Telford
Te Whare Wānaka o Puerua
A Division of Lincoln University

Private Box 6
Balclutha, 9240, New Zealand
Phone (03) 419 0300
Fax (03) 418 3584
www.telford.ac.nz

TLM 511500

Feed Budgets

Feed Budgets

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Contents

Learning outcomes

Planning, and the ability to adjust plans as a result of feedback, is an important skill for any successful business and farming is no exception. One important farm planning tool is the feed budget. Preparing feed budgets, monitoring production and adjusting budgets as required helps you to reduce risk and prepare to handle uncertainty.

To optimise farm profitability it is important to match feed supply with feed demand as closely as possible to achieve production targets. Providing too much or too little feed may result in waste, poor production and lower farm returns. Feed budgets play an important role in ensuring the right feed balance is met to achieve farm targets.

In this module you will learn how to prepare feed budgets to help achieve farm production targets. You will learn about the three different types of feed budgets; feed profiles, seasonal feed budgets and feed allocation or grazing plans.

At the end of this course you will be able to describe:

- describe the advantages and disadvantages of the different types of feed budgets
- identify and calculate the different components of feed budgets
- prepare a feed profile, seasonal feed budget and feed allocations
- interpret the different types of feed budgets

With the information learnt during this course you will gain a greater understanding of feed budgets and their use in assisting you to achieve farm production targets.

Feed planning

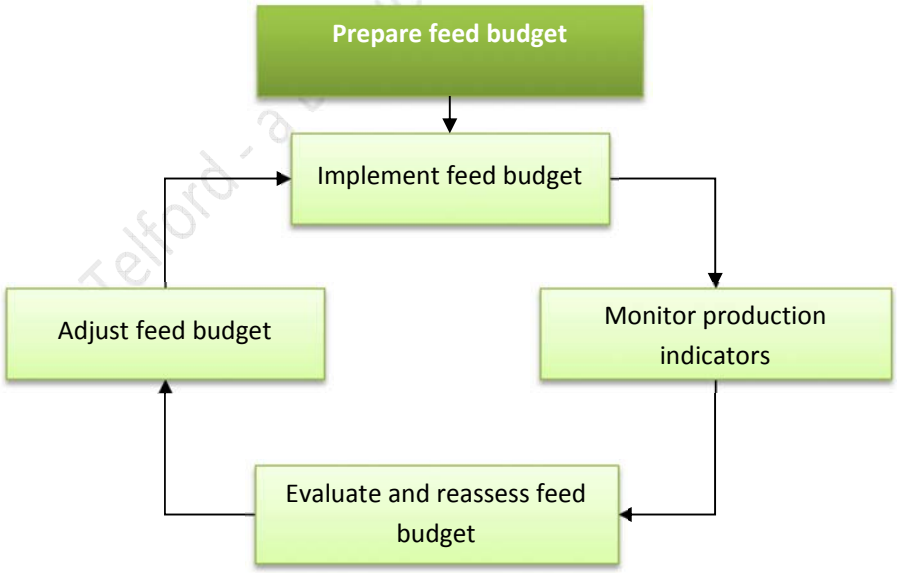
In pastoral systems, where the main feed source is pasture, seasonal and annual pasture mass and growth rates usually provide the basic limits of potential animal production. Knowledge of the timing and size of possible pasture surpluses and deficits is critical to aid decision-making to ensure animal production targets are achieved.

Perfect integration of animal needs with available feed is rarely achieved. Nevertheless, with the help of feed budgets feeding practices can be planned and adjusted to try to attain the ideal balance between animal feed demand and farm feed supply. To achieve this:

- you must always be aware of the total quantities of feed you have available
- the way and rate at which these are changing
- how these quantities can be used most effectively to meet feed demand now and in the future

This knowledge enables you to become more conscious of the capabilities of both your pastures and livestock. In turn, you are likely to develop the necessary confidence to improve farming efficiency and profits.

Feed budgets are planning tools that provide you with a level of control, not just to achieve required production targets, but to recognise when things are going wrong and allow you to take action before a situation becomes critical. The following diagram summarises the process of using feed budgets.



Although many farmers rely on experience and have a 'feel' for their property and livestock, the added assurances gained by objective measurements and budgets are invaluable, particularly in dealing with seasons and markets that fall outside the 'normal'. A drought in winter, high rainfall in summer, a failed

forage crop, an unexpected dip in commodity prices, an increase in exchange rates or any number of unpredicted variables may affect the final balance sheet of the farming enterprise.

In general, estimating animal requirements can be done with more confidence than estimating feed supply, particularly when relying largely on pasture. For example, you can estimate feed requirements for a cow of a certain liveweight and milk production reasonably accurately and these are unlikely to change from year to year. However, pasture production is significantly affected by the weather and predicting the weather is notoriously difficult. There may be less rain than expected or a flood could destroy ten of your paddocks. The best you can do is use average historical pasture production values when preparing your feed budget, then closely monitor the real situation as it occurs and update the feed budget accordingly.

Feed budgets can start at any time of the year and be of any duration.

The main objectives of feed budgets are:

- prediction and identification of periods of feed surplus or deficit
- provision of pasture cover targets that can be monitored to determine the effects of short term management changes
- analysis of the feasibility of different management and farm systems

Types of feed plans

Feed planning involves the use of different types of budgets. The main features of these are summarised in the following diagram. Common principles apply for calculating feed supply and feed demand for each type of plan.

Source: Adapted from 'Farm Management in New Zealand'

The feed profile provides the overall picture for the year, the feed budget provides more detail for specified time periods during the year and the grazing plan provides even more detail to determine day to day pasture allocation to livestock.

Computer or paper?

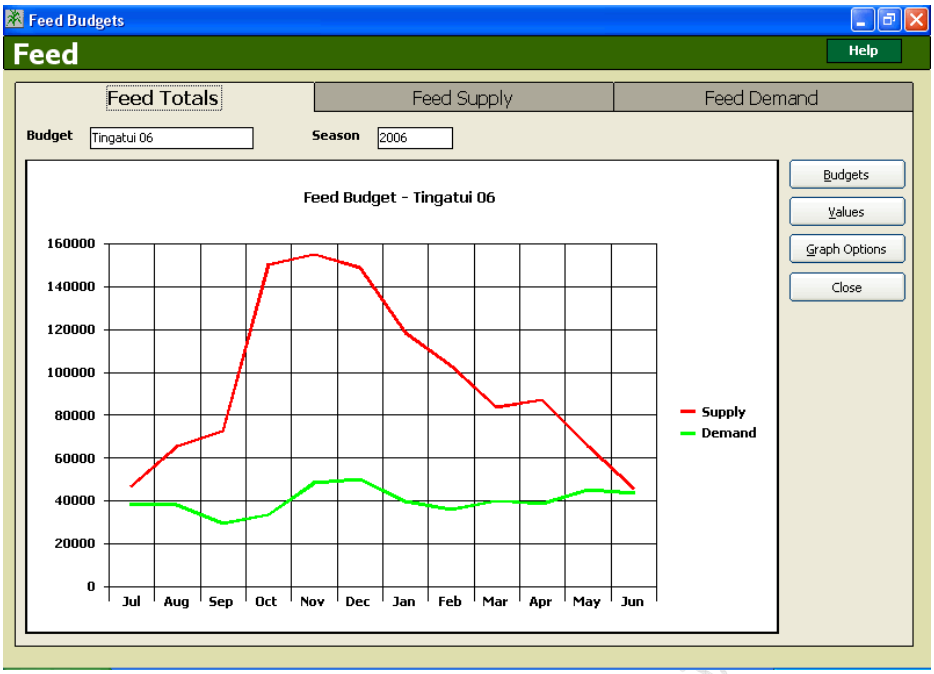
As with financial budgets, feed budgets are less prone to simple arithmetic errors and less time consuming when prepared using a computer. They are also easier to manipulate to explore different management options. Either a spreadsheet or specific feed budget programme can be used. There are several commercial feed budget programmes available including the following:

- **Farmax** can be used for feed budgeting or more complex performance modelling for sheep/beef/deer farmers. It is also suitable for managing dairy heifers. See www.farmax.co.nz for more information.
- **Feed calculators** from DairyNZ for dairy cow grazing: various Excel spreadsheets assist with seasonal planning – e.g., Spring Rotation Planner and other short term feed budgets. These are available free from DairyNZ's website (www.dairynz.co.nz).
- **FeedPlan Pro** from DairyNZ is used to prepare weekly feed budget plans for dairy cow grazing. Find out more or download a free evaluation version from www.feedplan.co.nz.
- **Q-Graze** for non-pregnant, non-lactating sheep and cattle: predicts diet selection, intakes and animal performance using monitored pasture mass and feed quality information. See Beef + Lamb NZ (www.beeflambnz.com) for more information.

An internet search will reveal more products for various feed management purposes (e.g. from consultants and pasture measurement tool suppliers). Talk to farmers or consultants who use the software and, ideally, try it out to assess suitability for your grazing system.

As with all computer programmes the final output is only as good as the information fed into it. It is vital that you have good knowledge of your farming systems and good estimates for production values so that any mistakes can be picked up quickly. For example, entering an August pasture growth measurement of 30 kgDM/ha/day instead of 20 kgDM/ha/day would have huge flow on effects that would totally change the look of the spring budget. Having a good general knowledge of the farm and its normal seasonal pasture production ensures simple data entry mistakes can be easily picked up.

Graphs, such as the following, are also easier to prepare using a computerised feed budget and provide at a glance the feed supply and demand situation over the period chosen.



If you don't have access to a computer, paper based templates can be used. These typically use a fill-in-the-gaps format for the feed and animal information, along with equations to use for calculations.

It is important to remember that feed budgets are based mainly on assumptions. Even with the best methods available, measurements can be lacking in accuracy or be incorrect, for instance, using pasture growth rate values from tables that don't really match the actual situation.

Feed profiles

In this section we will describe what a feed profile is, what the parts are, how it is created and how to interpret a feed profile.

A feed profile is a feed budget that predicts a farm's feed supply and feed demand situation for a typical year.

It is a strategic planning tool that uses farmer defined data, technical data and historical information. The more detailed the data and information is, the more accurate the predications and the better the contingency plans that can be developed for when the unexpected happens. A feed profile can be used to evaluate different scenarios and evaluate the viability of different management options. For example, the effects of the following actions can be compared to expected pasture growth:

- changing lambing or calving dates
- increasing stocking rate
- changing production targets
- changing the mix of livestock classes

Appropriate management strategies can then be planned to meet feed deficits and utilise feed surpluses.

Advantages and disadvantages of preparing feed profiles

The advantages of preparing a feed profile as part of your farm planning process include:

- aiding management decision-making
- identification of likely pasture deficits and surpluses enabling plans to be made to deal with these, and, in turn, aiding cashflow and workplan preparation
- ability to assess alternative farm systems which may lead to improved farm sustainability and profitability
- establishment of a base line from which to monitor actual pasture production and animal requirements and to enable you to recognise when conditions deviate from normal conditions so contingency plans can be initiated

Disadvantages of preparing a feed profile include:

- treating the feed profile as a rigid document and trying to make the farm fit the profile regardless of circumstances – this can lead to poor decision making – the profile should be viewed as a flexible tool that can be used and adjusted to assess varying potential conditions and actual on-farm conditions
- the possibility of using inaccurate farm or technical data that may lead to poor decision making, e.g. using pasture growth rates that do not accurately reflect your farm's pasture production hence inaccurate predictions of surpluses and deficits – this is more likely to happen in the early years of preparing feed profiles and over time your estimates of variables

such as pasture growth rates and pasture cover should get more realistic as you learn about your farm's specific characteristics

- the time needed to prepare and adjust the profile as required – this is only a drawback if you don't make use of the profile to aid management decisions

Units of measure

When creating a feed profile, total feed supply and total feed demand must be compared using the same units of measurement. These may be kilograms of dry matter (kgDM), kilograms of dry matter per hectare (kgDM/ha) or kilograms of dry matter per hectare per day (kgDM/ha/day).

Supplements such as hay, silage or grains are typically measured in kgDM so initially the units of measure to determine both feed supply and feed demand are typically kgDM. These can then be converted to kgDM/ha or kgDM/ha/day. This means supplements such as hay, silage, grains, PKE, crops, etc. are considered on a whole-farm basis, i.e. as if they are available spread evenly over the farm. This is a way of accounting for all the feed available (not just pasture).

Activity

Throughout this module we will be converting between kgDM, kgDM/ha and kgDM/ha/day.

You need to understand how to make these calculations. Study and complete the exercises in the attached document 'Converting units of measurement'.

Parts of a feed profile

There are two main parts to a feed profile:

1. Feed supply
2. Feed demand

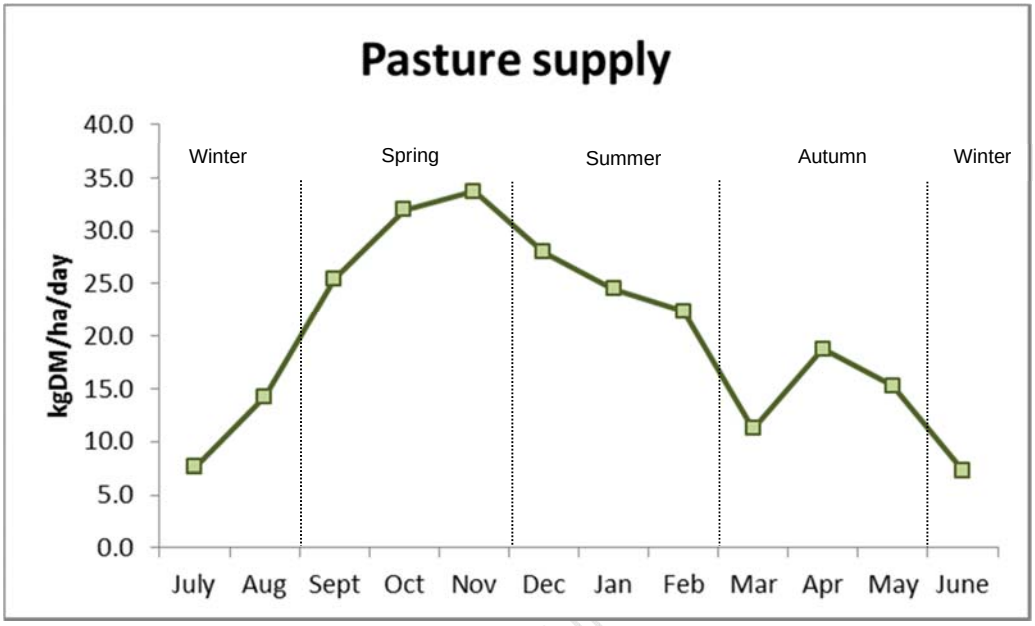
1. Feed supply

When first preparing a feed profile the aim is to assess how well pasture production matches animal requirements. Once pasture deficits and surpluses have been identified making or purchasing, and feeding supplementary feeds can be included in the feed profile to address these issues. Figure 1 shows monthly pasture supply for a 1000 hectare sheep and beef farm for a typical year.

In this example the year starts at 1 July. This is often used as a starting point as because farmers may have more time in the middle of winter to prepare a profile. Pasture covers are also often more even and easier

to estimate as pasture growth is slower. It is also the beginning of the financial year for many farmers and information collected for the last year's financial budget, such as stock reconciliations, can also be used to prepare a feed profile. The profile can be started on 1 June if you prefer.

Figure 1: Pasture supply (kgDM/ha/day) for a central North Island sheep and beef farm



Pasture accumulation follows seasonal patterns.

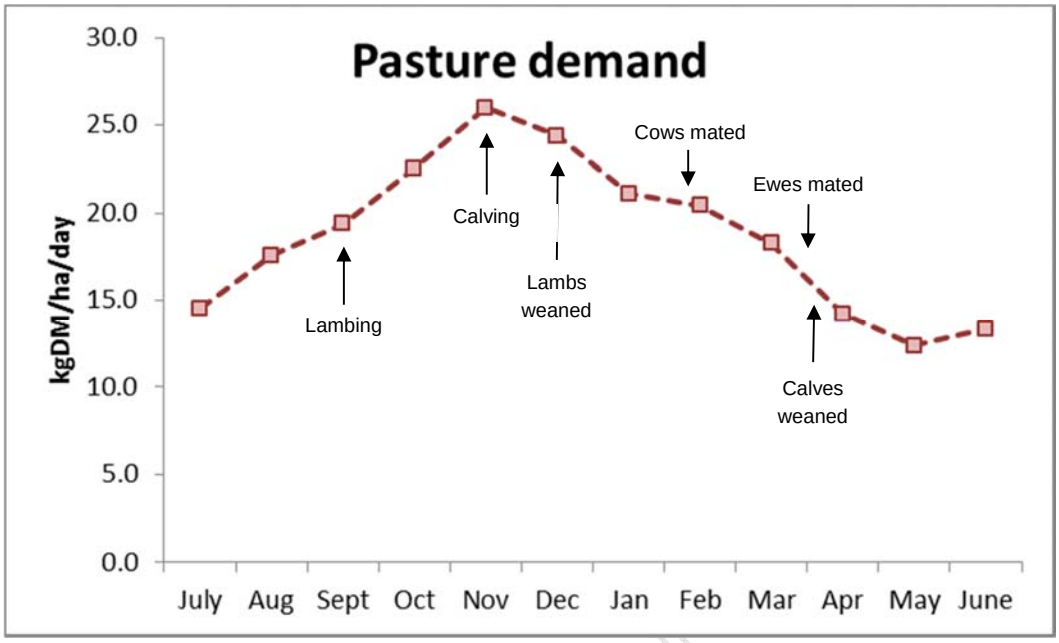
- Pasture supply is low during winter due to cooler temperatures, shorter days and lower light levels.
- It then increases rapidly in early to mid-spring (the spring 'flush') as temperatures increase, day length increases, light levels increase and mineralisation of nutrients increases as the soil warms.
- Supply peaks in November then reduces during summer as warm, dry conditions reduce grass growth and grasses form seedheads.
- In this location there is a significant reduction in early autumn pasture supply due to dry conditions at this time. It picks up again in mid-autumn (the autumn 'flush') and then drops again as temperatures cool and day length shortens.

2. Feed demand

The feed demand for a farm is the total feed requirements needed by animals to meet the farms production targets. It includes all livestock on the farm. If some livestock is grazed off the farm then the requirements of these animals are not included.

Figure ***2*** shows the feed demand for sheep and cattle on the same farm as Figure 1. To enable a comparison between feed demand and feed supply, feed demand is also measured in kgDM/ha/day. Timing of some key activities is indicated by the arrows.

Figure 2: Feed demand (kgDM/ha/day) for a central North Island sheep and beef farm



Animal feed demand depends on many factors; some seasonal (e.g. sheep normally mate in response to shortening day length) and others due to farm policies (e.g. stocking rates and production levels).

Figure ***2*** reflects these factors for this particular farm.

- Ewes and cows have a high feed demand during lactation and this is indicated in the increasing demand over the spring months. This also includes the pasture eaten by suckling livestock.
- On this farm sheep are the main livestock class. Lambs are grown through to slaughter weights and most are sold over January, February and March. Surplus ewe lambs are sold in January. Bulls are grown and sold as rising two year olds. As lambs and bulls are sold the feed demand drops off during the summer months.
- By April most lambs (other than replacements), rising two year old bulls raised for beef and heifers not required for replacements are sold resulting in a relatively low feed demand over late autumn through to mid-winter.
- As lambing approaches in late winter feed demand begins to increase again.

The feed profile

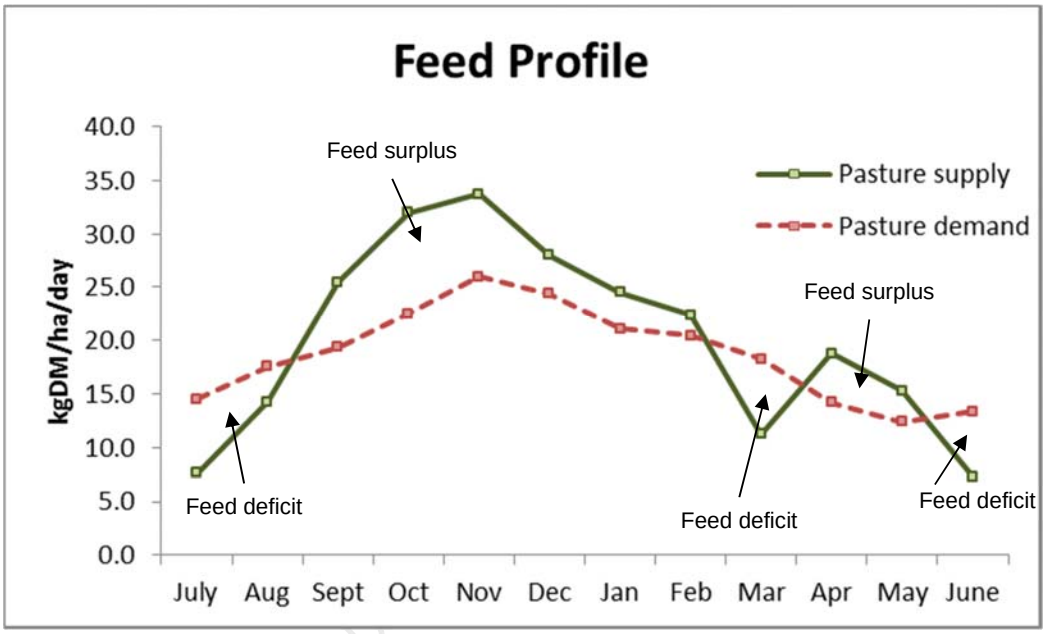
Putting Figure 1 and

Figure 2 together we get the feed profile for the farm (

Figure 3). This enables us to see when feed supply is:

- sufficient to meet feed demand (where the two lines meet)
- greater than feed demand (the solid line is above the dotted line)
- lower than feed demand (the solid line is below the dotted line)

Figure 3: Feed profile for a central North Island sheep and beef farm



The *size* of the feed deficit or surplus is also evident from the graph; the greater the distance between the lines the greater the difference between supply and demand. For instance:

- the surplus in April/May is smaller than the surplus from September to November but is similar to the surplus in December/January
- the deficit in March is about the same as the deficit in June/July

Given the feed supply and demand shown in

Figure 3 it is unlikely that the farm system is feasible without some changes. The large surpluses are likely to result in thin, open pastures which would be prone to weed invasion, further reducing their quality and production. The deficit periods would result in poor animal performance. Knowing the timing and size of surpluses and deficits enables you to make decisions on how to deal with them.

Exercise 1

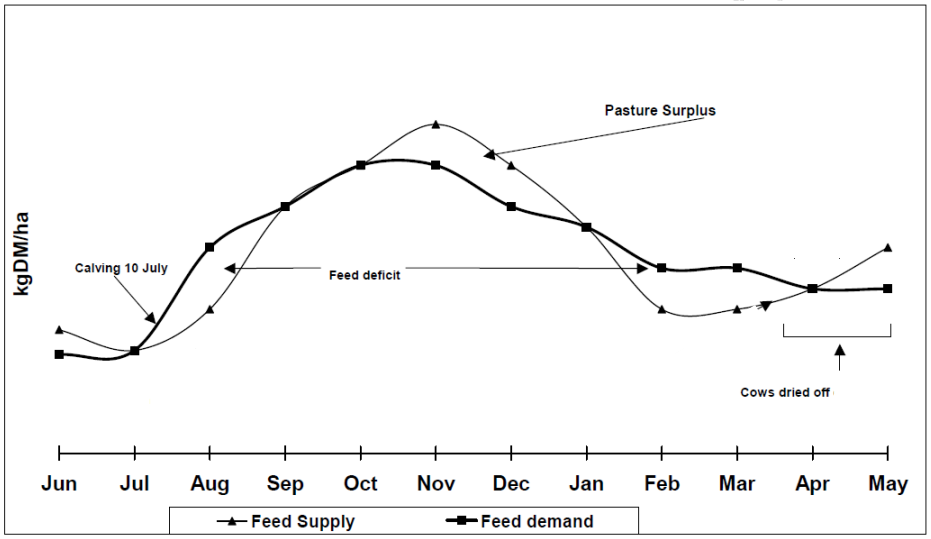
Compare the sheep and beef farm feed profile above with the dairy farm feed profile in

Figure 4 (compare the patterns as no scale is available for the dairy feed profile).

1. Describe the difference in timing of the surpluses and deficits.

2. Describe any similarities in the feed profiles.

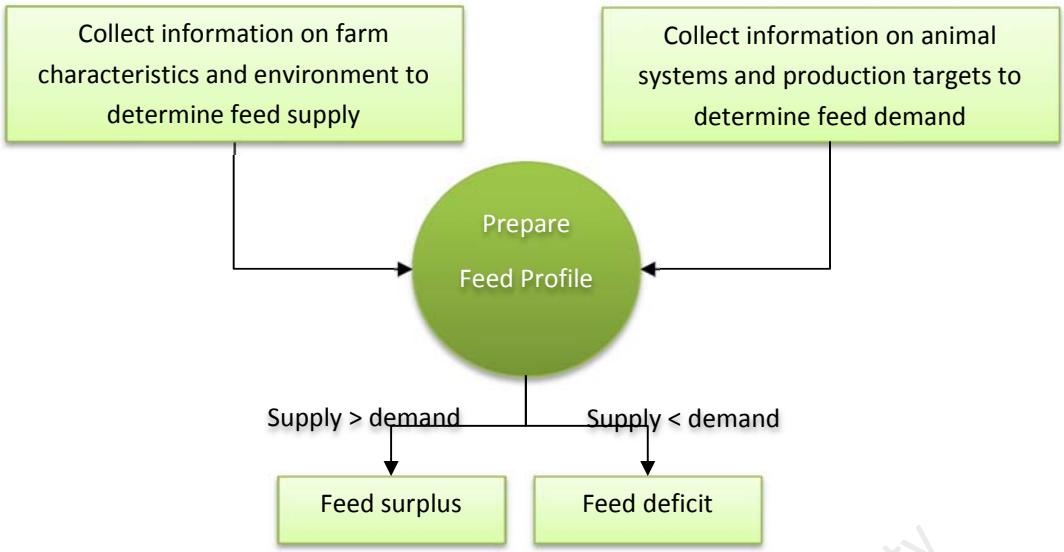
Figure 4: Waikato dairy farm feed profile



Source: Adapted from Controlling Farm Costs, 2006 Volume 4: Proceedings of the 4th

Information needed to create a feed profile

Before a feed profile can be prepared production targets and other farm policies need to be decided as these will affect feed supply and particularly feed demand. Production targets such as milk solids per hectare per day or kilograms carcass weight per hectare affects the feed demand and determines the number of animals that can be farmed. Other policies such as birthing dates, sale dates, fertiliser regime, using an all-grass farming system, or grass plus forage crop or other types of supplement all influence the feed supply/demand profile of a farm. This process is summarised in the following diagram.



There is some variation in how feed profiles are formatted but the information and calculations used are similar. You need to supply the following information about your farm and farming system to prepare a feed profile:

a) grazing area
b) start pasture cover for the first month of the profile
c) pasture growth rates
d) supplement quantities
e) animal numbers
f) animal dry matter intake
g) pasture utilisation

From these values you can then calculate the following:

h) total feed supply
i) total animal feed demand
j) difference between feed supply and feed demand
k) end pasture cover

Values a) to g) depend on your goals and production targets, and your farm's physical and environmental characteristics. We will call these 'farmer defined values'. As values h) to k) are calculated from the farmer defined values we will call these 'calculated values'.

Farmer defined values

a) Grazing area

The grazing area is required so you can calculate the amount of pasture available. A farm map of known scale, with paddock boundaries marked, can be used to work out the areas of paddocks. Land taken up by buildings, tracks, areas of bush, and dams and streams should be excluded leaving only the area of pasture animals can eat.

The grazing area can vary over the year if some paddocks are taken out of pasture for forage or arable cropping. Paddocks used for making hay and silage remain in the 'grazing area' as they contribute to the farms pasture supply and affect the farms pasture cover.

Activity

Check out your own farm map and look at the actual area available for grazing compared to the total area of the farm.

b) Start or opening pasture cover

The average pasture cover (APC), at the start of the first month of the feed profile period is called the start or opening pasture cover. It is measured in kilograms dry matter per hectare (kgDM/ha). The start pasture cover provides the base value from which changes in APC for each subsequent month are calculated. It should be determined from actual measurements. Errors in estimating the start pasture cover may have significant effects later in the season so actual measurements will give a more accurate feed profile. (Measuring APC is covered in the Telford learning module 'Pasture Mass'.)

The start pasture cover is an average value for the whole farm. It does NOT indicate the range of pasture masses. For example, high APC might mean the whole farm has a high pasture mass or some paddocks have very high masses while others are lower. However, very low APC usually means most of the pasture is short.

The broad aim is to maintain average pasture cover between 1,000 and 2,500 kg DM/ha. If you go outside these limits both animal and pasture performance are likely to suffer. Lower than 1000 kgDM/ha typically results in lower animal intake, hence lower performance and slower recovery of pasture after grazing. Higher than 2,500 kgDM/ha will result in poor quality pasture with higher levels of dead plant material. If livestock are forced to eat this to reduce pasture cover then performance may fall.

c) Pasture growth rates

Pasture growth rates are the pasture accumulation rates measured in kilograms of dry matter per hectare per day (kgDM/ha/day). They represent the amount of pasture which can be harvested per day through grazing or cutting (e.g. for making balage).

Pasture growth rate values can significantly affect the accuracy of a feed profile. Measuring pasture growth rates over your farm over time will allow you to build up a history of typical pasture growth rates. Growth rates will vary with:

- topography, e.g. hills or flat
- aspect, e.g. north or south facing slopes
- pasture species, e.g. improved grass species

Many feed budget computer programmes such as Farmfax, include pasture growth rates for many different places in New Zealand. However care must be taken when using 'general' growth rate values. If they don't truly reflect your farms situation then you may under- or over-estimate the growth rates. This may result in inaccurate predictions of feed surplus and deficit.

Activity

1. Read the attached document 'R & D Brief, Number 137, Measuring Pasture Growth Rates' which details the steps required to measure pasture growth rates.

2. Graph the pasture growth rates for each month for your region and two other regions from the tables in the appendix. If you have measured pasture growth rates for your own farm use these instead of the values from the table. Note the variation between regions. Think about how this would affect the farming systems in each region.

d) Supplement quantities

Supplements are entered into the feed budget as the total weight fed or harvested over the period of the profile, i.e. kgDM (*not* per hectare). When making hay or silage the weight is shown as a negative value. When it is fed to livestock it is shown as a positive value. For example, if you harvest 20,000 kgDM of pasture in December to make hay, this will be entered into the feed budget as -20,000 kgDM. If you feed most of it out in June and July you would enter, for example, 8,000 kgDM in June and 9,000 kgDM in July.

Other supplements are entered into the feed budget as the total weight when they are fed including crops, grains and by-products.

Some of the most common supplements used on New Zealand farms include:

- pasture based products
  - hay
  - silage
  - nitrogen fertiliser enhanced pasture growth
- fodder crops
  - brassicas
  - cereals – green feed or silage
  - maize – green feed or silage
  - fodder beet
- grains
  - barley
  - oats
  - wheat

- by-products
  - palm kernel expeller
  - molasses

e) Animal numbers

For each month of the year the number of animals per class is needed so dry matter requirements can be estimated. Changes in numbers may occur because of sales, purchases, deaths, births, or transfer of animals to the mixed age breeding flock or herd. For example, heifers are 'transferred out' of the two year old heifer class when they start to breed and are 'transferred in' to the breeding cow herd.

The number of each class of animal for each month is used to prepare the yearly stock reconciliation. A stock reconciliation is usually done at the end of the farm's financial year and shows the change in stock numbers by class of animal for that year and the stock on hand at the balance date. Information from meat processors and buyers about purchases and sales should match the change in livestock numbers.

Activity

Study the following two tables of monthly livestock numbers and the livestock reconciliation for a sheep and beef farm. The change in numbers of animals should make sense. For example, if lambing occurs in early September you would expect to have weaned lambs in December. It would be unusual to have some in November. The number of ewe and male lambs should be about the same and the number of replacement ewe lambs at the end of June should equal the number of hoggets at the beginning of July. The reconciliation indicates why the numbers of animals in each class change.

If the farm policy is to maintain stock numbers then the number of breeding animals at the start the period should equal the number at the end. For example, in July there were 4365 ewes. During the farming year there were some deaths, sales of culled ewes and transfer of hoggets into the ewe flock, so the total number of breeding ewes remained at 4365 at the beginning of July the following year.

Table 1: Number of different classes of sheep and cattle over a year on a sheep and beef farm

Monthly livestock numbers												
Stock class	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Ewes	4365	4340	4300	4265	4250	4225	4225	3165	4365	4365	4365	4365
Ewe hoggets	1400	1390	1380	1362	1200	1200	1200	1200				
Ewe lambs						2600	1428	1414	1400	1400	1400	1400
Male lambs						2600	3772	2673	1673	612		
Rams	104	104	104	104	104	104	114	114	114	114	109	104
Cows	406	400	390	390	390	390	390	390	390	406	406	406
2yr heifers	182	182	182	182	182	152	124	110	96			
1yr heifers	186	186	185	185	184	184	183	183	183	182	182	182
Heifer calves									190	189	188	186
Bulls	12	12	12	12	12	12	12	12	12	12	12	12
2yr bulls	180	180	178	178	177	177	140	96	66	37	8	
1yr bulls	184	183	183	183	182	182	182	181	181	180	180	180
Bull calves									190	188	186	184

Table 2: Sheep and cattle reconciliation

Livestock reconciliation								
Stock	**Opening**	**Wean**	**Die**	**Buy**	**Sell**	**Transfer in**	**Transfer out**	**Close**
Ewes	4365		140		1060	1200		4365
Ewe hoggets	1400		38		162		1200	
Weaned ewe lambs		2600	28		1172			1400
Weaned male lambs		2600		1172	3772			
Rams	104		10	10				104
Cows	406		16		80	96		406
2yr heifers	182		4		80		96	
1yr heifers	186		4					182
Heifer calves		190	4					186
Breeding bulls	12			4	4			12
2yr bulls	180		4		176			
1yr bulls	184		4					180
Bull calves		190	6					184

f) Animal dry matter intake (DMI)

Estimating dry matter intake (measured in kgDM/day) with a reasonable level of accuracy requires a good understanding of animal energy and nutrient requirements, and the interaction of feed quality and pasture characteristics with dry matter intake. For example, animals eating green, leafy high quality feed need less kgDM/day to achieve the same energy intake than if they were eating pasture with a lot of stem and seedheads. Predicting pasture DMI depends on the:

- animal species
- animal age or maturity

- animal physiological state
- pasture metabolisable energy value (ME)
- pasture height
- digestibility
- other pasture characteristics such as plant species composition, animal selection/preference and presence of mycotoxins

Feed profile software packages take into account many of these factors automatically sometimes with the opportunity to enter specific values to fine tune the DMI to suit specific farm conditions.

g) Pasture utilisation

Pasture utilisation (measured as a percentage) is an adjustment value that takes into account that not all pasture grown is eaten. There is always some wastage. Generally the poorer the quality of the feed, as indicated by pasture metabolisable energy (ME), the lower the utilisation.

Sometimes wastage is included in the livestock DMI value, i.e. DMI values are increased to take into account wastage. Either method is acceptable but in this module we will allow for wastage when determining the pasture dry matter available for livestock.

Calculated values

These values are calculated using the farmer defined values. We will explain these values here but we will look at them in more detail, including exercises, in the section on preparing summer and winter feed budgets.

h) Total feed supply (kgDM and kgDM/ha/day)

The total feed supply equals total pasture grown over the grazing area for a specified time period (monthly for a feed profile) plus any dry matter supplied from supplementary feed including hay, silage, crops and/or strategic nitrogen boosted pasture growth.

Supplements are normally measured in kgDM. To keep all units of measurement the same, daily pasture growth rates are converted from kgDM/ha/day to kgDM by multiplying by the grazing area and the number of days in the month.

Once the pasture growth and supplements have been summed the total feed supply in kgDM are then converted to kgDM/ha/day by dividing by the area and number of days. For example, if the total feed supply for June is 280,000 kgDM, then:

280,000 kgDM ÷ 950 ha ÷ 30 days = 9.8 kgDM/ha/day

i) Total feed demand or dry matter intake (DMI) required (kgDM and kgDM/ha/day)

Total dry matter intake required is the total feed demand or feed requirement, in kilograms of dry matter eaten (kgDM) for each month of the feed profile. Dry matter intake in tables is usually measured in kgDM/head/day. To change to kgDM multiply kgDM/head/day by the number of heads i.e. the number of animals and the number of days e.g. 1.2 kgDM/ewe/day x 500 ewes x 30 days = 18,000 kgDM.

If there is more than one livestock class then sum the DMI for each class to get the total DMI. For example, you may have replacement heifers and bulls as well as pregnant cows so you need to sum the daily DMI for each class to get the total DMI.

Once the total feed demand (DMI) has been calculated, the total kgDM are then converted to kgDM/ha/day by dividing by the area and number of days. For example, if the total feed demand for June is 390,000 kgDM, then:

390,000 kgDM ÷ 950 ha ÷ 30 days = 13.7 kgDM/ha/day

j) Difference between feed supply and feed demand

This value is the total feed supply minus the total DMI requirement. It is the amount of pasture grown plus any supplements fed minus the total DMI requirement for the month. This can be calculated as kgDM or kgDM/ha/day.

If the difference is negative the feed demand is greater than the feed supply so there is a feed deficit, i.e. more feed is eaten than grown and/or supplemented. If the difference is positive the feed demand is less than the feed supply so there is a feed surplus, i.e. more feed is supplied than eaten. For example,

9.8 kgDM/ha/day feed supply – 13.7 kgDM/ha/day feed demand = -3.9 kgDM/ha/day

In this case, because the difference is negative, there would be a feed deficit of 3.9 kgDM/ha/day or the animals would need 3.9 kgDM/ha/day more than the feed supplied can provide.

k) End or final cover (kgDM/ha)

The end pasture cover is the average pasture cover on the farm at the end of each month (or other specified time period). It is the start or opening cover **plus** the difference between feed supply and demand expressed as **kgDM/ha** (to convert kgDM/ha/day to kgDM/ha multiply by the number of days). For example,

15,000 kgDM/ha + (-117 kgDM/ha) = 14,883 kgDM/ha

If the difference is negative then the final cover will be less than the opening cover. If the difference is positive the final cover will be more than the opening cover. The final cover becomes the opening pasture cover for the next time period (i.e. the final cover for June is the start cover for July).

Preparing and interpreting a feed profile

In this section we will prepare a feed profile for a 1000ha central North Island sheep and beef farm, and discuss what this tells us about the farming system. You will then create a revised feed profile for the farm.

Meadow Farm feed profile

Meadow Farm is a sheep and beef farm near Taihape recently purchased by Mary and Roger Meadow. After their first year on the property the Meadows want to prepare a feed profile to determine the timing and size of feed surpluses and deficits for a typical year so they can plan what supplements or crops may be needed. They can also assess what may happen in atypical years.

Fortunately the farmer they purchased the farm from was happy to give the Meadows average pasture growth estimates from measurements he had collected for the past fifteen years. They can use these when preparing the feed profile. They can estimate all the other values required depending on their own goals and production targets, and the current pasture cover situation at the beginning of July. Table 3 summarises the numbers of different stock classes on the farm for each month of a typical year.

Table 3: Stock numbers for Meadow Farm for a typical year

Monthly livestock numbers												
Stock class	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Ewes	4365	4340	4300	4265	4250	4225	4225	3165	4365	4365	4365	4365
Ewe hoggets	1400	1390	1380	1362	1200	1200	1200	1200				
Ewe lambs						2600	1428	1414	1400	1400	1400	1400
Male lambs						2600	3772	2673	1673	612		
Rams	104	104	104	104	104	104	114	114	114	114	109	104
Cows	406	400	390	390	390	390	390	390	390	406	406	406
2yr heifers	182	182	182	182	182	152	124	110	96			
1yr heifers	186	186	185	185	184	184	183	183	183	182	182	182
Heifer calves									190	189	188	186
Bulls	12	12	12	12	12	12	12	12	12	12	12	12
2yr bulls	180	180	178	178	177	177	140	96	66	37	8	
1yr bulls	184	183	183	183	182	182	182	181	181	180	180	180
Bull calves									190	188	186	184

Using the above table the Meadow's can calculate the expected animal dry matter intake (DMI) for each stock class for each month. Details on how to do this are covered in a separate Telford Learning Module.

Using the feed supply and demand values, the Meadows have prepared a feed profile (Table 4).

Table 4: Feed profile data for a 1000 ha central North Island sheep and beef farm

Month	Calculations*	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
No. of days	A	31	31	30	31	30	31	31	28	31	30	31	30
Area (ha)	B	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Start pasture cover (kgDM/ha)	C	1,500	1,285	1,183	1,367	1,660	1,893	2,005	2,110	2,166	1,949	2,085	2,176
Pasture growth rate (kgDM/ha/day)	D	8	15	30	40	45	40	35	32	15	25	18	8
Monthly growth rate (kgDM/ha)	E = D x A	248	465	900	1,240	1,350	1,240	1,085	896	465	750	558	240
Utilisation (%)	F	95	95	85	80	75	70	70	70	75	75	85	90
Pasture ME (MJME/kgDM)		11.0	11.4	11.3	11.2	11.4	11.6	10.2	10.4	10.4	10.8	11.0	11.0
Pasture DM available (kgDM)	G = E x (F ÷ 100) x B	235,600	441,750	765,000	992,000	1,012,500	868,000	759,500	627,200	348,750	562,500	474,300	216,000
Supplement DM available (kgDM)	H												
Feed supply (kgDM)	I = G + H	235,600	441,750	765,000	992,000	1,012,500	868,000	759,500	627,200	348,750	562,500	474,300	216,000
Feed demand (kgDM)	J	450,131	544,528	581,111	698,614	779,733	755,758	654,020	571,746	565,513	426,401	383,708	400,583
Supply - demand (kgDM)	K = I - J	-214,531	-102,778	183,889	293,386	232,767	112,242	105,480	55,454	-216,763	136,099	90,592	-184,583
End pasture cover (kgDM/ha)	L = C + (K ÷ B)	1,285	1,183	1,367	1,660	1,893	2,005	2,110	2,166	1,949	2,085	2,176	1,991
Feed supply (kgDM/ha/day)	M = I ÷ A ÷ B	7.6	14.3	25.5	32.0	33.8	28.0	24.5	22.4	11.3	18.8	15.3	7.2
Feed demand (kgDM/ha/day)	N = J ÷ A ÷ B	14.5	17.6	19.4	22.5	26.0	24.4	21.1	20.4	18.2	14.2	12.4	13.4
Difference (kgDM/ha/day)	O = M - N	-6.9	-3.3	6.1	9.5	7.8	3.6	3.4	2.0	-7.0	4.5	2.9	-6.2

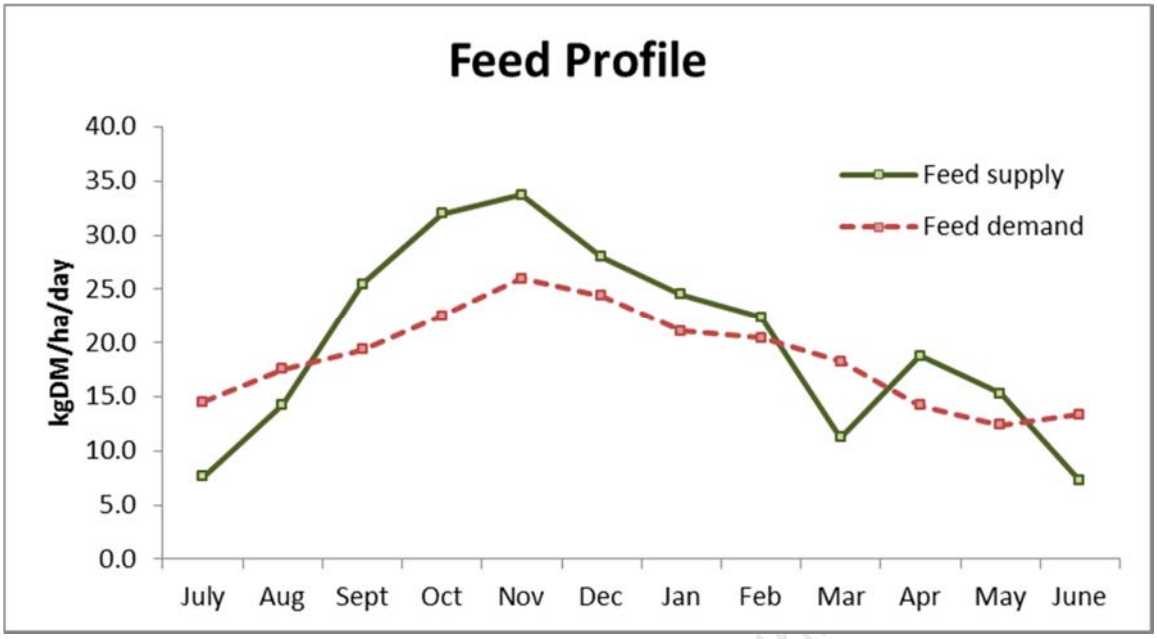
Source: Data from 'Pasture and Supplements for Grazing Animals'

*Although the calculations have been included here we will look at them in more detail when we prepare a feed budget in the next section.

NOTE: In this profile **no supplement** has been included because the Meadow's want to assess the size of expected pasture surpluses and deficits. Once they know these, they can decide what type of supplements they will make and use. They could harvest surplus pasture in October as balage and/or surplus pasture in December as hay. They could also grow crops to fill the winter and early autumn deficits.

A graph of pasture supply and pasture demand for each month shows the feed profile visually.

Figure 5: Meadow Farm feed profile



Checks

When preparing a new profile, first check for errors and omissions. Does the end of month cover reflect what appears to have happened in the calculations? Pasture cover at the start of the budget is a critical value. Any errors here will flow through the entire budget. Assess this figure as accurately as possible. Do feed surpluses and deficits occur when expected? Are all stock included? Has account been taken of grazing stock off farm and bringing them back on?

What does the feed profile tell us?

- There is a surplus of pasture from September to February and again in April and May; the feed supply line (solid) is higher than the animal demand line (dotted). This means more pasture *grew* than the animals could eat.
- The spring surplus is greater than the autumn surplus.
- There is a deficit in in June, July, August and March; the feed supply line is lower than the animal demand line. This means less pasture *grew* than the animals could eat.
- The March deficit is short but larger than the winter deficit.

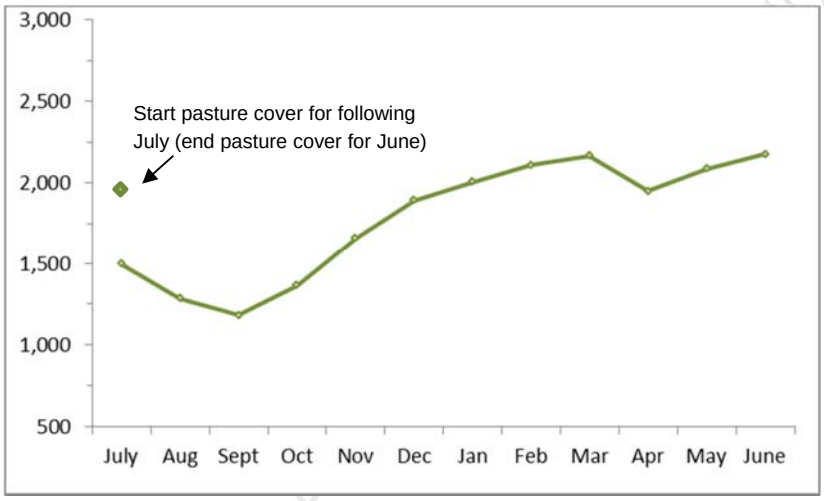
What does this mean for Meadow Farm?

- Even though lambing, with its associated increase in feed demand over spring, coincides with the flush of spring pasture growth, the size of the surplus means additional control measures are needed to maintain pasture quality. The end pasture covers for each month of the year, even in deficit months, are reasonably high. The high pasture covers in spring and summer indicate that pasture is likely to be poor quality. If the surplus is reduced by making balage how will that affect the start/end pasture covers later in the season?
- The autumn surplus may be acceptable because surplus pasture grown at this time may be grazed in winter when pasture growth rates slow down. If the autumn surplus is reduced it may result in too low start and end pasture covers in winter.

- The March deficit is significant as ewes are mated at this time and need to be in good condition (ideally a body condition score of 4) and gaining weight prior to and over the mating period. Weaned lambs and calves also need good feed at this time. However the end pasture cover for March is still quite high (1949 kgDM/ha) so the deficit may be acceptable if ewes and growing young stock graze the best quality pasture, followed up by lower priority stock classes.
- A deficit may be acceptable in June and July as most stock will be near maintenance requirements apart from young growing cattle and replacement ewe hoggets. A deficit will result in a lower monthly end pasture cover but this may be acceptable given the values used are the average pasture cover so some paddocks will have higher cover and some lower. The animals on maintenance feeding can be grazed harder than those needing to grow. Different stocking policies could be looked at to see how it affects the feed profile.

Start pasture cover

Figure 6: Start pasture cover for each month of the year (kgDM/ha)



Recall that the difference in feed supply and animal demand is based on the amount of pasture grown. It does not include the starting pasture cover for the month. A deficit will result in lower pasture cover at the end of the month than at the beginning. For example, in July, Meadow Farm had a starting pasture cover of 1500 kgDM/ha. There was a deficit of 215 kgDM/ha (214,531 kgDM ÷ 1000 ha), leaving an end cover of 1285 kgDM/ha (1500 – 215 = 1285). This then becomes the start cover for August.

From Figure 6 we see that apart from a decrease from July to September and a small decrease at the beginning of April, the start pasture cover increases over the 12 month period. This indicates that the feed supply and demand situation is not sustainable without some intervention.

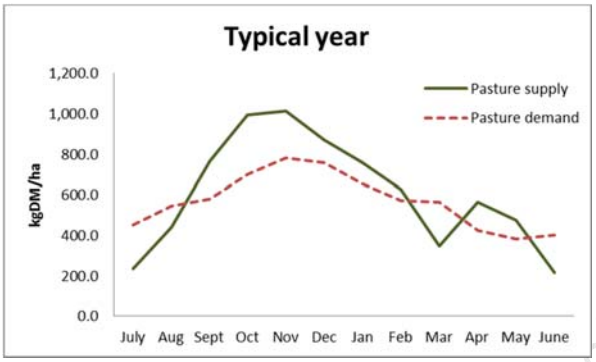
The start pasture cover for the following July is indicated by the small diamond shape above the line. If the same pattern of supply and demand occurred as for the profile year the start pasture covers would be even higher in the second year. This would result in rank, poor quality pasture that would have a lot of dead material and result in poor animal performance.

Using the feed profile to assess 'What if?' scenarios

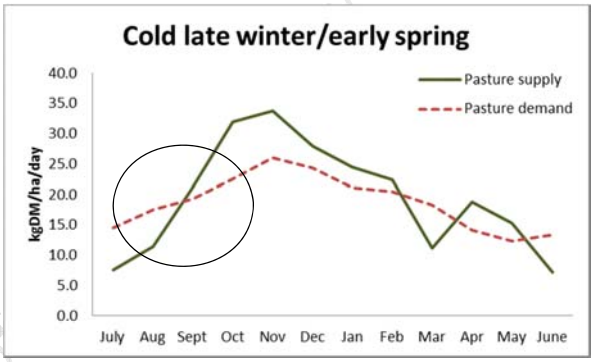
The Meadows can see that they need to take some action to control their feed surpluses and deficits but before they address this they want to recalculate the feed profile to see what happens if pasture growth rates differ from typical values (this is where a computer is useful). How will their stock policies work when feed conditions vary from normal?

Graph A is a typical year with pasture growth rates of 35 kgDM/ha in January, 32 kgDM/ha in February, 15 kgDM/ha in March, 15 kgDM/ha in August and 30 kgDM/ha in September. Compare this graph with graphs B, C and D. The effects of the changes in pasture growth compared to a typical year are highlighted by the circled areas. For each of these situations the Meadows can develop a set of contingency plans that can be implemented to overcome or take advantage of the conditions.

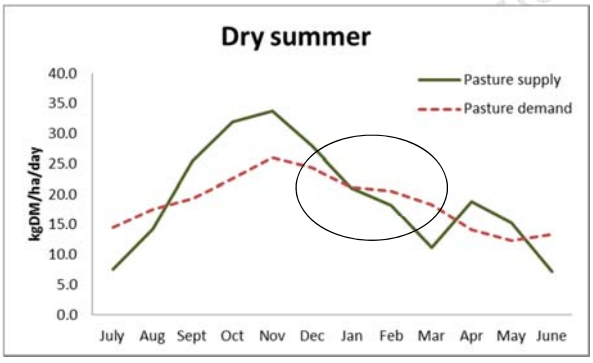
Graph A



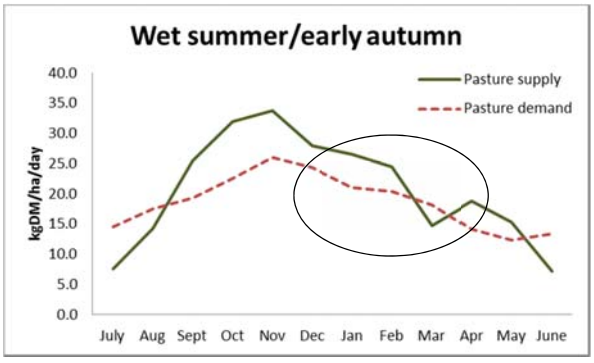
Graph B



Graph C

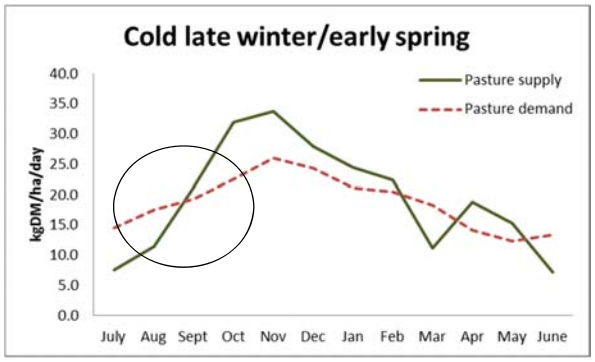


Graph D



Graph B has pasture growth rates of 12 kgDM/ha in August and 25 kgDM/ha in September to represent a colder than normal late winter/early spring.

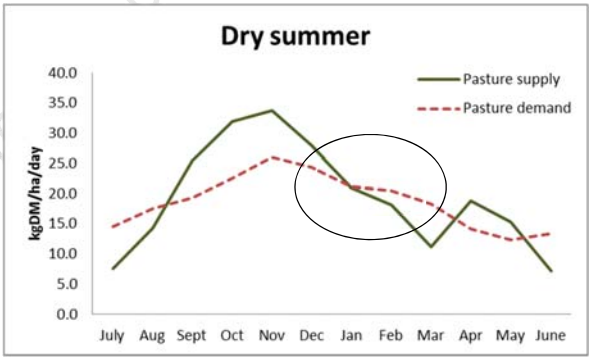
Graph B



Poor late winter/early spring growth is likely to result in a delayed and lower early spring pasture surplus compared to a typical year. As lambing normally starts at the beginning of September this would have serious consequences for Meadow Farm. The opening pasture cover in September would be 1094 kgDM/ha (instead of 1367 kgDM/ha in a typical year) and target pre-grazing covers of over 1800 kgDM/ha for ewes in late pregnancy and early lactation may be hard to achieve under these conditions. More supplements and/or crop than normal would need to be fed in August to allow pasture to accumulate and increase the opening pasture cover for September.

Graph C has pasture growth rates of 30 kgDM/ha in January and 26 kgDM/ha in February to represent a drier than normal summer.

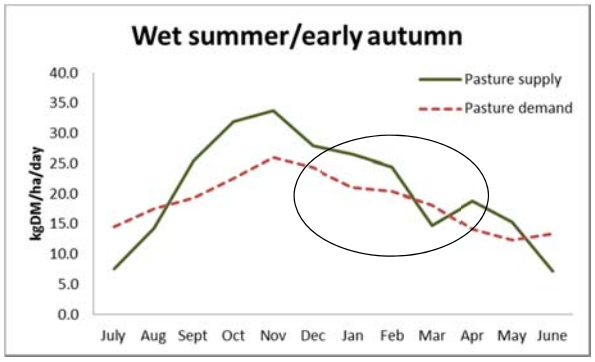
Graph C



If a drier than normal summer reduces pasture growth average pasture cover (APC) only just matches animal feed demand over January and a longer period of deficit occurs, i.e. February and March instead of just March in a typical year. As APC does not indicate the *range* of pasture covers over the farm then it is possible that pasture cover over much of the farm in January could also be lower than required with just some paddocks high in dry matter lifting the APC. Supplements could be fed to help meet animal demand and some bulls, lambs and culls could be sold earlier than normal to reduce feed demand.

Graph D has pasture growth rates of 38 kgDM/ha in January and 35 kgDM/ha in February and 20 kgDM/ha in March to represent a wetter than normal summer/early autumn.

Graph D



If pasture growth rates are higher than expected during a wet summer the surplus is larger and the size of the deficit is smaller. This may allow more pasture to be conserved as hay (as long as the wet weather stops for long enough to make hay), more animals may be purchased to eat the surplus and/or liveweight gain production targets may be raised.

Other scenarios the Meadows could look at include:

- changing production targets, e.g. increasing lambing percentage to from their current 120% to 150%, increasing bull liveweight gain targets
- changing birthing dates, e.g. delaying or bringing forward lambing by one week or two weeks
- changing livestock policies e.g. finishing cattle as steers instead of bulls or introducing deer to raise for venison on part of the farm
- introducing supplementary feed policies e.g. grow winter crops, use nitrogen to boost pasture growth, grow summer crops and make pasture based supplements

Each of these scenarios will alter the amount and/or timing of feed required or supplied.

Exercise 2

The Meadows want to prepare a feed profile for a typical year including making and feeding out supplements and crops to address the feed surpluses and deficits. They decide to do the following:

- make 150,000 kgDM balage in October and 100,000 kgDM in November
- make 50,000 kgDM hay in late December
- plant 50ha of leafy turnips in early November (land prepared in October and resown with pasture in late March)
- feed out the turnips in March; expected available dry matter = 150,000 kgDM
- feed out 50,000 kgDM of balage and 25,000 kgDM of hay in July
- feed out 100,000 kgDM of balage in August

Overall, the Meadows have estimated feeding out 325,000 kgDM of supplements (including the crop) and making 450,000 kgDM of supplements (including the crop). Some of the extra balage and hay made may be sold and some kept in reserve in case pasture growth is lower than expected.

Graph a revised feed profile (using kgDM/ha) for Meadow Farm using the information provided in

2. Table ***5*** on the following page.

3. Graph the *feed supply* of the original feed profile (see Table 4) and the *feed supply* of the revised profile for each month. Identify on the graph what has caused the change in feed supply.

4. Compare the revised feed profile to the original one.
    a. How has the use of supplementary feed and crops changed the feed profile?
    b. Describe how the start pasture covers have changed.
    c. Identify possible risk periods and explain why?

IMPORTANT

Study the revised feed profile data carefully and note:

- The grazing area is reduced from 1000 ha to 950 ha to take into account the growing of the crop and time taken before re-sown pasture can be grazed (October to April).
- When balage and hay are made the quantity is entered into the feed profile as a negative value in the 'Supplement DM' column (see October and December).
- When supplements, including the crop, are fed out they are entered as a positive value (see February, March, June, July and August).

Table 5: Revised feed profile data for Meadow Farm

Month	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
No. of days	31	31	30	31	30	31	31	28	31	30	31	30
Area (ha)	1,000	1,000	1,000	950	950	950	950	950	950	950	1,000	1,000
Start pasture cover (kgDM/ha)	1,500	1,360	1,358	1,542	1,640	1,727	1,747	1,818	1,843	1,754	1,868	1,959
Pasture growth rate (kgDM/ha/day)	8	15	30	40	45	40	35	32	15	25	18	8
Monthly growth rate (kgDM/ha)	248	465	900	1,240	1,350	1,240	1,085	896	465	750	558	240
Utilisation (%)	95	95	85	80	75	70	70	70	75	75	85	90
Pasture ME (MJME/kgDM)	11.0	11.4	11.3	11.2	11.4	11.6	10.2	10.4	10.4	10.8	11.0	11.0
Pasture DM available (kgDM)	235,600	441,750	765,000	942,400	961,875	824,600	721,525	595,840	331,313	534,375	474,300	216,000
Supplement DM available (kgDM)	75,000	100,000		-150,000	-100,000	-50,000			150,000			
Feed supply (kgDM)	310,600	541,750	765,000	792,400	861,875	774,600	721,525	595,840	481,313	534,375	474,300	216,000
Feed demand (kgDM)	450,131	544,528	581,111	698,614	779,733	755,758	654,020	571,746	565,513	426,401	383,708	400,583
Supply minus demand (kgDM)	-139,531	-2,778	183,889	93,786	82,142	18,842	67,505	24,094	-84,201	107,974	90,592	-184,583
End pasture cover (kgDM/ha)	1,360	1,358	1,542	1,640	1,727	1,747	1,818	1,843	1,754	1,868	1,959	1,774
Feed supply revised (kgDM/ha/day)	10.0	17.5	25.5	26.9	30.2	26.3	24.5	22.4	16.3	18.8	15.3	7.2
Feed demand (kgDM/ha/day)	14.5	17.6	19.4	23.7	27.4	25.7	22.2	21.5	19.2	15.0	12.4	13.4
Difference (kgDM/ha/day)	-4.5	-0.1	6.1	3.2	2.9	0.6	2.3	0.9	-2.9	3.8	2.9	-6.2

Feed budgets

In this section we will introduce feed budgets, work through the calculations required, prepare a feed budget and interpret it.

What is a feed budget?

The main difference between a feed budget and a feed profile is the time frame covered and the detail entered. The basic information is the same as a feed profile but a feed budget typically covers part of a year, such as summer or winter, and has shorter time periods, such as weeks rather than months.

For instance, in a *feed profile* you may have entered the pasture growth rate for April as 30 kgDM/ha. In a *feed budget* for April, you may divide the month into four, roughly equal time periods. For each period pasture growth rates are entered as 23, 31, 32 and 34 kgDM/ha (giving an average of 30 kgDM/ha). Likewise feed demand may vary over the month. The total DMI requirements for a month may be 400,000 kgDM but it could be that most of these kgDM are required in the early part of the month because in the last week you sell off stock or reduce production targets. This type of detail allows you to make better management decisions regarding the use of feed and monitoring of production targets.

A feed budget may also cover only one period, for instance on a dairy farm it may cover from 1st May to start of calving. In this case the budget is used to determine how much supplementary feed may be required and if target pasture cover for start of calving will be met. Once this has been determined then a feed budget divided into shorter periods can be prepared to help with week to week management.

A feed budget can also be prepared for only part of the farm. For example, you may run an elite mob of ewes on the flat land of your farm and prepare a budget to determine the feed situation for this area and livestock system separately from your hill paddocks.

It is important to remember that feed budgets are based mainly on assumptions because even with the best methods available measurements can be lacking in accuracy or incorrect due to factors such as unusual pasture growth variability over an area.

Types of feed budgets

Feed budgets are prepared in two main ways:

1. Tabular or boxed format
2. Columnar or spreadsheet format

The information and calculations required are similar in all feed budget types. Most formats can be set up as computer spreadsheets but you can also work through them out by hand.

illustrates three different feed budget styles. The two on the left are a tabular style and the one on the right a columnar or spreadsheet style. You may come across other layouts but they should all include the same basic information to enable you to determine your feed supply and demand situation. *Note:*
The information and calculations required are similar in all feed budget types. Most formats can be set up as computer spreadsheets but you can also work through them out by hand.

Is designed to show the different formats so don't worry if you can't read the small print as we will look at this in more detail when we prepare a feed budget.

Figure 7: Three feed budget templates illustrating different styles

Budget Period: ______________________ = _______ days
Effective ha = _______ha Spring Calving Cows = _______ Autumn Calving cows = _________

FEED SUPPLY									
Refer Page 2 to calculate Average pasture growth rate kg DM/ha/day			*Days*	*x*	*Avge Growth/day Kg DM/ha/day*		*=*		Kg DM/ha
Pasture Growth				x			=		A
	No. Cows Grazing off.	X	*Intake per cow kgDM/cow/day*[1/]	*x*	*Days*		*÷*	*Ha*	Kg DM/ha
Grazing Off Note [1/]		X		x			÷		B
1/ *Intake at grazing is feed eaten therefore multiply intake offered x 85% dry or 75- 80% wet conditions eg offer 12 kg DM/cow/day x 85% utilisation = 10.2 kg DM/cow eaten*					*Supplement Eaten Total Kg DM*		*÷*	*ha*	Kg DM/ha
Supplements	*Refer Page 2 to calculate total supplements eaten*						÷		C
TOTAL FEED SUPPLY							*A + B + C = D*		D
LESS FEED DEMAND									
	No.	*x*	*Intake/head Fr (Jersey)*	*x*	*Days*	*Total Feed Heifers/Other*	*÷*	*ha*	Kg DM/ha
R 1 yr Hfrs		x	6 (5)	x			÷		E
In Calf Heifers/Other		x	10 (8)	x			÷		F
Maintenance Milking/Dry Cows	*Cows*	*x*	*Intake kgDM/cow/d Fr (Jersey)*	*x*	*Days*	*Total kg DM*			
Spring Dry Cows		x	8.0 (7.0)	x					
Autumn Milkers		x	6.0 (5.5)	x			*÷*	*ha*	Kg DM/ha
Total Feed for Maintenance	*(Refer Table 1 for maintenance intake per cow)*						÷		G
	Cows	*x*	*Kg DM/c/d Milk Prod'n (Refer Table 3)*	*x*	*Days =*	*Total KgDM for Milk Production*	*÷*	*ha*	Kg DM/ha
Milk Production		x		x	=		÷		H
	MA Cows	*x*	*DM/score Fr (Jersey) (Refer Table 4)*	*x*	*No. of scores*	*Total Cond'n Kg DM*		*ha*	Kg DM/ha
Cow Condition		x		x			÷		I
			Pasture Cover at Calving		*Less*	*Opening Pasture Cover*			Kg DM/ha
Pasture Cover					-			=	J
Total Feed Demand							*E + F + G + H + I + J = K*		K
FEED SURPLUS/DEFICIT KG DM/HA							*D - K*		

______________ **Feed Budget**				
	Calculations	Dates	Dates	Dates
		____	____	____
Area (ha)	A			
No. of days	B			
Start pasture cover (kgDM/ha)	C			
Feed supply				
Daily pasture growth rate (kgDM/ha/day)	D			
Growth rate for the period (kgDM/ha)	E = B x D			
Utilisation (%)	F			
Pasture ME (MJME/kgDM)	G			
Pasture DM available (kgDM)	H = E x (F ÷ 100) x A			
Supplements				
Hay (kgDM)	a			
Silage (kgDM)	b			
Balage (kgDM)	c			
Nitrogen (kgDM)	d			
Crop (kgDM)	e			
Other (kgDM)	f			
Total supplements available (kgDM)	I = a + b + c + d + e + f			
DM available (kgDM)	J = H + I			
Feed demand				
No. of cows	g			
Daily intake (kgDM/cow/day)	h			
No. of heifers	i			
Daily intake (kgDM/heifer/day)	j			
No. of other livestock	k			
Daily intake (kgDM/head/day)	l			
Total DMI required (kgDM)	K = ((g x h) + (I x j) + (k x l)) x B			
Available DM minus DMI (kgDM)	L = J - K			
End pasture cover (kgDM/ha)	M = C - (L ÷ A)			
Pasture supply (kgDM/ha/day)	N = J ÷ A			
Pasture demand (kgDM/ha/day)	O = K ÷ A			
Difference (kgDM/ha/day)	P = J - K			

Source: www.siddc.org.nz/southlanddemofarm/southlanddocs

FEED BUDGET WORKING FORWARDS FROM PASTURE COVER ON THE FARM			
PERIOD	ANIMAL DEMAND	FEED SUPPLY	PASTURE COVER
No. of Days	_____ Cows x _____ Kg DM/cow/d _____	Feed Type kg DM/ha/day	(2) Total kgDM SUPPLIED /ha/day= _____
	_____ Other x _____ Kg DM/cow/d _____	Grass Growth _____	(1) Total kgDM DEMAND/ha/day = _____
	_____ Other x _____ Kg DM/cow/d _____	Silage _____	SUPPLY – DEMAND = _____
Date	Total Daily Requirements (kg DM) = _____	Hay _____	Multiply by _____ days = _____
	Ensure cow intake allows for wastage	Nitrogen _____	(Change in cover in Period)
	Divide by Effective ha _____ Kg DM/ha = _____	Other _____	Add Opening Cover _____
	Total kg DM/ha/day DEMAND (1)	Total kgDM SUPPLIED/ha/d (2) _____	Equals Closing Cover _____
PERIOD	ANIMAL DEMAND	FEED SUPPLY	PASTURE COVER
No. of Days	_____ Cows x _____ Kg DM/cow/d _____	Feed Type kg DM/ha/day	(2) Total kgDM SUPPLIED /ha/day= _____
	_____ Other x _____ Kg DM/cow/d _____	Grass Growth _____	(1) Total kgDM DEMAND/ha/day = _____
	_____ Other x _____ Kg DM/cow/d _____	Silage _____	SUPPLY – DEMAND = _____
Date	Total Daily Requirements (kg DM) = _____	Hay _____	Multiply by _____ days = _____
	Ensure cow intake allows for wastage	Nitrogen _____	(Change in cover in Period)
	Divide by Effective ha _____ Kg DM/ha = _____	Other _____	Add Opening Cover _____
	Total kg DM/ha/day DEMAND (1)	Total kgDM SUPPLIED/ha/d (2) _____	Equals Closing Cover _____
PERIOD	ANIMAL DEMAND	FEED SUPPLY	PASTURE COVER
No. of Days	_____ Cows x _____ Kg DM/cow/d _____	Feed Type kg DM/ha/day	(2) Total kgDM SUPPLIED /ha/day= _____
	_____ Other x _____ Kg DM/cow/d _____	Grass Growth _____	(1) Total kgDM DEMAND/ha/day = _____
	_____ Other x _____ Kg DM/cow/d _____	Silage _____	SUPPLY – DEMAND = _____
Date	Total Daily Requirements (kg DM) = _____	Hay _____	Multiply by _____ days = _____
	Ensure cow intake allows for wastage	Nitrogen _____	(Change in cover in Period)
	Divide by Effective ha _____ Kg DM/ha = _____	Other _____	Add Opening Cover _____
	Total kg DM/ha/day DEMAND (1)	Total kgDM SUPPLIED/ha/d (2) _____	Equals Closing Cover _____

Source: DairyNZ farmfact 1-83 www.dairynz.co.nz

1. A tabular feed budget uses a series of boxes that you fill in with farmer defined values and calculations. This type of budget is useful when you are preparing a budget for a short, specific time period. For example:

- during a summer dry spell you need to assess how many cows you can expect to milk given the conditions
- when rain occurs after a drought and you want to assess your supply/demand situation for the period before pasture regrowth is sufficient for grazing, e.g. 15 – 20 days
- when pasture supply is changing rapidly in spring a tabular feed budget can be used to monitor the situation, particularly if pasture growth conditions change unexpectedly

Be aware that it may be difficult to account for changes in effective grazing area (e.g. due to planting crops) in some boxed formatted budgets. The top left budget template in Figure 7 assumes no change in grazing area over the time period of the feed budget whereas the bottom template does take grazing area into account.

2. A column style feed budget suits a budget that covers a number of time periods. For example:

- three months divided into two week periods giving a total of twelve columns
- two months divided into weeks giving eight columns

The information and calculations required are similar in all feed budget types. Most formats can be set up as computer spreadsheets but you can also work through them out by hand.

Calculations required to prepare a feed budget

In this section we will work through the calculations required to prepare a feed budget including a number of exercises for you to try.

We will start with an activity for you to complete. You will need to do this to enable you to complete the calculated values for the feed budget.

Activity

The 'Farmer defined values' used to prepare a feed budget are similar to those used to prepare a feed profile. Return to the 'Farmer defined values' in the 'Feed profile' section.

- Make a list of the farmer defined values.
- Make sure you understand what the values mean.
- Describe what differences you think there will be between the values used to prepare a feed budget compared to those used to prepare a feed profile.

Using the farmer defined values we can then calculate other values we need to prepare the feed budget.

Calculate total feed supply (kgDM)

The total feed supply equals total pasture available over the grazing area for a specified time period (e.g. 10 days, weekly, daily) plus any dry matter supplied from supplementary feed including hay, silage, crops and/or nitrogen boosted pasture growth.

Supplements are measured in kgDM e.g. 5,000 kgDM of hay. To keep all units of measurement the same, daily pasture growth rates are converted from kgDM/ha/day to kgDM by multiplying by the grazing area and the number of days in the time period. You cannot add different units of measurement together.

Both pasture and supplements are multiplied by their expected percentage utilisation. This takes into consideration wastage and decay of plant material so the total feed supply (kgDM) is feed that is available for livestock to eat. Generally the higher the pasture cover the more wastage and decay and the lower the utilisation. Also poor quality feed (i.e. low in energy), such as hay, normally has lower utilisation.

Total feed supply (kgDM) = ((daily pasture growth rate x no. days x area) x utilisation) + (supplement x utilisation)

Once the total feed supply has been calculated in kgDM it can be converted to kgDM/ha by dividing by the total grazing area. To calculate the kgDM/ha/day, the kgDM/ha is divided by the number of days of the time period in the feed budget (e.g. 7 days, 10 days, 31 days).

Calculation example

Calculate the feed supply, in kgDM, kgDM/ha and kgDM/ha/day, for one week (7 days) in July for a 300 ha sheep and beef farm given the following information:

- Pasture growth rate = 10 kgDM/ha/day with 95% utilisation
- Hay available to feed out = 2,000 kgDM with 85% utilisation
- Balage available to feed out = 1,000 kgDM with 90% utilisation

***Note**: 95% is the same as (95 ÷ 100) or 0.95. The full calculation has been included in step 1 below but the decimal percentage form (0.95) is used from then on.*

Pasture (kgDM) = (10 kgDM/ha/day x 7 days x 300 ha) x (95 ÷ 100)
= 19,950

Hay (kgDM) = 2,000 x 0.85
= 1,700

Balage (kgDM) = 1,000 x 0.90
= 900

Total feed supply (kgDM) = 19,950 + 1,700 + 900
= 22,550 kgDM

Total feed supply (kgDM/ha) = 22,550 ÷ 300 ha
= 75 kgDM/ha

Total feed supply (kgDM/ha/day) = 75 ÷ 7 days
= 10.7 kgDM/ha/day

Exercise 3

1. Calculate the kilograms of dry matter of feed available for the first 10 days of September for a 250 ha dairy farm given the following information:
   - Pasture growth rate = 35 kgDM/ha/day with 95% utilisation
   - Balage available to feed out = 5,000 kgDM with 90% utilisation

2. You are a dairy farmer preparing a feed budget for May. You have divided the month into three roughly equal periods and want to work out the total feed available for each period.

   The first time period has been worked out for you. Complete the calculations for the rest of the month (shaded boxes) using the information provided. Use separate paper if required.

May Feed Budget	**Dates** $1^{st} – 10^{th}$	**Dates** $11^{th} – 20^{th}$	**Dates** $21^{th} – 31^{st}$
Area (ha)	100	100	100
No. of days	10		
Feed supply			
Daily pasture growth rate (kgDM/ha/day)	25	25	25
Utilisation (%)	95	95	95
Pasture DM available (kgDM)	25 x 10 x 100 x 0.95 = 23,750		
Supplements			

Silage (kgDM)	13,000		13,000	11,000
Silage utilisation %	90		90	90
Nitrogen response pasture (kgDM)	6,000		8,000	6,600
Pasture utilisation %	95		95	95
Total supplements available (kgDM)	(13,000 x 0.90) + (6,000 x 0.95)	= 17,400		
Total DM available (kgDM)	23,750 + 17,400	= **41,150**		
Total DM available (kgDM/ha)	41,150 ÷ 100	= **412**		
Total DM available (kgDM/ha/day)	412 ÷ 10	= **41**		

You will have noticed that 'nitrogen response pasture' has been included as a supplementary feed. This refers to the extra pasture production grown as a result of strategic use of nitrogen fertiliser. Refer to the separate document 'Nitrogen response calculations' to work out the quantity of pasture to include as a supplement when using nitrogen fertiliser.

Calculate total dry matter intake (DMI) required

Total daily dry matter intake is the total feed demand, in kilograms of dry matter eaten (kgDM) for each time period of the feed profile. The equation to calculate DMI requirement for a particular livestock class for a particular number of days is:

Dry matter intake (kgDM) = DMI (kgDM/head/day) x number of animals x number of days

If there is more than one livestock class then sum the DMI for each class to get the total DMI. For example, you may have replacement heifers and some bulls as well as pregnant cows so you need to sum the DMI for heifers, bulls and cows to get the total DMI.

Once the DMI requirement for each livestock class has been determined, taking into account the above factors, the total daily DMI can be calculated for a specified time period.

Calculation example

In January on your 140 ha dairy farm you only have lactating cows on the farm, with heifers and other dry stock grazing on a run-off. What is the total DMI required?

- 350 lactating 450kg Jersey x Friesian cow producing 1.8 kgMS/day and walking 4km a day on rolling land (2 x 2km)
- diet ME is 10.5 MJME/kgDM
- DMI requirement would be 20.3 kgDM/cow/day

The total DMI requirement for January would be:

Total DMI = 20.3 kgDM/cow/day x 350 cows x 31 days
= 220,255 kgDM

or = 220,255 ÷ 140 ha ÷ 31
= 51 kgDM/ha/day

Calculation example

In July on your 500 ha sheep and beef farm you may have:

- pregnant ewes
- hoggets
- wethers
- rams
- pregnant cows
- rising 1 year heifers
- rising 2 year heifers
- bulls

This is a little more complicated than the dairy situation but the principle is the same. Multiply the average daily DMI for each class by the number of animals in that class by the number of days in the month and then add the kgDM for each class to get the total DMI. This is where a computer makes things easier. Using a spreadsheet you can calculate the requirements for each livestock class and then sum them to get the total for the month.

Livestock classes in July (31 days)	**DMI required (kgDM/head/day)**	**No. of animals**	**DMI required (kgDM)**
Ewes	1.0	2173	= 1.0 x 2173 x 31 = 67,363
Hoggets	0.8	900	= 0.8 x 900 x 31 = 22,320
Wethers	1.0	60	= 1.0 x 60 x 31 = 1,860
Rams	1.0	25	= 1.0 x 25 x 31 = 775
Cows	6.0	168	= 6.0 x 168 x 31 = 31,248
R1 yr heifers	3.0	45	= 3.0 x 45 x 31 = 4,185
R2 yr heifers	4.0	44	= 4.0 x 44 x 31 = 5,456
Bulls	3.0	8	= 3.0 x 8 x 31 = 744
Total DMI required (kgDM)			**133,951**
Total DMI required (kgDM/ha) - divide kgDM by area			**268**
Total DMI required (kgDM/ha/day) - divide kgDM by area, then days			**8.7**

Exercise 4

1. Calculate the total weekly DMI requirement, in kgDM/ha, on a 140 ha dairy farm two weeks out from calving.

    - 300 Friesian cow (500kg at BCS 5.0) eating 10 kgDM/cow/day of 11 MJME/kgDM pasture
    - 60 heifers eating 6.8 kgDM/cow/day of 11 MJME/kgDM pasture

2. Calculate the total DMI requirement for a dairy farm for May given the following information. The feed budget is divided into three periods for May.

    From 1st – 10th May
    - 250 cows require 16 kgDM/cow/day
    - 50 other livestock require 10 kgDM/head/day

    From 11th – 20th of May
    - 250 cows require 12 kgDM/cow/day
    - 50 other livestock require 10 kgDM/head/day

    From 21th – 31th of May
    - 250 cows require 12 kgDM/cow/day
    - 50 other livestock require 10 kgDM/head/day

3. Calculate the total weekly DMI requirement for your farm for March.

Calculate the difference between feed available and feed eaten

This figure is the feed supply minus the feed demand. It is the amount of pasture grown plus any supplements fed minus the total DMI for a time period (e.g. per month).

Difference (kgDM) = (total accumulated pasture growth + supplements) (kgDM) – total DMI (kgDM)

If the difference is negative the feed demand is greater than the feed supply, i.e. more feed is eaten than grown. If the difference is positive the feed demand is less than the feed supply, i.e. more feed is grown than eaten.

Note: The difference is calculated using pasture grown and does NOT include the pasture mass present at the start of the month (the start pasture cover).

As with all the other values we have looked at the difference can be converted from kgDM to kgDM/ha (divide by the area) and kgDM/ha/day (divide by the area and number of days).

Calculation example

Calculate the difference in feed supply and demand given the following situation:

- Total feed supply = 125,000 kgDM
- Total DMI demand = 143,951 kgDM

Difference = 125,000 – 143,951
= -18,951 kgDM

The difference is negative which means there is a feed deficit of 8,951 kgDM, i.e. animals require 8,951 more kgDM than is grown or provided as supplements.

Calculate end or final cover

The end pasture cover is the average pasture cover on the farm at the end of the specified time period. It is normally measured in kgDM/ha. If the difference (above) is negative then the end cover will be less than the start cover. If the difference is positive the end cover will be more than the start cover. The end cover becomes the start pasture cover for the next time period (i.e. the end cover for July is the start cover for August).

End cover (kgDM/ha) = start pasture cover (kgDM/ha) + difference (kgDM/ha)

Calculation example

Calculate the end cover given the following situation:

- Area = 750 ha
- Start cover = 1,850 kgDM/ha
- Difference = -18,951 kgDM

End cover = 1,850 + (-18,951 ÷ 750 ha)
= 1,825 kgDM/ha

Exercise 5

1. Calculate the difference in pasture supply and feed demand, and the end pasture cover given the following information.

    - Area = 750 ha
    - Start pasture cover = 1,550 kgDM/ha
    - Total feed supply = 759,375 kgDM
    - Total feed demand = 584,798 kgDM

2. You are preparing a monthly summer feed budget and your start pasture cover for February is 1,800 kgDM/ha. You have calculated an expected feed deficit of 89,750 kgDM for the month. Calculate the end pasture.

Supplements

When pasture-based supplementary feed is included in the feed profile *making* silage, balage or hay needs to be accounted for as well as the supplement fed out.

When silage, balage or hay is made, the quantity is entered as a **negative** value in the feed budget in the time period it is made to show pasture is removed.

For instance, you are preparing a weekly spring feed budget and make 100,000 kgDM of balage in the first week of October. To take into account that this pasture is no longer available to livestock you need to include -100,000 kgDM in your calculation for feed supply that week (or month if preparing a monthly feed budget).

A **positive** value is added when the supplement is fed out. Supplements include:

- silage, balage or hay
- purchased supplements such as palm kernel expeller (PKE) or grains
- pasture grazed in response to the strategic use nitrogen fertiliser
- grazed forage crops

For instance, if you bought in grain to feed out during August then this dry matter would be included as a positive value in August when it is *fed*, even though you may have purchased it in June.

Forage crops

If crops are grown, the area of pasture has to be adjusted to take this in to account.

For example, if you grow 20 ha of kale on your 500 ha farm for grazing in late summer/early autumn, the area could be out of pasture for about seven months from October through to March (as well as growing the crop, the area will need to be re-sown with pasture and allowed to grow before it can be grazed again).

The pasture area over this time would need to be adjusted to 480 ha instead of 500 ha and the feed supply from the crop would be entered as a positive supplement value in the feed budget in the time period it is grazed.

Preparing and interpreting a feed budget

In this section, after studying an example, you will prepare a feed budget.

River Farm summer feed budget

John and Mark River run a dairy farm near Bulls milking 300 Friesian cows. Early summer was much drier than normal and the weather forecast for mid-January to March is for little or no rain and warmer than normal temperatures. The Rivers prepare a feed budget to cover the coming dry period divided into three ten day periods; 11th – 31st January, 1st – 10th February, 11th February – 3rd March

- The Rivers have used a rising plate meter to measure the start average pasture cover for February and estimate it to be 1750 kgDM.
- They have 60,000 kgDM of balage available to use during this time and want to work out how much PKE to order. As a first estimate they enter 5,000 kgDM of PKE will be needed per 10 day period (about 1.7 kgDM/cow/day).
- They have lowered milk production targets to 0.9 kgmilksolids/cow/day and aim to maintain cow weight at 500kg.
- To prioritise feed use they have managed to arrange off-farm grazing for their young stock starting 1st of March but they will have to carry them through until then.

Activity

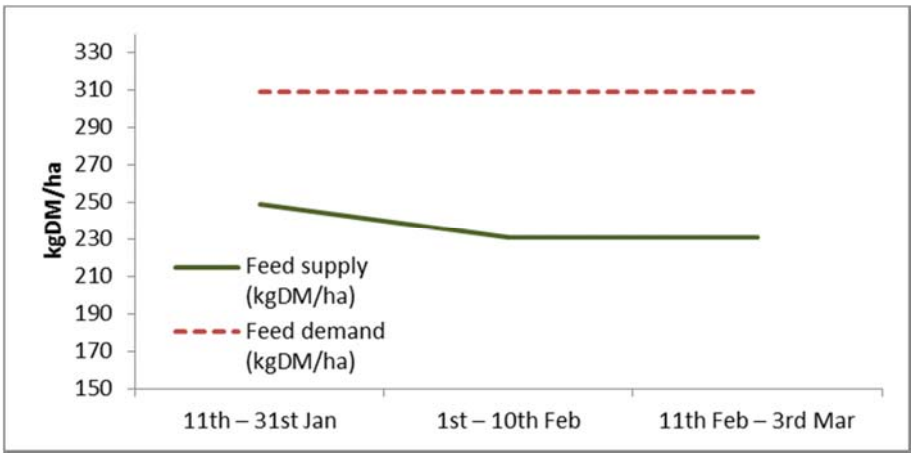
Study the feed budget presented in Figure 8. Some values have been defined by the Rivers and some have been calculated.

Identify the calculated values and check them to make sure that they have been correctly calculated.

Figure 8: River Farm summer feed budget

Dates		**11th – 31st Jan**	**1st – 10th Feb**	**11th Feb – 3rd Mar**
Area (ha)	A	135	135	135
No. of days	B	10	10	10
Start pasture cover (kgDM/ha)	C	1,750	1,690	1,613
Feed supply				
Daily pasture growth rate (kgDM/ha/day)	D	10	8	8
Growth rate for the period (kgDM/ha)	E = B x D	100	80	80
Utilisation (%)	F	90	90	90
Pasture ME (MJME/kgDM)	G	10.5	10.5	10.5
Pasture DM available (kgDM)	H = E x (F ÷ 100) x A	12,150	9,720	9,720
Supplements				
Silage (kgDM)	a	20,000	20,000	20,000
Silage utilisation (%)	b	85	85	85
PKE (kgDM)	c	5,000	5,000	5,000
PKE uiltisation (%)	d	90	90	90
Total supplements available (kgDM)	I = (a x b) + (c x d)	21,500	21,500	21,500
DM available (kgDM)	J = H + I	33,650	31,220	31,220
Feed demand				
No. of cows	g	300	300	300
Daily intake (kgDM/cow/day)	h	12.9	12.9	12.9
No. of young stock	i	50	50	50
Daily intake (kgDM/head/day)	j	6.0	6.0	6.0
Total DMI required (kgDM)	K = ((g x h) + (I x j)) x B	41,700	41,700	41,700
Difference (kgDM)	L = J - K	-8,050	-10,480	-10,480
End pasture cover (kgDM/ha)	M = C - (L ÷ A)	1,690	1,613	1,535
Feed supply (kgDM/ha)	N = J ÷ A	249	231	231
Feed demand (kgDM/ha)	O = K ÷ A	309	309	309
Difference (kgDM/ha)	P = L ÷ A	-59.6	-77.6	-77.6

Figure 9: Graph of feed supply vs feed demand for River Farm summer feed budget



What does the feed budget tell us?

- Feed demand remains constant for the 30 days.
- Feed supply drops during the last 10 days of January but remains constant through February.
- Given the existing livestock and feed policy, there will be a feed shortfall for each 10 day period of the 30 day budget.
- The deficit in the first 10 day period will be smaller than the following two ten day periods; approximately 59 kgDM/ha compared to 78 kgDM/ha. This is due to higher pasture growth during January.
- Start pasture covers will fall from 1,750 kgDM/ha to 1,535 kgDM/ha (the start pasture cover for 4th March, which is the same as the end pasture cover for 11th Feb – 3rd Mar).

What does this mean for River Farm?

- The production target of 0.9 kgMS/cow/day[1] will not be met, and cows and/or young livestock are likely to lose weight.
- The decreasing start pasture covers are not acceptable. If the average pasture cover is less than 1700 kgDM/ha it is possible pre-grazing pasture masses may be less than 2000 kgDM and post-grazing pasture mass may less than 1450 kgDM/ha which means cows are forced to eat lower quality plant material near the base of the pasture and use more energy moving about when grazing; both actions contribute to lower production.

The Rivers need to make some changes to their farming policy to ensure feed supply meets feed demand for the period.

- They could increase feed supply by buying more supplements to feed. They would need another 29,010 kgDM to fill the deficit and they still need to keep in mind the likely need for supplements in the coming winter/early spring. Price of supplements may be prohibitive given the demand brought about by the dry spell.
- They could try to improve the utilisation of silage to 90%.
- They could reduce feed demand by grazing the young stock off-farm. This may be possible but could also prove difficult because other farms in the district are also suffering from the dry conditions.

[1] kgMS/cow/day = kg milk solids per cow per day

- They could reduce feed demand by reducing the number of cows they milk by drying off some of their lighter cows. For example, feed demand for maintenance is 5.7 kgDM/cow/head whereas cows need 12.9 kgDM/cow/head to meet 0.9 kgMS/cow/day production.
- They could reduce feed demand by selling some of their cull cows early.
- They could reduce feed demand by reducing their milk production targets. For example if they reduced milk production to 0.7 kgMS/cow/day then cow demand would be 11.3 kgDM/cow/day instead of 12.9 kgDM/cow/day.

One or more of these options may be put into practice to ensure feed supply meets feed demand.

Exercise 6

Choose one or more of the options above and recalculate the feed budget so feed supply meets or exceeds feed demand. Graph feed supply and feed demand over the 30 day period.

a) Describe what options you have chosen and why.
b) How do the changes affect the start pasture covers for each time period?

On the following page River Farm summer feed budget has been prepared in a tabular format (

Figure ***10***). The shaded cells indicate values that need to be entered as farmer defined values or calculated values. You may find this type of format easier to use if you are not using a computer to prepare the feed budget. The form could be expanded to include other classes of livestock and other types of supplementary feed.

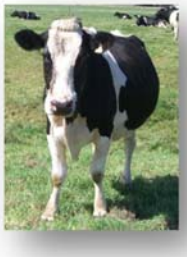
Activity

Study the feed budget presented in Figure ***10***. Make sure you understand the values and calculations.

Figure 10: River Farm summer feed budget in tabular format

Period	Animal demand						Feed supply					*		Pasture cover	
Date	300	cows x	12.9	kgDM/cow/d	3870	kgDM/day	Pasture growth (kgDM/ha/day)	10	x	10 days x 135 ha =	13500	x 0.90	12150	Total kgDM supply	41700
11-31 Jan	50	other x	6	kgDM/head/d	300	kgDM/day	Silage (kgDM)				20000	x 0.85	17000	Total kgDM demand	33650
				Total	4170	kgDM/day	PKE (kgDM)				5000	x 0.90	4500	Difference (supply - demand)	-8050
Days							Nitrogen (kgDM)							Convert to kgDM/ha (÷ by area)	-59.6
10							Hay (kgDM)								
							Other (kgDM)							Start cover	1750
				Total kgDM	4170 x 10 =	41700				Total kgDM			33650	End cover (start - difference)	1690
Period	**Animal demand**						**Feed supply**					*		**Pasture cover**	
Date	300	cows x	12.9	kgDM/cow/d	3870	kgDM/day	Pasture growth (kgDM/ha/day)	8	x	10 days x 135 ha =	10800	x 0.90	9720	Total kgDM supply	41700
1-10 Feb	50	other x	6	kgDM/head/d	300	kgDM/day	Silage (kgDM)				20000	x 0.85	17000	Total kgDM demand	31220
				Total	4170	kgDM/day	PKE (kgDM)				5000	x 0.90	4500	Difference (supply - demand)	-10480
Days							Nitrogen (kgDM)							Convert to kgDM/ha (÷ by area)	-77.6
10							Hay (kgDM)								
							Other (kgDM)							Start cover	1750
				Total kgDM	4170 x 10 =	41700				Total kgDM			31220	End cover (start - difference)	1613
Period	**Animal demand**						**Feed supply**					*		**Pasture cover**	
Date	300	cows x	12.9	kgDM/cow/d	3870	kgDM/day	Pasture growth (kgDM/ha/day)	8	x	10 days x 135 ha =	13500	x 0.90	9720	Total kgDM supply	41700
11 Feb - 3 Mar	50	other x	6	kgDM/head/d	300	kgDM/day	Silage (kgDM)				20000	x 0.85	17000	Total kgDM demand	31220
				Total	4170	kgDM/day	PKE (kgDM)				5000	x 0.90	4500	Difference (supply - demand)	-10480
Days							Nitrogen (kgDM)							Convert to kgDM/ha (÷ by area)	-77.6
10							Hay (kgDM)								
							Other (kgDM)							Start cover	1750
				Total kgDM	4170 x 10 =	41700				Total kgDM			31220	End cover (start - difference)	1535

* These values are the % utilisation shown in a decimal form.



River Farm winter feed budget

A warm, wet autumn resulted in good pasture growth at River Farm and average pasture cover recovered to 2000 kgDM/ha by mid-May. The Rivers now want you to prepare a feed budget to determine if the quantity of supplements available will ensure there is not a feed deficit over winter and that pasture cover at the start of calving is 2200 kgDM/ha. They also want the cows to gain one body score condition over this time. In this case only one time period is used to assess the feed supply demand situation.

Exercise 7

a) Prepare a winter feed budget for River Farm using the following information.
   - Budget to cover from 1st May to the 10th July (1 period).
   - Start pasture cover is 2000 kgDM/ha.
   - Target pasture cover at start of calving on 11 July is 2200 kgDM/ha.
   - Average pasture growth over the period is 17 kgDM/ha/day – utilisation of 90%.
   - Supplements available are:
     - 50,000 kgDM maize silage – utilisation 85%
     - 70,000 kgDM PKE – utilisation 90%
   - DMI required for dry in-calf cows is 11.0 kgDM/head/day. This includes 3.0 kgDM/head/day for increasing body condition score of cows by 1.0 over the period.
   - Other livestock are grazed off-farm during this time.

b) Does feed supply exceed feed demand?

c) Will the target start pasture cover for the start of calving be achieved?

Once the Rivers have assessed the overall quantity of supplements they will need to meet pasture cover and animal production targets they can prepare a more detailed feed budget that takes into account differences in pasture growth rate and animal requirements over winter. They could choose weekly, 10 or 15 day periods depending on typical farm conditions over winter. From this more detailed feed budget they can determine the timing and quantities of supplementary feed to feed out.

The next step is to prepare a daily feed plan that ensures the more detailed feed budget targets are met.

Feed allocations

In this section we will introduce feed allocation principles and some of the calculations required to prepare a grazing plan.

The feed budget tells you if you will have enough feed for a particular time period but it typically lacks daily detail (e.g. which paddocks to graze, how quickly to move stock) so a 'grazing plan' is needed. Plans differ with farm type and the mix of stock classes.

A grazing plan for a dairy herd should:

1. Identify the next paddocks to graze and the approximate order of grazing around the farm.
2. Review the rotation length given recent pasture growth (especially if this differs from budgeted pasture growth).
3. Set target pre- and post-grazing pasture masses for desired intakes and performance.
4. Set daily areas to graze and break sizes if temporary electric fences are used.
5. Allocate supplements if pasture will not provide 100% of the desired intake.

A sheep, beef and/or deer farm manager often has several stock classes to consider, each with its own feed intake and suitable pre- and post-grazing pasture masses. The manager can still:

- Set pre- and post-grazing pasture mass for each class and consider how mobs fit together (e.g., leader and follower mobs or separate grazing blocks for different stock classes).
- Allocate break sizes for animals that are breakfed (e.g. on rationed pasture or forage crops).
- Compare daily feed requirements with expected pasture growth and allocate supplements.

Identifying the next paddocks to graze

A feed wedge is ideal tool to use to identify the order of paddocks to graze.

- Do a farm walk and record pasture mass of all paddocks in the grazing area.
- Draw up a feed wedge. (This is covered a another Telford learning module)
- Plan to graze paddocks in order from highest to lowest pasture mass UNLESS paddocks are too long and will be dropped from the rotation for feed conservation or re-grassing.
- If there is a clear surplus, go to the first paddock at the target pre-grazing pasture mass (or a little above). Remember this is the paddock at target pre-grazing pasture mass, NOT the first paddock to touch the line on the feed wedge.

More complicated grazing systems (e.g. leader/follower systems with two or more stock classes) also graze the longest paddocks first, using the stock class that requires the greatest pre-grazing pasture mass; animals that go into shorter pastures follow them. If stock classes have their own grazing blocks then make separate grazing plans with a feed wedge for each block and line drawn to reflect pre- and post-grazing pasture masses for the stock class.

The feed wedge gives an idea of longer term grazing order BUT paddocks may change order due to variations in pasture growth rates. The best paddocks may grow up to twice as fast as the poorest, so check the grazing order at intervals.

Grazing order can be affected by factors other than pasture mass such as to have sheep near yards before shearing and in sheltered areas after shearing, to leave suitable mass for lambing/calving on flatter, more sheltered paddocks or to graze particular paddocks before cropping/re-grassing.

Rotation length and area to graze

Rotation length ideally allows suitable pasture recovery for the next grazing without losing control of pasture quality. (Setting rotation lengths is covered in another Telford learning module.)

The daily grazing area is affected by rotation length and adjusted if any paddocks are closed (e.g. for feed conservation, re-grassing or forage cropping).

Calculating crop or pasture breaks

Animals grazing forage crops or tightly rationed pasture may need daily breaks so you need to be able to calculate the area required to meet target daily intakes.

Daily break area (m^2) = (number of animals x DMI/head/day) ÷ (crop yield (kgDM/ha) x utilisation %)

Break depth (m) = break area (m^2) ÷ paddock width (m)

Example calculation

You have 200 pregnant rising 2 year old Friesian heifers eating a kale crop. The crop yield is 7,650 kgDM/ha and the heifers eat 85% of the crop on offer (i.e. they waste 15%). They require 6 kg DM/head/day from the crop (the rest of their diet is fed as silage).

Daily break area = (200 heifers x 6 kgDM/head/day) ÷ (7,600 kgDM/ha x 0.85)
= 1,200 kgDM/day ÷ 6,840 kgDM/ha
= 0.18 ha or 1,800 m^2 (0.18 x 10,000 m^2)

If the paddock is 110 m wide, how far should the break fence be moved each day?

Break depth = 1,800 m^2 ÷ 110 m = 16.4 m
The break should be moved 17m each day.

In practice 17 metres is reasonable and should be adjusted when the crop is much heavier or lighter than the average across the paddock – i.e., actual break sizes might be 15 to 20 metres. Small variations in daily intake are likely to occur but it is essential to avoid chronic over or underfeeding by measuring crop yield, using accurate paddock size, measuring break sizes and monitoring animal performance over time.

Exercise 8

You have 400 ram lambs growing at 220g/day requiring 1.6 kgDM/lamb/day. They are grazing a crop of rape yielding 7,000 kgDM/ha. Utilisation is expected to be 80%. The crop paddock is 85 m wide.

a) Calculate the area of crop required per day.
b) Calculate how far the break fence should be moved each day

Set pre- and post-grazing pasture mass targets

The pre-grazing pasture mass is the paddock pasture mass when animals enter the paddock and the post-grazing mass or residual mass is the pasture mass remaining when the animals move onto the next paddock. Pre- and post-grazing pasture mass largely determine animal feed intake. Table 6 is a guide to suitable targets for various stock classes.

Table 6: Typical pre- and post-grazing pasture mass ranges for various stock classes

Stock class and performance	Pre-grazing pasture mass (kg DM/ha)	Post-grazing pasture mass (kg DM/ha)
Dairy cows in milk	2,400 to 3,200	1,450 to 1,600
Dry cows at maintenance	variable	1,000 to 1,100
Ewes at maintenance	up to about 2,000	600 to 800
Ewes losing weight	<1,500	<600
Ewes in late pregnancy	1,800+	1,000 to 1,200
Rapidly growing young cattle (gaining 1+ kg/day)	2,500+	1,500 to 1,600
Slow growing young cattle (e.g., 0.3 kg/day, winter)	2,500+	1,000 to 1,100
Good condition pregnant beef cows at maintenance	2,000+	600 to 800

Note: Pasture growth is maximised when pasture is green, leafy, has high leaf area (for photosynthesis) and does not shade its base (reducing clover growth and increasing dead material) – i.e. 1,200 to 2,700 kg DM/ha. Low pasture mass reduces leaf area and allows light to fall on bare ground while high mass shades the base and allows pasture to go to seed (depending on time of year). Pre- and post-grazing pasture masses shown above therefore affect pasture growth and feed quality as well as animal intakes.

Calculate supplements needed

Your feed budget will indicate if supplements such as hay, silage and PKE are needed but it doesn't indicate the actual number of bales, the fresh weight of silage or the fresh weight of PKE to feed out each day. The following calculation is an example of how to calculate the daily supplement requirement.

Example calculation 1

From your feed budget you know you need to supply 10,000 kgDM of balage to meet the feed requirements of your 300 cows over a ten day period. You have assumed that the cows will only utilise 90% of the balage. Each bale weighs 500 kg fresh weight[2] (kgFW) and has a dry matter percentage of 32%. How many bales of balage do you need to feed each day?

Daily DMI requirement	= (10,000 kgDM ÷ 0.9) ÷ 10 days = 1,111 kgDM/day
Total dry matter/bale	= 500 x 0.32 = 160 kgDM
Number of bales/day	= 1,111 ÷ 160 = 6.9 or 7 bales/day

Always round *up* the value to the nearest bale (or other unit of feed) to ensure enough feed is offered.

Example calculation 2

If you were to feed your cows maize silage instead of balage you could calculate the quantity to feed out in terms of weight (kgFW) or volume (cubic metres, m^3).

a) What fresh weight of maize silage would you need to feed out each day?
b) What volume of maize silage would you need to feed out each day?

- The dry matter % of the maize silage is 35%.
- The maize silage has a density of 250 kgDM per m^3
- You are feeding the silage on the ground and expect 85% utilisation.

a)

Daily DMI requirement	= (10,000 kgDM ÷ 0.85) ÷ 10 days = 1,176 kgDM/day
Total fresh weight required	= 1,176 ÷ 0.35 = 3,360 kgFW/day

b)

Daily DMI requirement	= (10,000 kgDM ÷ 0.85) ÷ 10 days = 1,176 kgDM/day
m^3 required	= 1,176 ÷ 250 = 4.7 m^3

[2] kgFW is the kgDM plus the water content

The following table shows typical dry weights of common units of supplements.

Table 7: Typical feed quantities by bale or cubic metre (adapted from DairyNZ 'Feed supply information' sheet).

Feed type	kgDM per unit
Grass silage (stack)	150 – 200 kgDM per m^3
Pasture balage	130 – 180 kgDM per 500 bale
Maize silage (stack)	170 – 250 kgDM per m^3
Hay – small bales	15 – 21 kgDM per bale
Hay – round bales	150 – 250 kgDM per bale

Note: Large square bales come in several different sizes. It is best to weigh some bales and multiply the average bale weight by dry matter percentage for the feed type to determine the kgDM.

Exercise 9

Calculate the fresh weight of barley needed per day given the following scenario:

- From your feed budget you have determined that you will need to feed 500 of your ewes 8,170 kgDM of supplement during the four weeks prior to mating.
- You have chosen to feed barley grain with a DM% of 85%.
- You will be feeding out in troughs and expect 90% utilisation.

A final note

All types of feed budgets are valuable farm planning tools. As you gain experience measuring pasture covers and animal requirements the accuracy of your budgets will improve, allowing better decision making. Like all plans however, they need to be put into action, monitored and changed if required. Feed budgeting should be thought of as a continuous process that you are constantly auctioning and monitoring to ensure production targets are met.

Although the main components of the different types of feed budgets are similar you may find many different versions or arrangements presented by different farming organisations and advisors. Take care to use the format that suits your needs.

Glossary

Pasture mass

Pasture mass = the amount of pasture present, in kilograms of dry matter per hectare (kgDM/ha)

Pasture mass is used to discuss feed in a single paddock or the average over a block or farm. It indicates the total amount of feed present (i.e. NOT just the feed available for stock to eat above a certain height) unless otherwise specified.

There are several common ways to use pasture mass in daily management and feed budgeting:

- **Average pasture mass** = the amount of pasture present (kgDM/ha) as an average across the whole farm or block of land we are considering. This is also called **average pasture cover** (APC) and this term is used in this module because it is more commonly used in industry.
- **Pre-grazing pasture mass** = the amount of pasture present (kgDM/ha) immediately BEFORE animals begin grazing a paddock (i.e. present when they go into the paddock). This is also called pre-grazing pasture cover. Pre-grazing pasture mass affects intakes, especially if animals are not left in the paddock for long.
- **Post-grazing pasture mass** = the amount of pasture present (kgDM/ha) immediately AFTER grazing (i.e. present when the animals are removed from the paddock). This is often called residual pasture mass or just residual. Post-grazing pasture mass has important effects on pasture quality.
- **Available pasture mass** = the amount of pasture available for stock to eat (kgDM/ha). It is the difference between pre-grazing pasture mass and post-grazing pasture mass (i.e. it DOES allow for uneaten pasture). It is important when calculating the area animals need for a period of grazing or the number of animals to put in a paddock for a given length of time.

References and further reading

The publications and websites listed below have been used to compile this module but there may be others available that are also of value.

There is a lot of information on the internet. Make sure the sites you source information from are reputable. Many New Zealand and overseas research organisations and universities such as AgResearch, Plant & Food, Lincoln University, Massey University and the Australian Department of Primary Industries are good sources to use. Many agribusiness sites also provide valuable information but remember these are commercial enterprises so assess the information carefully.

Pasture and Supplements for Grazing Animals, 2007, Edited by P.V. Rattray, I.M. Brookes and A.M. Nicol. NZSAP Occasional Publication No. 14: This book provides detailed information on pasture and supplement growth and quality, animal requirements and intake, and the interactions between feed supply and feed demand. It can be purchased from the New Zealand Society of Animal Production website.

Farm Management in New Zealand, 2005, N. M. Shadbolt: This book discusses feed budgeting as a planning tool for farmers in addition to other management issues.

Facts and Figures for New Zealand Dairy Farmers book from DairyNZ, 2010: This book contains a wide range of information for dairy farming, including feed intakes, feed quality information, guides to feed budgeting, mineral supplementation and more. Much of this information is also useful for beef farming, especially high performance cattle and intensive management. It can be downloaded or ordered free from the DairyNZ website.

Feed allowance information from DairyNZ, 2009: This large poster sheet has detailed tables of feed demand for dairy livestock (including replacement heifers, lactating and dry cows) plus information about feeds used in the industry. It is available free from the DairyNZ website.

FeedSmart workshop manual: This book describes principles of feed management (including pasture growth, feed intakes, quality and feed budgeting) for sheep and beef farmers and outlines the use of FeedSmart feed budgeting software. It is available (with free software) from AgResearch through FeedSmart workshops.

Beef + Lamb New Zealand (was Meat and Wool New Zealand) for information and fact sheets about feed budgets for sheep and beef animals – www.beeflambnz.com

DairyNZ FarmFacts can be viewed or downloaded from www.dairynz.co.nz

- 1-35 Summer deficit feed budget
- 1-83 Feed budget template working forwards
- 1-8 Feed requirements of dry cows
- and many more useful FarmFacts and articles

Answers to exercises

Exercise 1 answers

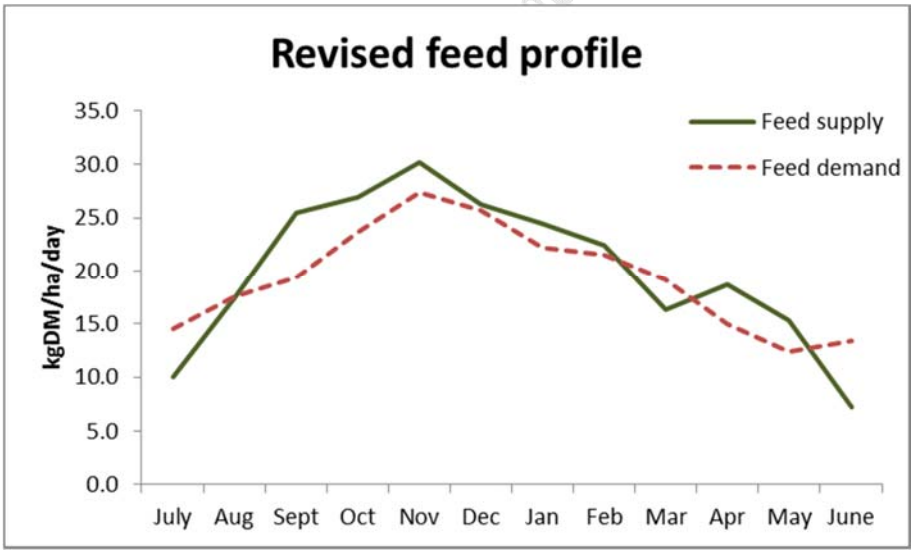
Compare the sheep and beef farm feed profile with the dairy farm feed profile (compare the patterns as no scale is available for the dairy feed profile).

1. The sheep and beef farm has feed deficits in June, July, August and March whereas the dairy farm has deficits in July, August, January, February and March. The sheep and beef farm has feed surpluses from September through to January and again in April and May whereas the dairy farm has surpluses in October through to December, and in May and June. These differences are due mainly to the differences in feed demand over the year.

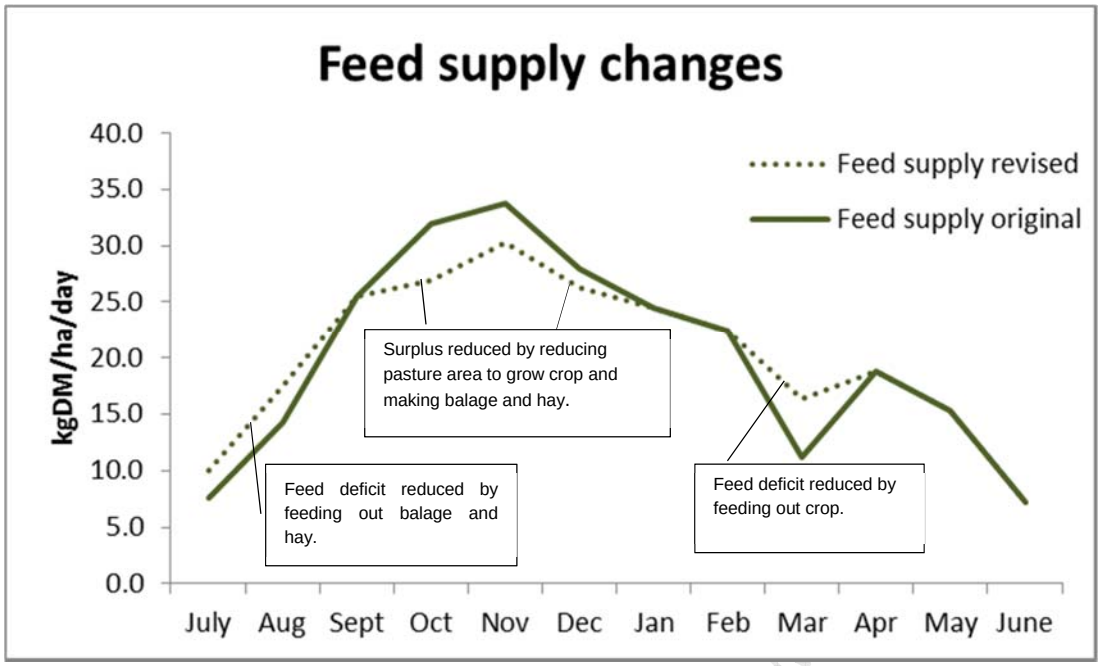
2. The general shape of the feed supply for both feed profiles is similar. There is lower pasture supply in winter, then an increase over spring to a peak in about November, then a reduction over summer and a small increase around April and May before dropping again to winter levels.

Exercise 2 answers

1. Revised feed profile.



2. Feed supply from the original profile (solid line) compared to the feed supply from the revised profile (dotted line).



3. Compare the revised feed profile to the original one.

   a) The combination of reduced pasture area due to growing the crop, and making balage and hay has reduced the feed surplus in October, November and December from 9.5, 7.8 and 3.6 kgDM/ha/day respectively to 3.2, 2.9 and 0.6 kgDM/ha/day.

   Feeding out supplements and crop has resulted in a reduction in the feed deficits apart from June. (Values in kgDM/ha/day):

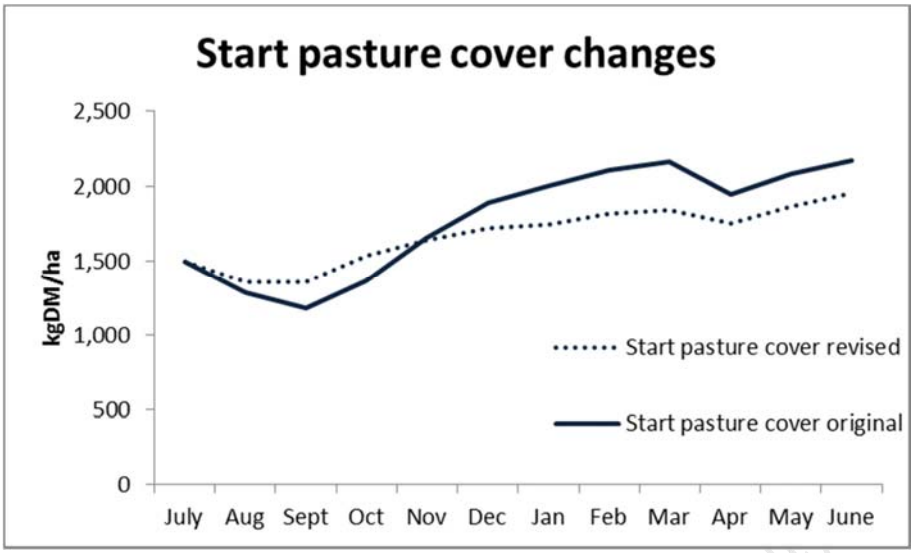
Month	*Original deficit*	*Revised deficit*
July	-6.9	-4.5
August	-3.3	-0.1
March	-7.0	-2.9
June	-6.2	-6.2

   Overall there are still some deficit and surplus periods but the feed supply now more closely matches the feed demand. Over summer and autumn the match may be too close to allow any safety margin if lower than expected pasture growth occurs due to drier than normal conditions or other unexpected weather events.

   b) The revised profile has resulted in higher start pasture covers in August, September and October and reduced start covers from December to July (see Figure 11). Overall the start pasture covers now range from 1,358 kgDM/ha to 1959 kgDM/ha compared to the original profile where they ranged from 1183 kgDM/ha to 2176 kgDM/ha.

   Given that these are average pasture cover values, the revised profile start covers may still be a little too high to promote good pasture quality and other actions may need to be taken such as increasing feed demand by increasing production targets such as lambing percentage, animal growth rates or purchasing more stock.

Figure 11: Start pasture covers for original and revised feed profile



c) Making hay in December has reduced the feed surplus to 26.3 kgDM/ha/day (compared to 33.8 kgDM/ha/day in the original profile) which is close to the feed demand for this time (25.7 kgDM/ha/day). If pasture growth rates are less than expected around this time this could result in a feed deficit in December.

If the crop fails or yields less than expected the deficit in March may be greater which may affect ewe liveweights leading up to mating and/or lamb growth rates (depending on which classes of stock graze the crop).

If pasture growth rates are higher than expected in spring there could still be an unacceptable surplus that could reduce pasture quality.

Exercise 3 answers

1. Calculate the kilograms of dry matter of feed available for the first 10 days of September for a 250 ha dairy farm given the following information:
   - Pasture growth rate = 35 kgDM/ha/day with 95% utilisation
   - Balage available to feed out = 5,000 kgDM with 90% utilisation

Pasture	(35 x 250 x 10) x 0.95	= 83,125 kgDM
Balage	5,000 x 0.90	= 4,500 kgDM
Total feed supply	83,125 + 4,500	= 87,625 kgDM

2. **Note**: There are 11 days in the last period for May.

May Feed Budget	**Dates** 1st – 10th	**Dates** 11th – 20th	**Dates** 21th – 31st
Area (ha)	100	100	100
No. of days	10	**10**	**11**
Feed supply			
Daily pasture growth rate (kgDM/ha/day)	25	25	25
Utilisation (%)	95	95	95
Pasture DM available (kgDM)	25 x 10 x 100 x 0.95 = **23,750**	**23,750**	**26,125**
Supplements			
Silage (kgDM)	13,000	13,000	11,000
Silage utilisation %	90	90	90
Nitrogen boosted pasture (kgDM)	6,000	8,000	6,600
Pasture utilisation %	95	95	95
Total supplements available (kgDM)	(13,000 x 0.90) + (6,000 x 0.95) = 17,400	19,300	16,170
Total DM available (kgDM)	23,750 + 17,400 = **41,150**	**43,050**	**42,295**
Total DM available (kgDM/ha)	41,150 ÷ 100 = **412**	**431**	**423**
Total DM available (kgDM/ha/day)	412 ÷ 10 = **41**	**43**	**38**

Exercise 4 answers

1. Calculate the total weekly DMI requirement, in kgDM/ha, on a 140 ha dairy farm two weeks out from calving.

   (10 kgDM/cow/day x 300 cows x 7 days) ÷ 140 = 150 kgDM/ha

2. Calculate the DMI requirement, in kgDM, for a dairy farm for May given the following information. The feed budget is divided into three periods for May.

   - kgDM required from 1st – 10th May = 45,000 kgDM
     - (16 kgDM x 250 cows x 10 days) + (10 kgDM x 50 other animals x 10 days)
   - kgDM required from 11th – 20th of May = 35,000 kgDM
     - (12 x 250 x 10) + (10 x 50 x 10)
   - kgDM required from 21th – 31th of May = 38,500 kgDM
     - (12 x 250 x 11) + (10 x 50 x 11)

3. Calculate the total weekly DMI requirement for your farm for March.

   Answers will depend on the type of farm and livestock system.

Exercise 5 answers

1. Calculate the difference in pasture supply and feed demand, and the end pasture cover given the following information.

Difference	= (759,375 – 584,798) ÷ 750	= 233 kgDM/ha
End pasture cover	= 1,550 + 233	= 1,783 kgDM/ha

2. You are preparing a monthly summer feed budget for your 600 ha farm. Your start pasture cover for February is 1,800 kgDM/ha. You have calculated an expected feed deficit of 89,750 kgDM for the month. Calculate the end pasture.

End pasture cover	= 1,800 + (-89,750 ÷ 600)	= 1650 kgDM/ha

The following calculation is also correct. In this case the start pasture cover has been changed to kgDM then the end pasture cover in kgDM is converted to kgDM/ha by dividing by the area.

End pasture cover	= (1,800 x 600) + (-89,750)	= 990,250 kgDM
	= 990,250 ÷ 600	
	= 1650 kgDM/ha	

Exercise 6 answers

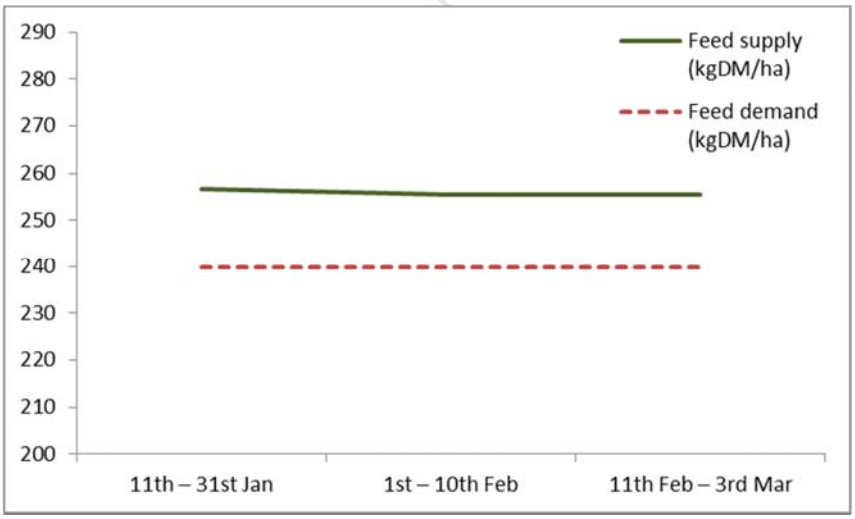
You may have chosen different options from that shown below. This is an example only.

a) See next page for budget and graph.
   a) The Rivers have sold 40 cull cows (13% of the herd).
   b) They have reduced the production targets to 0.7 kgMS/cow/day. By doing this they reduce the daily feed demand to 11.3 kgDM/cow.
   c) They have increased the silage utilisation by feeding out in troughs instead of on the ground.
   d) They have also chosen to buy an extra 5,000 kgDM PKE to supplement the cows from 1st February to the 3rd March. Although the cost may be high, by feeding more PKE they can maintain some milk production and ensure reasonable average start pasture covers.

b) Start pasture covers remain fairly constant over the period. This should allow for sufficient leaf to allow relatively rapid regrowth when rain does occur.

Dates	**11th – 31st Jan**	**1st – 10th Feb**	**11th Feb – 3rd Mar**
Area (ha)	135	135	135
No. of days	10	10	10
Start pasture cover (kgDM/ha)	1,750	1,767	1,782
Feed supply			
Daily pasture growth rate (kgDM/ha/day)	10	8	8
Growth rate for the period (kgDM/ha)	100	80	80
Utilisation (%)	90	90	90

Pasture ME (MJME/kgDM)	10.5	10.5	10.5
Pasture DM available (kgDM)	12,150	9,720	9,720
Supplements			
Silage (kgDM)	20,000	20,000	20,000
Silage utilisation (%)	90	90	90
PKE (kgDM)	5,000	7,500	7,500
PKE utilisation (%)	90	90	90
Total supplements available (kgDM)	22,500	24,750	24,750
DM available (kgDM)	34,650	34,470	34,470
Feed demand			
No. of cows	260	260	260
Daily intake (kgDM/cow/day)	11.3	11.3	11.3
No. of young stock	50	50	50
Daily intake (kgDM/head/day)	6.0	6.0	6.0
Total DMI required (kgDM)	32,380	32,380	32,380
Difference (kgDM)	2,270	2,090	2,090
End pasture cover (kgDM/ha)	1,767	1,782	1,798
Feed supply (kgDM/ha)	257	255	255
Feed demand (kgDM/ha)	240	240	240
Difference (kgDM/ha)	16.8	15.5	15.5



Exercise 7 answers

a) River Farm winter feed budget.

Dates		1 May - 10th July
Area (ha)	A	135
No. of days	B	60

Start pasture cover (kgDM/ha)	C	2,000
Feed supply		
Daily pasture growth rate (kgDM/ha/day)	D	17
Growth rate for the period (kgDM/ha)	E = B x D	1,020
Utilisation (%)	F	90
Pasture ME (MJME/kgDM)	G	11.0
Pasture DM available (kgDM)	H = E x (F ÷ 100) x A	123,930
Supplements		
Maize silage (kgDM)	a	50,000
Silage utilisation (%)	b	85
PKE (kgDM)	c	70,000
PKE uiltisation (%)	d	90
Total supplements available (kgDM)	I = (a x b) + (c x d)	105,500
DM available (kgDM)	J = H + I	229,430
Feed demand		
No. of cows	g	300
Daily intake (kgDM/cow/day)	h	11
No. of young stock	i	
Daily intake (kgDM/head/day)	j	
Total DMI required (kgDM)	K = ((g x h) + (I x j)) x B	198,000
Difference (kgDM)	L = J - K	31,430
End pasture cover (kgDM/ha)	M = C - (L ÷ A)	2,233
Feed supply (kgDM/ha)	N = J ÷ A	1,699
Feed demand (kgDM/ha)	O = K ÷ A	1,467
Difference (kgDM/ha)	P = L ÷ A	232.8

b) Does feed supply exceed feed demand? Yes, supply exceeds demand by 233 kgDM/ha

c) Will the target start pasture cover for the start of calving be achieved? Yes, the start pasture cover at 11 July will be 2,233 kgDM/ha

Exercise 8 answers

You have 400 ram lambs growing at 220g/day requiring 1.6 kgDM/lamb/day. They are grazing a crop of rape yielding 7,000 kgDM/ha. Utilisation is expected to be 80%. The crop paddock is 85 m wide.

a) Calculate the area of crop required per day.

Daily break area = (400 lambs x 1.6 kgDM/head/day) ÷ (7,000 kgDM/ha x 0.80)
= 640 kgDM/day ÷ 5,600 kgDM/ha
= 0.11 ha or 1,142 m^2

b) Calculate how far the break fence should be moved each day.

Break depth = 1,142 m^2 ÷ 85 m = 13.4 m
The break should be moved 14m each day.

Exercise 9 answers

Calculate the fresh weight of barley needed per day given the following scenario:

- From your feed budget you have determined that you will need to feed 500 of your ewes 8,170 kgDM of supplement during the four weeks prior to mating.
- You have chosen to feed barley grain with a DM% of 85%.
- You will be feeding out in troughs and expect 90% utilisation.

Daily DMI requirement = 8,170 kgDM ÷ 28 days
= 292 kgDM/day

Daily DM allowance (taking into account wastage) = 292 ÷ 0.90
= 324 kgDM

Fresh weight per day = 324 ÷ 0.85
= 381 kgFW

Appendix

This feed budget template in DairyNZ farmfact 1-35 can be downloaded from www.dairynz.co.nz.

Summer deficit feed budget – how many cows to milk (1-35)

Feed budget period: _____ to _____

No. of days	A			Opening milking cow numbers	H
Area ha	B			Opening dry stock and replacement numbers	I
Feed supply					
Average pasture cover now	C	Kg DM/ha			
Average pasture cover period end	D	Kg DM/ha			
Available feed Kg DM/ha	C-D = E	B (ha)		ExB = J	J
Pasture growth Kg DM/ha/day	G	A (days)	B (ha)	GxAxB = K	K

Supplements available

Silage	Kg DM		L
Hay	Kg DM		
Maize	Kg DM		
Other	Kg DM		
Crops	Kg DM		
Total supplements	Kg DM	L	
Less supplements for winter	Total Kg DM	M	

Less supplements for when it rains [1/]	H No. cows	x	Kg DM/cow	N	L-M-N = O
Feed available				J + K + O = P	J+K+O = P
Less: Feed for maintenance	H	A (days)	Q Kg DM/cow	HxAxQ = R	
Less: Feed for young stock and dry cows	I	A (days)	S Kg DM/head	IxAxS = T	R+T = U
Total Kg DM available for milk production				P – U = V	P-U = V
Feed demand/cow for milk production	Kg MS/cow/d	W kg DM/cow/d	A (days)	W x A = Z	Z
Number of cows you can milk	Total Kg DM for milk production ÷ Feed demand/cow for budget period			V ÷ Z	

[1/] Need minimum of 100 kg DM/cow when it rains

Feed demand for maintenance & milk production Kg DM per cow based on 10.5 ME /kg DM

Cow Lwt	Maintenance	Kg MS/cow/day					
		0.7	0.8	0.9	1.0	1.1	1.2
400 kg Lwt	4.8	5.3	6.0	6.8	7.5	8.3	9.0
500 kg Lwt	5.7	5.6	6.4	7.2	8.0	8.8	9.6

This template can be found in Southland Demonstration Farm Information Handout, 10th February 2011. It can be downloaded from www.siddc.org.nz

DairyNZ

11 May 2010

Autumn/Winter Feed Budget

Spring or Autumn or Split Calving
(From March to Start of Calving or Balance Date)

Budget Period: _____ = _____ **days**

Effective ha = _____**ha** **Spring Calving Cows =** _____ **Autumn Calving cows =** _____

FEED SUPPLY										
Refer Page 2 to calculate Average pasture growth rate kg DM/ha/day			*Days*	*x*	*Avge Growth/day Kg DM/ha/day*		=	Kg DM/ha	
Pasture Growth				x			=		A
	No. Cows Grazing off.	X	*Intake per cow kgDM/cow/day 1/*	*x*	*Days*	÷	*Ha*	Kg DM/ha	
Grazing Off Note 1/		X		x		÷			B
1/ *Intake at grazing is feed eaten therefore multiply intake offered x 85% dry or 75- 80% wet conditions eg offer 12 kg DM/cow/day x 85% utilisation = 10.2 kg DM/cow eaten*					*Supplement Eaten Total Kg DM*	÷	*ha*	Kg DM/ha	
Supplements			*Refer Page 2 to calculate total supplements eaten*			÷			C
TOTAL FEED SUPPLY							***A + B + C = D***		**D**
LESS FEED DEMAND									
	No.	*x*	*Intake/head Fr (Jersey)*	*x*	*Days*	*Total Feed Heifers/Other*	÷	*ha*	Kg DM/ha	
R 1 yr Hfrs		x	6 (5)	x			÷			E
In Calf Heifers/Other		x	10 (8)	x			÷			F
Maintenance **Milking/Dry Cows**	*Cows*	*x*	*Intake kgDM/cow/d Fr (Jersey)*	*x*	*Days*	*Total kg DM*				
Spring Dry Cows		x	8.0 (7.0)	x						
Autumn Milkers		x	6.0 (5.5)	x			÷	*ha*	Kg DM/ha	
Total Feed for Maintenance			*(Refer Table 1 for maintenance intake per cow)*				÷			G
	Cows	*x*	*Kg DM/c/d Milk Prod'n (Refer Table 3)*	*x*	*Days*	= *Total KgDM for Milk Production*	÷	*ha*	Kg DM/ha	
Milk Production		x		x		=	÷			H
	MA Cows	*x*	*DM/score Fr (Jersey) (Refer Table 4)*	*x*	*No. of scores*	*Total Cond'n Kg DM*		*ha*	Kg DM/ha	
Cow Condition		x		x			÷			I
			Pasture Cover at Calving		*Less*	*Opening Pasture Cover*			Kg DM/ha	
Pasture Cover					-		=			J
Total Feed Demand							***E + F + G + H + I + J = K***			**K**
FEED SURPLUS/DEFICIT KG DM/HA							***D - K***			

DairyNZ **Table 1** **Average Pasture Growth Rate for Budget Period**

	Days		Growth rate		Total
March		x		=	
April		x		=	
May		x		=	
June		x		=	
July		x		=	
August		x		=	
September		x		=	
Total	b				a
	Total		*Days*		
Average Monthly Growth Rate	b	÷	a	=	A

Table 2 **Supplementary Feed kg DM/ha**

Supplement	Tonnes DM			
Grass Silage (150-200 kg DM/m^3; avge 180 kgDM/m^3)				
Maize Silage (200 kgDM/m^3 stack; 220 kgDM/m^3 bunker)				
Hay (18 kg DM/BE)				
Other (PKE 90% DM; grain 87% DM)				
Other		*Ha*	=	*Kg DM/ha*
Total			÷	C

Table 3 ***Milksolids Requirements – kg DM Eaten/kg MS above Maintenance (for 11.0 MJME/kg DM)***

Kg MS/cow/day	**0.7**	**0.8**	**0.9**	**1.0**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**
Kg DM above maintenance	5.2	5.9	6.7	7.4	8.1	8.9	9.6	10.4	11.1	11.8	12.6	13.3

Table 4 ***Kg DM Offered for One Body Condition Score (above maintenance)***

Breed	**Autumn Pasture 6% wastage**	**Supplement**		
		Utilisation		
		90%	**85%**	**75%**
Jersey	**180**	**140**	**150**	**165**
Friesian	**220**	**155**	**180**	**200**

This template is available in DairyNZ farmfact 1-83 which can be downloaded from www.dairynz.co.nz.

FEED BUDGET WORKING FORWARDS FROM PASTURE COVER ON THE FARM

PERIOD	ANIMAL DEMAND	FEED SUPPLY	PASTURE COVER
No. of Days	_____ Cows x _____ Kg DM/cow/d _____	**Feed Type kg DM/ha/day**	(2) Total kgDM SUPPLIED /ha/day= _____
	_____ Other x _____ Kg DM/cow/d _____	Grass Growth _____	(1) Total kgDM DEMAND/ha/day = _____
	_____ Other x _____ Kg DM/cow/d _____	Silage _____	SUPPLY – DEMAND = _____
Date	Total Daily Requirements (kg DM) = _____	Hay _____	Multiply by _____ days = _____
	Ensure cow intake allows for wastage	Nitrogen _____	(Change in cover in Period)
	Divide by Effective ha _____ Kg DM/ha = _____	Other _____	Add Opening Cover _____
	Total kg DM/ha/day DEMAND (1)	Total kgDM SUPPLIED/ha/d (2) _____	Equals Closing Cover _____
PERIOD	**ANIMAL DEMAND**	**FEED SUPPLY**	**PASTURE COVER**
No. of Days	_____ Cows x _____ Kg DM/cow/d _____	**Feed Type kg DM/ha/day**	(2) Total kgDM SUPPLIED /ha/day= _____
	_____ Other x _____ Kg DM/cow/d _____	Grass Growth _____	(1) Total kgDM DEMAND/ha/day = _____
	_____ Other x _____ Kg DM/cow/d _____	Silage _____	SUPPLY – DEMAND = _____
Date	Total Daily Requirements (kg DM) = _____	Hay _____	Multiply by _____ days = _____
	Ensure cow intake allows for wastage	Nitrogen _____	(Change in cover in Period)
	Divide by Effective ha _____ Kg DM/ha = _____	Other _____	Add Opening Cover _____
	Total kg DM/ha/day DEMAND (1)	Total kgDM SUPPLIED/ha/d (2) _____	Equals Closing Cover _____
PERIOD	**ANIMAL DEMAND**	**FEED SUPPLY**	**PASTURE COVER**
No. of Days	_____ Cows x _____ Kg DM/cow/d _____	**Feed Type kg DM/ha/day**	(2) Total kgDM SUPPLIED /ha/day= _____
	_____ Other x _____ Kg DM/cow/d _____	Grass Growth _____	(1) Total kgDM DEMAND/ha/day = _____
	_____ Other x _____ Kg DM/cow/d _____	Silage _____	SUPPLY – DEMAND = _____
Date	Total Daily Requirements (kg DM) = _____	Hay _____	Multiply by _____ days = _____
	Ensure cow intake allows for wastage	Nitrogen _____	(Change in cover in Period)
	Divide by Effective ha _____ Kg DM/ha = _____	Other _____	Add Opening Cover _____
	Total kg DM/ha/day DEMAND (1)	Total kgDM SUPPLIED/ha/d (2) _____	Equals Closing Cover _____

The following tables show pasture Growth rates for various New Zealand locations (kgDM/ha/day). For all tables:

*Annual average = Production (kg/ha/year) averaged over 30 years

**Annual range = Annual pasture production falls within this range in *most* (2 out of 3) years

Site	Dargaville	Helensville	Rukuhia (Hamilton)	Gisborne	Gisborne Hills	Hastings	Wairakei (flat site)
Soil Type	Kaipara clay	Red hill sand complex	Hamilton clay loam	Recent alluvial soils	Gisborne sandy loam	Takapau light silt loam	Atiamuri sand
Jun	25	17	8	18	10	10	4
Jul	24	18	12	19	8	10	5
Aug	33	29	32	33	14	20	5
Sep	50	37	50	47	25	40	17
Oct	58	51	53	47	46	40	30
Nov	63	50	44	38	52	13	33
Dec	73	45	42	37	52	14	33
Jan	59	32	17	29	52	9	19
Feb	61	29	21	30	38	13	14
Mar	50	31	21	32	39	15	11
Apr	41	36	23	29	29	18	9
May	32	26	13	24	15	18	8
Annual average*	17150	12750	10200	11750	11550	6750	5750
Annual range**	13550-20750	10400-15150	8000-12400	9050-14450	8390-13340	5550-7950	4300-7200

Source: Lincoln University Farm Technical Manual

Site	Wairakei (hill site)	Stratford	Hawera	Marton	Bulls	Masterton	Westport
Soil Type	Oruanui hill soil	Stratford sandy loam	Egmont brown loam	Marton silt loam	Rangitikei loamy sand	Katatau silt loam	Addison 'pakahi'
Jun	8	8	11	12	13	16	11
Jul	4	8	12	13	5	16	10
Aug	11	15	18	23	8	32	13
Sep	29	25	36	44	21	56	16
Oct	45	42	46	47	27	70	38
Nov	42	42	46	40	28	51	55
Dec	52	43	44	43	22	30	54
Jan	34	38	38	32	17	15	49
Feb	18	30	26	26	19	12	40
Mar	24	34	30	29	15	21	32
Apr	18	25	28	25	14	26	21
May	13	14	20	17	15	25	10
Annual average*	9000	9940	10665	10850	6250	10900	10900
Annual range**	7600-10420	7670-11300	6260-13600	8900-12800	5500-7050	8500-13300	10200-11650

Source: Lincoln University Farm Technical Manual

Site	Greymouth	Hokitika	Motueka	Winchmore (dry land)	Winchmore (irrigated)	Waitaki Plains (irrigated)	Awamoko (irrigated)
Soil Type	Ahaura stony silt loam	Hari Hari silt loam	Rosedale silt loam	Lismore stony silt loam	Lismore stony silt loam	Steward very stony silt loam	Georgetown silt loam
Jun	5	5	13	5	5	5	4
Jul	3	3	17	5	5	5	4
Aug	7	4	30	9	11	5	13
Sep	32	20	58	30	31	20	45
Oct	51	32	57	37	40	50	72
Nov	51	50	55	27	41	65	74
Dec	34	32	36	19	48	62	64
Jan	36	31	15	13	48	54	62
Feb	35	33	14	14	43	48	53
Mar	34	33	32	16	31	35	48
Apr	21	20	30	14	20	26	29
May	8	10	16	8	10	9	15
Annual average*	9370	8100	11550	5850	10150	11500	15073
Annual range**	7730-11620	5610-11000	9500-13600	4750-6700	9150-11200	10660-12370	10410-19180

Source: Lincoln University Farm Technical Manual

Site	Windsor (Oamaru)	Palmerston	Arrowtown (irrigated)	Cromwell (irrigated)	Poolburn	Otago Plateau (Alexandra)	Hindon (Dunedin)
Soil Type	Kauru silt loam	Claremont silt loam	Shotover silt loam	Molyneux loamy sand	Linnburn sandy loam	Teviot silt loam	Wehenga silt loam
Jun	1	3	0	0	0	0	2
Jul	2	4	0	0	0	0	2
Aug	10	11	0	0	0	0	2
Sep	25	27	19	16	15	1	15
Oct	44	53	48	39	24	18	35
Nov	31	55	66	48	17	20	58
Dec	28	39	58	52	12	16	43
Jan	23	28	56	42	12	14	36
Feb	15	20	54	35	7	8	32
Mar	18	25	42	27	7	7	25
Apr	13	13	19	13	5	0	23
May	6	7	3	3	1	0	7
Annual average*	6583	8824	10850	8300	2800	2540	8820
Annual range**		2546-13264	8880-12180	6700-9900	770-4570	1520-3830	7520-12760

Source: Lincoln University Farm Technical Manual

Site	Taieri Plain (Dunedin)	Taieri Hill	Mona Bush (Invercargill)	Winton (Invercargill)
Soil Type	Alluvial soil	Warepa series	Waikiwi silt loam	Otapiri silt loam
Jun	5	5	6	8
Jul	5	5	5	9
Aug	12	9	8	10
Sep	32	25	35	26
Oct	55	46	35	53
Nov	49	47	70	54
Dec	47	44	69	54
Jan	40	36	58	53
Feb	33	28	58	51
Mar	29	24	49	42
Apr	18	16	31	26
May	8	9	10	13
Annual average*	10400	8900	14600	12000
Annual range**	8800-12000	6500-11100	11850-17350	9700-14300

Source: Lincoln University Farm Technical Manual