Getting the most from your dairy support land – Tips for allocating winter forages

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Summary

Best practice allocation of winter forages relies on

- Having a plan
- Knowing paddock areas
- Accurately estimating crop yields
- Determining the quality of the crop
- Measuring break sizes correctly
- Achieving high utilisation
- Making the system workable for staff

Introduction

As dairy farming businesses expand and the push for productivity improvement continues there is increasing pressure to maximise milksolids production from the milking platform. A consequence of this production drive is the need for off-farm grazing for replacement stock and cows during winter. There are several ways this can be met and the most common approach is to incorporate a support block into the dairy system. The South Island Dairy Development Centre (SIDDC) partners have just completed a 3-year study of dairy support blocks, especially how they can be integrated successfully into the farming business. This paper will provide an overview of the project's findings about dairy support blocks and will focus primarily on how to make the most from winter forages. Winter is extremely important for preparing cows for the following lactation therefore planning must occur early to control winter feed supply. Gone are the days when winter was a quiet time on the farm with staff taking time off to recharge their batteries before the demands of calving.

Key Drivers for Dairy Support Land use

Results from the project showed that the number one reason farmers opt for a dairy support block is to achieve control of feed supply and to minimise risk by reducing their exposure to market forces. The alternative, using graziers, has perceived risks (growth targets not met, price hikes, cows being sent back early, etc) that many believe can only be managed by taking control of this part of the business. Incorporating a support block gives self-containment and self-reliance. Often farmers are prepared to sacrifice profitability to gain control. However, for most, increased profitability and contribution to the overall operation are secondary drivers for having a support block.

Importance of control

To achieve high performance from the milking platform a high level of control over feed inputs and quality of stock in the system is required. Substandard experiences with outside parties often result in farmers deciding the risk of sourcing feed externally is too high. Purchasing dairy support land is often a strategic rather than a reactive decision and is a natural progression in the dairy farming career, once sufficient financial support is available to take this step. Support blocks are often purchased in 'high' income years when tax management is necessary. An alternative to purchasing is to lease land.

Increased profits

These occur primarily through increased revenue from additional livestock that can be reared and capital gain on the land. Capturing the profit synergies offered through the controlled interaction between the support block and the milking platform is also a driver for purchase. For many, capital gains are seen as a bonus to justify purchasing a block with few farmers opting to sell their support blocks to 'cash-in' on the capital gains. Selling relinquishes control, and control underpins the entire dairy operation.

Contribution to the overall dairy operation

Support blocks increase the variety of tasks that need to be undertaken by the farm team and provide opportunities away from the milking platform. For many they provide a new challenge and a change from the routine of milking cows. For some, the support block becomes the 'jet boat and holiday house' i.e. something that is enjoyable outside the milking operation. For efficiency gains to be realised farmers need to be able to define the purpose of their support land i.e. to increase total feed supply for milk production, control feed supply, remove the need to use graziers or for farm succession.

Support Block Management

Operations on support blocks are very diverse and are often driven by the degree of feed deficit on the milking platform. However, one key activity of support blocks is winter feeding of dry cows and in many situations this is based on forage crops, most commonly brassicas such as kale or swedes, grazed *in situ*. The remainder of the paper will focus on practical tips for allocating and utilising winter brassica crops. Most of the principles also apply to cereal and grass forages.

Factors to consider when allocating forages

Planning

Having a plan for winter is essential to ensure feeding targets are met and cows return to the milking platform in the correct body condition (5.0 for cows, 5.5 for heifers and rising 3-year olds). This is equally important when grazing the support block or wintering on contract. If wintering on contract establish a relationship with the grazier and involve them in winter planning so they know the targets and how they can be achieved. Autumn is the time to prepare a winter feed budget. Update this regularly as crop yields are confirmed, cow numbers finalised and condition score gain targets are established. The feed budget must include provision to transition cows onto forage crops. It is unrealistic to expect cows to adjust from a milking cow diet to consuming 10 kg dry matter (DM) of kale or swedes in one day. Ensure sufficient silage and/or pasture and straw to meet cow energy requirements during this 10-14 day period. Nichol *et al*. (2006) provide an excellent example of adapting cows to winter brassica crops. Include in your feed plan a strategy to deal with the percentage of cows that don't adjust to crops and ensure you have a robust monitoring system in place to identify these animals early.

Paddock area

An important starting point with feed allocation is knowing the paddock area. Without this any estimates of crop availability will be inaccurate and consequently feed allocation will differ from that intended. For example, consider a 250-cow herd being offered 10 kg DM/cow/day of crop, utilising 80% of the crop and requiring 120 MJ ME/cow/day. A 10 ha paddock with a yield of 12 tonnes DM/ha would feed the cows for 48 days (Table 1). However, it would provide only 46 days grazing if the paddock was in fact 9.5 ha. Alternatively, if the feed allocation calculations were based on 48 grazing days, less area in the paddock would result in less feed available over the grazing period. As a result, either less of the energy requirement of the cows would be met from the forage crop or less improvement in body condition would result. While the impact of paddock area on potential DM intake may seem small (Table 1), the cumulative effect becomes important if it is combined with inaccurate estimates of crop yield and low utilisation.

Table 1: Effect of paddock area on DM and energy intake by cows grazing crops.

Paddock area (ha)	Crop DM yield (kg/ha)	Available feed (kg DM)	No. of days grazing	Available per cow (kg DM)	Eaten DM (kg DM/cow/ day)	Energy intake (MJME/ cow/day)	% of require-ment
10.0	12000	120,000	48	10.0	8.0	100	83
9.5	12000	114,000	48	9.5	7.6	95	79
9.5	12000	114,000	46	10.0	8.0	100	83

Crop yield

The industry acknowledges that accurately determining the yield of kale and swede crops is difficult. However, there is a recommended standard methodology. It is important to remember that any method will only give an estimate. There is always a margin of error, mainly because of crop variability within each paddock reflecting soil type, uneven irrigation and fertility variation. The aim is to minimise the margin of error by using a robust method for estimating yield. The more even the crop the more accurate the yield estimate is likely to be. Crop variation across the paddock should be considered when determining break widths.

Use the following method to estimate the yield of a brassica crop (see the example in Table 2)

- Take several quadrat samples out of the crop. The more samples the better.
- For a reliable result, collect at least 6-8 quadrat samples per paddock. They should be evenly distributed so they are representative of the crop across the paddock.
- The bigger each quadrat area the better. A minimum size should be 1m^2 (use a 1m x 1m square quadrat or a circle made with a 3.55 m length of alkathene). For a 2 m^2 quadrat use 7.1 m length of alkathene to make the circle.
- Harvest all the material within each quadrat and measure its fresh weight after removing any excess soil, especially from the bulbs of swedes
- Determine the DM content of the plants. This may be estimated but, ideally, it should be calculated from measurements of the fresh weight of a sub-sample of plants and their dry weight after drying in an oven. DM content determination is offered as a service by some testing laboratories
- Calculated the yield from each quadrat by multiplying the fresh weight of the sample by its DM percentage (e.g. 9 kg fresh weight at 16% DM = 9 x 0.16 = 1.44 kg DM).
- Calculate the yield per hectare by multiplying by 10,000 for a 1m^2 quadrat or by 5000 for a 2 m^2 sample (e.g. 1.44 kg DM from a 1 m^2 quadrat multiplies up to 14400 kg DM/ha or 14.4 tonnes DM/ha).
- Finally, calculate the average yield from all the quadrat samples.

With an increasing number of cultivars available and variations in leaf:stem ratio and DM content, DM yield for a given crop height can be quite variable. Therefore, it is important that measurements are made rather than assuming an average yield. Judson & Edwards (2008) measured kale crop yields in Canterbury in winter 2007 that ranged from 4.4 to 17.1 tonnes DM/ha depending on fertiliser inputs, irrigation and cultivar. Comparable ranges for swede and kale crops in Southland are 8 to 20 tonnes DM/ha (PGG Wrightson, unpublished data).

Table 2: Example of yield calculations for a kale crop using an average DM content of 16%.

Quadrat ($1m^2$)	Wet Weight (kg/m^2)	DM content (%)	Dry Weight (kg/m^2)	Yield (kg DM/ha)
1	8.0	16	1.28	12800
2	10.0	16	1.60	16000
3	9.0	16	1.44	14400
4	11.0	16	1.76	17600
5	7.0	16	1.12	11200
6	9.5	16	1.52	15200
Average	9.08	16	1.45	14500

Often it is tempting to use an average DM content for crops. Commonly used figures are 15-18% for kale and 11-12% for swedes (Nichol *et al*., 2006). However, this introduces another error into the estimate. Judson and Edwards (2008) reported DM content of kale crops ranging from 14 to 20%. In general dryland crops were around 13.5-16% DM while irrigated crops were 18-20%. Kale leaf is 13-19% DM and stem 15-31%, so leaf:stem ratios also have an effect. If the fresh weight from a 1 m^2 quadrat is 10 kg, calculations using this range of DM contents would give yield estimates from 14 to 20 tonnes DM/ha. The DM content of the crop does not change much during the grazing period unless there is significant leaf drop or stems lignify rapidly in the latter part of winter.

The impact of yield on the number of grazing days, amounts of feed available and eaten and, energy intake for a 250-cow herd, being offered 10 kg DM/cow/day of crop, 80% utilisation of the crop and requiring 120 MJ ME/cow/day, is presented in Table 3. The difference between crops yielding 10 tonnes and 14 tonnes DM/ha in this situation is 16 days grazing or an additional 34 MJ/cow/day over 48 days. In terms of economics, assuming $970/ha to grow the crop and 80% utilisation, the costs are 12.1 c/kg DM eaten for a 10 tonnes DM/ha crop and 8.7 c/kg DM eaten for a 14 tonnes DM/ha crop.

Table 3**:** Effect of crop yield estimate on DM intake of cows grazing crops

Paddock area (ha)	Crop DM yield (kg/ha)	Available feed (kg DM)	No. of days grazing	Available per cow (kg DM	Eaten DM (kg DM/cow/ day)	Energy intake (MJ ME/cow/ day)	% of require -ment
10	10000	100000	40	10.0	8.0	100	83
10	10000	100000	48	8.3	6.6	83	69
10	14000	140000	56	10.0	8.0	100	83
10	14000	140000	48	11.6	9.3	117	97

Utilisation

Crop utilisation is a topic that until recently has been poorly understood. In winter 2007 a survey on utilisation of kale crops was undertaken in 49 dairy herds in Canterbury (Judson and Edwards, 2008). The survey included both dryland and irrigated crops. On crops ranging from 5 to 17 tonnes DM/ha kale utilisation ranged from 40 to 90% with a mean of 80%. There were no relationships between herd size, crop yield and % utilisation.

Furthermore in the survey, break width did not affect utilisation. The general belief is that utilisation is higher with narrower breaks as there is less opportunity for cows to walk through the crop, damaging plants and knocking leaves to the ground. The degree of damage done by cows is likely to be related to the leaf:stem ratio of the crop and the environmental conditions during grazing. The survey results may reflect the relatively good (dry) weather in Canterbury during the survey period and suggest increasing break width is not a major factor in utilisation in dry conditions. However, it might be more important in muddy, wet conditions e.g. Southland.

Utilisation depends on daily allowance – in general the lower the allowance the higher the utilisation and ease of harvest. The impact of strip width, sowing date and leaf:stem ratio on utilisation is being investigated in Canterbury in June-July 2008. Cultivar choice can have a major impact on utilisation for kale (Gowers and Nicol, 1989). Medium to tall cultivars, such as ‘Proteor’ and ‘Sovereign’ should be used (Nichol *et al*., 2006) because they have high yield potential and a leaf:stem ratio between 35 and 50%. ‘Giant’ type kales such as ‘'Rawera’ have a very low leaf:stem ratio and therefore large yields will be mostly stem. For these reasons these types are best avoided (Nichol *et al*., 2006). As the crop matures during winter utilisation is likely to decline as stems become more difficult to harvest as a result of lignification.

Utilisation has a large impact on the amount of feed eaten and energy intake (Table 4). Using the previous example, a good utilisation of 80% will result in cows consuming 83% of their daily energy requirement compared with only 63% if utilisation drops to 60% (Table 4).

When grazing brassica crops reserve an area with shelter to run cows off onto to feed a fibre source if the weather deteriorates. This is particularly important if the wintering area is prone to snow.

Table 4: Effect of % utilisation on DM and energy intake of cows grazing crops

Paddock area (ha)	Crop DM yield (kg/ha)	Available feed (kg DM)	No. of days grazing	Utilisation (%)	Eaten DM (kg/cow /day)	Energy intake (MJME/ cow/day)	% of require -ment
10	12000	120000	48	60	6	75	63
10	12000	120000	48	70	7	88	73
10	12000	120000	48	80	8	100	83

Quality

Like DM content, ideally a forage quality analysis should be undertaken for each crop as it varies with cultivar, farm management and season. The same sample that is used to determine DM content can be used for quality assessment if a service laboratory is being used. The normal range for kale quality is 10-13 MJ ME/kg DM and for swedes it is 12-13.5 MJ ME/kg DM. A higher leaf:stem ratio for kale is generally associated with higher quality because leaf quality (12.9 MJ ME/kg DM) is better than stem quality (10.5 MJ ME/kg DM). Also, the quality of the stem decreases from top to bottom from 12.4 MJ ME/kg DM in the upper stem to 8.6 MJ ME/kg DM in the lower stem (Judson and Edwards, 2008). Swede quality depends mainly on the quality of the bulb. It is also reduced by dry rot and clubroot in the bulb. Leaf:bulb ratio has an effect on quality, with the bulb generally being better quality than the leaf (Nichol *et al*., 2006). In large crops, leaf contributes only a small amount to total yield.

Allocation

Crop allocation is the culmination of the assessment of paddock area, yield, quality and utilisation. Daily energy intake required from the brassica component of the diet can be determined from a feed budget, and the challenge now is to allocate the correct area of feed each day to achieve this target. Sometimes there may be other competing factors that drive feed allocation decisions. For example, it could be that there are three paddocks left that have to last for the remaining 60 days of wintering or an area of crop has been purchased and it is logical to use it all. In these situations it is important to do the calculations to ensure that there is enough total feed (crop plus fibre source) to at least meet the cow requirements for the rest of the winter.

In the survey by Judson and Edwards (2008), farmers' estimates of how much kale was available to be consumed ranged from 4.5 to 11 kg DM/cow/day. Despite high utilisation of the kale crops, two-thirds of the herds surveyed consumed less than the targeted DM intake by more than 1 kg DM/cow/day. They surmised that the reasons for this include: inaccurate DM yield and DM content estimates, variability in DM yield across the paddock, inaccurate allocation (i.e. strips too narrow) or farmers were unsure on how much was being offered. Variation across the paddock is difficult to calculate. However, with an accurate average paddock yield and corresponding estimate of the number of grazing days/break sizes, the daily variations will even out over the time the cows are in the paddock. What the farmer has under control are estimates of the yield and allocation area. Getting the breaksize wrong by only 1 m can decrease allocation by 2 kg DM/cow/day (Table 5). Achieving uniform break allocation requires attention to detail and reliable systems for erecting fences through high yielding crops.

Table 5**:** Effect of break width on DM intake of cows grazing crops

Paddock area (ha)	Paddock length (m)	Break width (m)	Area/ day (ha)	Yield (kg DM/ha)	Feed available (kg DM/ break)	No. of cows	Feed allocation (kg DM/cow/day)
10	100	5	0.05	12000	600	60	10
10	100	4	0.04	12000	480	60	8

Animal Health

Before grazing kale it is important to check nitrate levels in the crop. Using nitrate testing kits or laboratory testing are good insurance policies to guard against the risk of cow deaths that can be caused by high levels of nitrate accumulation in crops. This is most likely to occur in cool, cloudy weather. Animal health problems may also occur if grazing kale late when it may be starting to flower. Cultivar may influence how early this occurs in a crop. Talk to your veterinarian about the best options for your farm.

Conclusions

To achieve the optimum performance from the support block during winter it is important to plan, find a system that suits the farm operation and ensure everyone knows the outcomes that are required. Winter can be an unpleasant time for staff and animals so it is important to get the system right. Paddock area, crop yield, quality, allocation and diet makeup all affect the amount of forage crop consumed and, ultimately, the condition cows will calve in. Don’t let a poorly planned and implemented wintering system have a lasting effect on next season’s production. Have a plan, revisit it regularly and revise if necessary.

Acknowledgements

The SIDDC Dairy Support Land project was funded by the MAF Sustainable Farming Fund and SIDE. The Pastoral 21 Feed programme (supported by DairyNZ, Fonterra, Meat & Wool NZ and the Foundation for Research, Science and Technology) and PGG Wrightson funded the surveys of crop utilisation in Canterbury.

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