YOUR WINTERING SYSTEM

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## Summary

To be successfully implemented, all wintering systems require specific attention in the following areas:

- Feed budgeting and planning
- Stock management
- Risk management
- Staff skill development and relationship management and
- Environmental protection.
- Key performance indicators of successful wintering are:
- 90% of the herd achieving body condition score (BCS) targets at calving of 5 for mature cows and 5.5 for 2 and 3 year olds
- Less than 2% deaths between drying off and the end of calving
- No breaches of environmental rules or consent conditions
- Staff refreshed and prepared for calving
- Financial targets have been met.
- Recent research has indicated that
- High levels of crop utilisation (85 to 98%) can be achieved across a wide range of crop allocation and crop type
- Rate of intake is higher for kale than swedes but with both crops at least 85% of the daily intake can be consumed within the first 6 hours of feeding
- Both utilisation and rate of intake are lower when cows graze autumn saved pasture
- Allocating crop as two equal feeds 5 hours apart results in a slower intake rate but cows are still able to consume 98% of the daily intake within 3 hours of the second feeding
- Dry cows are capable of consuming up to 13 kg DM kale/day at a high level of utilisation
- Body condition score gain is unlikely when cows are offered 11 kg DM/cow/day kale and 2-3 kg straw during the dry period.
- The energy and protein content of kale decreases progressively down the stem – forcing high rates of utilisation will decrease the energy concentration of the diet especially in medium and giant kale cultivars.

## **Introduction**

The South Island, New Zealand has seen significant growth in dairy farming over the last 15-20 years. For many 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 Winter pasture growth is usually less than 10 kg DM/ha/day (D Dalley unpublished; [www.sidc.org.nz](http://www.sidc.org.nz)), which makes pasture based wintering an impractical option for many, due to the area of land required to accumulate sufficient pasture to meet herd feed requirements.

As a consequence alternative wintering systems such as grazing forages and off pasture systems, such as stand-off and housed systems have been adopted. The particular system a farmer selects will be determined by their individual circumstances, and all systems have an equal opportunity for success or failure (Dalley, 2010).

Regardless of the 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, 2007).

DairyNZ, in conjunction with MAF Sustainable Farming Fund and Environment Southland, have embarked on a 3 year research programme, called the Southern Wintering Systems Initiative, to provide key performance indicators (KPI) for a range of wintering systems against which farmers can compare the performance of their own systems or evaluate alternative wintering systems. While the project is based in Southland, the principles are directly transferable to other regions of the South Island.

## **The monitor farm project**

Six commercial dairy farms across Southland and South Otago have been selected to participate in the study. Monitoring on the farms commenced in June 2010 and the information collected is being used, together with research at Telford and Lincoln University, to develop key performance indicators for feed, environment, animal health and welfare, people and finances.

The project aims to demonstrate that wintering decisions need to take into account:

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## **Profitability and risks**

The profitability of forage crop systems is highly dependent on crop yields which vary greatly depending on crop management, soil condition, climate and the amount of supplement required. Housed systems can have the advantage of lower feed requirements during the winter but come with a higher capital cost, although some of this cost can be offset by increased days in milk (Beukes *et al.* 2010).

Do you know how much your wintering system is costing you, what additional income it is generating (increased days in milk, better BCS at calving) and what savings it is providing (replacement of fertiliser nutrients with manure and effluent)?

It is important to identify the risks associated with each wintering system and put plans in place to minimise these. A wintering system risk assessment has been undertaken for each component of the farm system on each monitor farm. An example template is provided below:

<b>Risk</b>	<b>Importance</b>	<b>Likelihood</b>	<b>Why/Mitigation</b>
Insufficient feed for winter	High	Low	Two long-term contracts for the provision of standing pasture for silage
Insufficient manure/effluent storage	Medium	Medium	Homework done on establishing size of storage requirement; provision to irrigate effluent via low rate during winter if conditions are suitable
Suitable bedding material not available	High	Medium	A range of sources available, good relationships developed for supply
Mastitis outbreak	Medium	Low	Blanket dry cow therapy/cows checked regularly through winter
Failure to achieve body condition score targets	Medium	Low	Ad libitum silage feeding through the winter
Farm owner has an extended period off the farm	Low	High	Simplicity of the system and low time commitment means staff members can ably implement the wintering system successfully.

**Figure 1.** Example wintering system risk assessment

System flexibility is important when considering risks. How easy is it to deal with insufficient feed, or a surplus of feed? Many farms in Southland/Otago operate a hybrid wintering system where several options are used for wintering cows on the farm to provide increased flexibility e.g. some cows on crop on the milking platform and some with a grazier. This does not appear to be as common in the Canterbury region. The level of flexibility

required will depend on the system being operated and the region. For example, the reliability of consistent crop yields on non irrigated support blocks will be lower than irrigated land where soil moisture is unlikely to be a limiting factor. Therefore, having contingencies for poor crop yields in un-irrigated regions will be a high priority.

### ***Feed supply, utilisation and quality***

All systems require a robust feed budget and the provision of sufficient high quality feed to achieve calving BCS targets. By monitoring crop yield on a monthly basis from early autumn, feed budgets can be revised and decisions made early on how to deal with shortfalls.

The results from a number of crop monitoring projects suggest that there is a wide range in dry matter content of crops and that leaf bulb ratios also vary across farms and regions. For plants like fodder beet where there is a significant difference in protein levels between leaf and bulb it is beneficial knowing the proportion of each in the crop to ensure the protein requirements of the animals are met.

While high utilisation of kale crops generally promotes lower DM intakes, the conditions in which the crop is offered, the daily allocation and the crop yield can influence this. Recent research at Lincoln University and Telford Rural Polytechnic has investigated crop utilisation, rates of intake and body condition or liveweight change in cows wintered on kale, swedes or pasture (Table 1). On light stony Lismore soils at Ashley Dene, utilisation of 7.5 tonne kale crops was 88-97% with no difference in utilisation between once and twice daily allocation of kale (Table 1; Rugoho unpublished). In contrast, utilisation of kale and swedes on heavier soils at Telford were in the range of 80 to 95% (Table 1). Utilisation of pasture in the two experiments conducted by Rugoho (Rugoho *et al.* 2010; 2010 unpub.) was less than that achieved with kale. The utilisation observed in recent research is similar to that reported by Judson and Edwards (2008) for kale crops across Canterbury dairy farms.

Whether cows achieve BCS gains at these levels of utilisation will be dependent on the amount and quality of supplement being offered, therefore, it is also important to monitor cow behaviour. If cows on crops have consumed all the available feed within 4 hours of allocation, they will not be meeting their energy requirements for maintenance, pregnancy and BCS gain. In contrast, cows in stand-off and housed systems have an increased ability to gain condition

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with a lower feed allowance due to higher feed utilisation, lower activity and lower energy requirements to stay warm. In cold and wet conditions, cows may need another 5 to 25 MJ ME/cow/day (0.5 to 2.5 extra kg DM) to keep warm (Verkerk 2011).

The body condition and liveweight change results from recent research differ between experiments, possibly reflecting the differences in energy intake. Greenwood *et al.* (2011) reported an increase in body condition score (0.8 BCS units) when cows were offered 14 kg DM kale and 3 kg DM straw but no increase when cows were offered 11 kg DM kale and 3 kg DM straw (Table 1). Greenwood estimated the energy intake of the two treatments to be 133 and 173 MJ ME/cow/day for 5 weeks for the low and high kale yields respectively. Pangborn and Gibbs (2009) were unable to detect changes in condition score when cows were offered 10 kg DM kale and 2 kg DM wheat straw. In contrast Stevens (unpub.) reported an increase in body condition score of 0.2 and 0.4 BCS units respectively, in one month, when cows consumed either kale (7.3 kg DM plus 3.4 kg baleage) or swedes (7.0 kg DM plus 5.0 kg pasture baleage).

Recent research (Greenwood *et al.* 2011) has demonstrated that high intake of kale can be achieved with once daily offering of crop, providing a generous allowance is given (Table 1). Offering kale or pasture as either a single feed or two equal breaks 5 hours apart did not increase dry matter intake (Table 1; Rugoho *et al.* unpub).

High crop utilisation may result in reduced diet quality (Judson & Edwards 2008; Rugoho *et al.* 2010) The ME of kale crops declined from 12.7 MJ ME/kg DM for leaf material to 6.6 MJ ME/kg DM for lower stem material (Judson & Edwards 2008). Cows eating 84% of an intermediate-stemmed kale cultivar (leaving just the lower stem) would have a diet quality (12 MJ ME/kg DM) greater than an equivalent cow grazing 80% (leaving just the lower stem) of a giant type cultivar (11 MJ ME/kg DM).

Recent research has demonstrated that dry cows are able to achieve very high rates of intake with both kale (Table 2) and swedes (Table 3). Rugoho offered 11 kg kale and 3 kg DM of straw either as a single feed at 10 am or two feeds split 50:50 at 10 am and 3 pm. Cows offered kale once per day had consumed 94% of their daily intake within 6 hours of feeding. For the two times per day treatment 98% of the daily intake had been consumed within 3 hours of the second feed (Table 2). Rate of intake was slower when pasture was offered with 83% of the daily intake consumed within 6 hours on once daily feeding and 93% consumed within 3 hours of the afternoon allocation with twice daily feeding (Table 2). In a second experiment the rate of intake of kale was increased when the kale allowance was lower (Table 2). Cows offered 11 kg DM kale/day consumed 98% of their daily kale intake in the first 6 hours of the day. At the higher allowance of 14 kg DM kale/day only 86% of the daily intake was consumed in the first 6 hours.

**Table 1.** Crop allocation (kg DM/cow./day), utilisation (%), intake (kg DM/cow/day) and body condition score change for recently completed research at Lincoln University and Telford Rural Polytechnic.

	<b>Crop/Grass Allocation</b>	<b>Supplement Allocation</b>	<b>Supplement Type</b>	<b>Crop Yield</b>	<b>Crop Intake</b>	<b>Total Intake</b>	<b>Crop Utilisation</b>	<b>BW Change</b>	<b>CS Change</b>	<b>Reference</b>
Kale High	14	3	Barley straw	15.2	12.1	14.8	88	+44	+0.4	Rugoho <i>et al.</i> 2010
Kale Low	11	3	Barley straw	14.9	10.7	13.4	96	+23	+0.2	Rugoho <i>et al.</i> 2010
Grass	11	3	Barley straw	4.4	7.6	9.3	70	+59	+0.2	Rugoho <i>et al.</i> 2010
Kale 1x	11	3	Barley straw	7.5	10.7	10.7	97	-	-	Rugoho (2010) unpub
Kale 2x	11	3	Barley straw	7.5	10.2	10.2	92	-	-	Rugoho (2010) unpub
Grass 1x	11	3	Barley straw	2.7	9.6	9.6	87	-	-	Rugoho (2010) unpub
Grass 2x	11	3	Barley straw	2.7	8.8	8.8	80	-	-	Rugoho (2010) unpub
Kale	8.4	3.4	Baleage	10.0	7.3	10.7	86	-	+0.2	Stevens (2010) unpub
Swede	8.6	5.1	Baleage	12.7	7.0	12.0	82	-	+0.4	Stevens (2010) unpub
Swede high	8	4.0	Baleage	12.7	7.6	13.0	86	-	-	Stevens (2010) unpub
Swede low	6	5.5	Baleage	12.7	5.1	8.9	95	-	-	Stevens (2010) unpub
Kale	10	2.0	Wheat straw	12.0 Est	8.5 Est	119 MJ ME	85% assumed	+2	-0.1	Pangborn & Gibbs (2009)
Pasture	6.3	7.0	Baleage	3.5	5.4 Est	117 MJ ME	85% assumed	+26	+0.1	Pangborn & Gibbs (2009)
Kale High	14	3	Barley straw	8.4	13.1	16.0	94	81	+0.8	Greenwood <i>et al.</i> (2011)
Kale Low	10	3	Barley straw	8.4	9.7	12.7	97	63	+0.1	Greenwood <i>et al.</i> (2011)

Similar observations were made by Stevens (unpublished). When 8.6 kg DM kale were offered once per day 95% of the daily intake was consumed within the first 6 hours. By comparison only 70% of the daily swede intake was consumed during the same period. When two allocations of swede were compared in the last 4 weeks of the dry period, there was no difference in the rate of intake. Approximately 86% of the daily intake was consumed within 6 hours of crop allocation (Table 3). The pattern of supplement intake was similar to crop intake in the research of Stevens (unpub.).

Correct crop allocation is critical. Judson and Edwards (2008) reported that cows on 66% of farms surveyed, consumed at least 1 kg DM kale/cow/day less than target intake with one herd being short by 8 kg DM/cow/day. Correct allocation requires accurate estimation of crop yield, paddock size, break width and available supplement (Dalley *et al.* 2008).

Undertaking a supplementary feed inventory to determine the quality and quantity of supplement on hand will increase the likelihood of winter feed targets being met. Weigh a few silage bales and get a DM test done rather than relying on book values. Cereal silage contains insufficient protein to meet cow requirements through the winter, so should not be fed as a sole diet or as the only fibre source with fodder beet.

**Table 2.** Effect of feeding frequency (once vs twice daily) or kale allocation 11 vs 14 DM/cow/day allocation) on cumulative kale intake (kg DM/cow/day) determined by measuring crop DM disappearance (Rugoho unpub; Rugoho *et al.* 2010)

	Kale		Grass		Kale 14	Kale 11	Grass 11
	1	2 <sup>1</sup>	1	2			
At 1 hour	7.21	3.59	6.38	3.63	3.0	4.1	5.1
At 2 hours	8.54	4.38	7.36	4.00	7.5	6.0	6.3
At 3 hours	9.13	4.95	7.84	4.09	9.4	8.4	6.8
At 6 hours	10.02	5.01	8.01	4.17	10.5	10.4	7.3
At 7 hours	-	8.95	-	7.94			
At 8 hours	-	9.56	-	8.12			
At 9 hours	-	10.03	-	8.21			
At 24 hours	10.71	10.20	9.63	8.82	12.1	10.7	7.6

<sup>1</sup>Twice (2) a day allocation cows received fresh allocation in the afternoon.

**Table 3:** Effect of crop type (kale or swedes) or swede allocation (high vs low) on cumulative DM intake of cows (kg DM/cow/day) offered crop once per day. Estimated intake determined by measuring crop DM disappearance (Stevens, unpub.)

	<b>Kale</b>	<b>Swede</b>	<b>Swede</b>	<b>Swede</b>
			<b>8 kg DM</b>	<b>6 kg DM</b>
At 1 hour	5.6	4.3	4.4	3.9
At 3 hours	6.2	4.7	5.9	4.2
At 6 hours	6.9	4.9	6.1	4.5
At 24 hours	7.3	7.0	7.2	5.1

### ***Environmental impact***

Most nitrogen (N) losses from forage crops come from leaching, rather than overland flow. Improved management practices such as minimal or no-tillage to establish crops (ex grass pasture) and the use of nitrification inhibitors can help to reduce these N losses (Monaghan *et al.* 2009). In contrast, most phosphorous (P) losses from forage crop paddocks occur through surface runoff, which also includes sediment and faecal matter.

Appropriate paddock selection and a well thought through grazing plan can minimise surface runoff and therefore the loss of nutrients and sediment into waterways. Below are some simple tips to consider when selecting and setting up paddocks for winter crops:

- Avoid paddocks with heavy soils and sufficient contour and slope to facilitate overland flow of water during periods when soils are waterlogged
- Graze towards waterways and roads. Ungrazed crop provides a buffer for runoff from grazed areas and a visual screen from road traffic
- Place bales away from the fenceline to allow good access and do not place them alongside drains and waterways where stock are likely to camp
- Move the back fence up regularly to reduce unnecessary walking and minimise soil structural damage

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- Fence off a riparian strip to form a vegetative filter near ephemeral streams and swales close to where they enter permanent waterways to reduce sediment and nutrient movement.
- Consider 3-4 rows of supplement to minimise walking distance when grazing
- Place the water trough centrally in the paddock, again to reduce walking.

Housed and standoff systems eliminate soil damage but require a good nutrient management plan and facilities for collecting, storing and spreading effluent/slurry/sludges. Significant savings in fertilizer costs can be made through the efficient use of the nutrients in the manure and effluent, however, this requires knowledge of the amount of material generated and the nutrient content.

On the monitor farm used in the Southland study that winters cows on stand-off pads with self feed silage, artificial fertilizer is now only applied to one third of the farm as one third receives the farm dairy effluent and the other third the effluent and slurry from the feed pads. This equates to an approximate savings of \$36,000 per annum on fertiliser for a 120 ha effective milking platform, wintering 370 cows.

### ***Animal health and welfare***

The primary objective of all wintering systems is to prepare cows for the subsequent lactation. A critical KPI is BCS. Having 90% of the herd achieve BCS targets at calving of 5 for mature cows and 5.5 for 2 and 3 year olds is a prerequisite of all wintering systems. Any wintering system that fails to achieve these targets cannot be deemed successful.

The monitor farm project has identified 4 critical times during the year when whole herd BCS assessments are undertaken. These times have been chosen to provide information to inform key decisions on the farm at that time. The 4 times are:

- Prior to mating to identify at risk animals that may require intervention
- Early autumn as part of developing the autumn feed budget
- Prior to dry off for allocation of animals to mobs for wintering
- Late winter to determine the success of the wintering system in achieving the BCS targets

By identifying individual cows within each BCS range, groups of animals can be tracked and decisions made on the appropriate plan of action.

Recent research has indicated that cows fed to gain condition are less susceptible to cold stress. In contrast, cows in poor condition are more susceptible to cold stress and are more likely to get ill in cold conditions (Verkerk, 2011). Therefore plan your autumn and winter feeding to reach condition score targets early.

The second important KPI relates to the incidence of disease and the number of deaths during the winter and spring. Wintering systems should be achieving less than 2% mortalities

from the start of winter to the end of calving. This equates to less than 10 deaths in a 500 cow herd.

To achieve both the BCS and mortality targets requires a smooth transition on and off the wintering system is required. This is particularly important when significant changes are being made in the diet such as when cows are being wintered on forage crops. Failure to transition cows onto crop correctly will reduce the amount of time available for BCS gain and increase the incidence of animal health issues.

Realistically, in a 10 week dry period, cows only have 6 weeks in which to gain condition as no condition is gained during the last 4 weeks of pregnancy (Roche, 2007). Poor transitioning onto crop can result in no condition gain for the first 2 weeks of the dry period, resulting in only 4 weeks in which to achieve calving BCS targets. Under these circumstances it is unrealistic to expect anything more than a 0.5 BCS unit gain over the winter period. In reality many herds only maintain condition during the dry period, therefore cows need to be dried off in the condition you are expecting to calve them in.

Incorporating a forage crop into the system on the milking platform can provide dual benefits and increase the flexibility of the overall system. Firstly, it allows cows to be transitioned onto the crop prior to drying off by allowing them access to the crop for 2-3 hours per day during the final 2 weeks of lactation and it also provides an area for late calving cows to come back onto in spring, reducing the demand for pasture and provides an area to stand cows off in wet conditions. Secondly, it can be used as a break crop in the regrassing programme or as part of the development process for new land.

In wintering systems based on pasture and silage, there is increased potential to achieve BCS targets that afford more flexibility with decisions during late lactation. However, consideration needs to be given to animal management in these systems. Any facility or system that decreases lying time is likely to have a negative impact on cow welfare (Fisher *et al.* 2002). If standoff and housed systems are being used permanently during winter with no on-off grazing then a minimum of 1 m<sup>2</sup>/100 kg cow liveweight is required.

Whichever system is adopted, keep in mind that some cows will just not adapt to being kept off pasture. These cows do not lie down for long enough, may not eat well, and often

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become lame. Make sure the farm staff can identify these cows and have a plan in place to deal with such problems as they arise.

### ***People***

The type of wintering system utilised will dictate the knowledge and skill base required by farm staff, and it also creates a working environment which may be deemed desirable or undesirable by future employees.

All grass wintering systems are generally considered ‘people friendly’ utilising similar feed and labour management skills to those that are used during the lactation period.

Brassica systems require sufficient technical knowledge and skill to produce consistently high yielding crops and the work associated with the feeding of this is perceived as hard on people and machinery. In contrast, housed systems appear to have a lower labour requirement compared to other wintering systems and they create a more favourable working environment for staff.

In considering the performance of your wintering system from a labour perspective you need to consider:

- The total hours worked each day
- The continuity of the work i.e. can all the tasks be completed in a 2-4 hour block at the beginning of the day or is there a requirement for someone to be around throughout the day to offer more feed?
- The skill requirement of the system – in more complex systems more training will be required to ensure all staff can implement the system successfully or alternatively, the skilled labour will have less flexibility in regards to annual leave.
- The physical conditions in which the staff are working. While little can be done about the weather, good planning when setting up a crop for feeding can reduce the effort required by staff. For example, leaving an ungrazed strip along the length of the paddock will make it easier to access the feeding face to move the fence each day, compared with the alternative of slogging through mud.

### ***Infrastructure***

The final consideration for wintering is the infrastructure needs of the system. Individual farms have unique resource bases and there is a range of avenues for securing land, infrastructure, and machinery, at varying costs to farm businesses. Successful wintering systems require the efficient use of existing capital, infrastructure, land resources, and the use of investment principles to drive profitable decision making.

## Conclusions

A successful wintering system will:

- Be profitable
- Meet the demands on safeguarding the environment
- Have healthy cows achieving body condition score targets of 5.0 for mixed age cows and 5.5 for first and second calvers and
- Ensure staff are happy and working sustainable hours

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