

Pasture assessment and livestock production

Alan Bell

Former Technical Specialist (Temperate Grazing Systems)

This Primefact was compiled in part from the PROGRAZE[®] Manual. PROGRAZE[®] is owned by NSW Department of Primary Industries and Meat & Livestock Australia Limited.

Introduction

Pasture assessment involves being able to estimate the quantity and quality of available pasture. For on-farm decision making it usually involves a visual estimation; however, various more objective techniques are available such as the median quadrat technique (see Primefact 324 *Measuring herbage mass – the median quadrat technique*), the rising and falling plate and capacitance meters, and in the future via remote sensing.

Pasture assessment can also involve estimates of botanical composition and ground cover.

Why assess pasture?

The main reasons for assessing pasture are:

- to match animals' requirements with pasture production;
- to achieve more precise supplementary feeding;
- for accurate feed planning;
- to more effectively manipulate pasture production and composition;
- to ensure ground cover is sufficient to protect soil from rainwater run-off and to encourage water infiltration into soil.

Sheep and cattle production levels are primarily determined by the daily intake of pasture and the extent to which this might vary throughout the year. While there is a range of pasture parameters that

influence how close **actual** intake gets to **potential** intake, by far the most critical are:

- pasture quantity (herbage mass / plant height)
- pasture quality (digestibility)
- species composition.

Pasture quantity (herbage mass/ plant height)

Pasture quantity is usually described as **herbage mass** and is expressed in **kilograms of pasture dry matter per hectare (kg DM/ha)**. 'Herbage mass' refers to the total amount of pasture present if cut at ground level, and includes both green and dead material.

Herbage mass is expressed in terms of dry matter because water content of pasture can vary depending on the time of day and on the different stages of growth. For example, a young, leafy, rapidly growing pasture may contain 85% water (or 15% dry matter), while flowering grasses may contain 50% water and therefore 50% dry matter. Dead pasture on a hot summer's day may contain over 90% dry matter. While water is vital, it has no nutritional value. When relating herbage mass to what the animal can eat and utilise, the water component is ignored.

Assessing herbage mass

The pasture components that determine herbage mass are:

- height
- density
- water content (and therefore dry matter).

The **critical herbage mass for sheep** is in the range 400–1700 kg DM/ha, and for **cattle** 700–2900 kg DM/ha (see Pasture benchmarks below). Over these herbage mass ranges, pasture assessment skills are usually developed quickly, involving cutting pasture and weighing and drying



pasture samples (see Primefact 324 *Measuring herbage mass – the median quadrat technique*).

Of the components that determine the herbage mass of a pasture, it is the **average plant height** which has the most significant impact on how much pasture livestock will consume. Following an assessment of the average height of the green edible plants in a pasture, Table 1 can be used in conjunction with the pasture benchmarks (Table 2 and Table 3 below) as a guide to the requirements of sheep and cattle. Table 1 provides a good indication of the actual herbage mass of a dense pasture at a given average plant height.

Table 1. Average height of green plants and the 'indicative' herbage mass

Average plant height (cm)	'Indicative' herbage mass (kg green DM/ha)
1	400
2	700
4	1200
6	1600
8	2000
10	2400
12	2800
14	3200

Why is herbage mass important to livestock production?

Obviously if herbage mass drops below a certain level, sheep and cattle will be unable to consume

sufficient pasture to increase or even maintain their weight. When herbage mass is low, animals must spend more time grazing to meet their nutritional requirements, since each bite of pasture harvests a smaller amount.

At the other end of the scale, there is a point at which intake will not increase even if more pasture is made available, because the animals have reached their maximum gut fill.

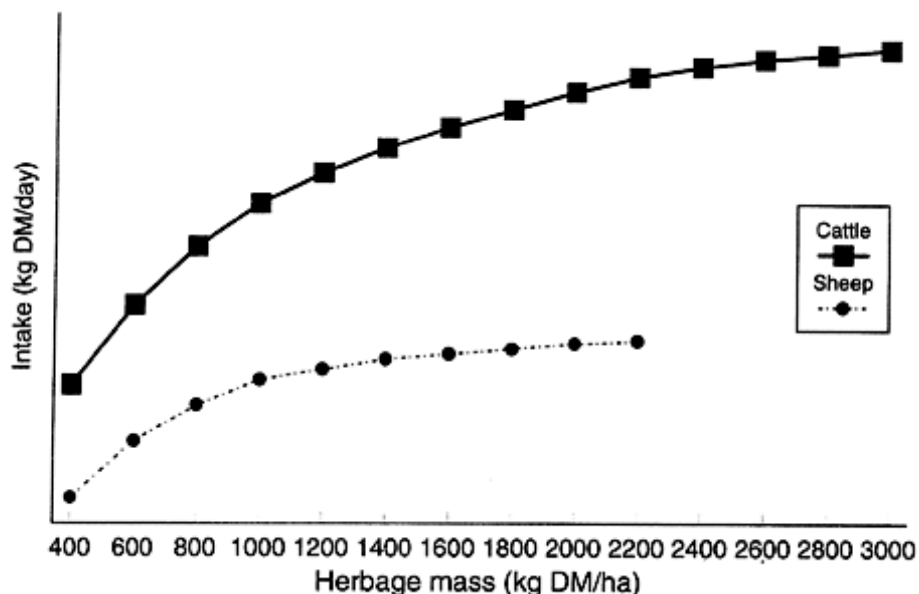
Figure 1 indicates the **general relationship between herbage mass and the daily intake** for both sheep and cattle. Using **sheep** as the example:

- As the available herbage mass increases up to 800–900 kg DM/ha, a sheep's pasture intake rises sharply.
- From that point to about 1500–1600 kg DM/ha, the intake response is not as great; however, this additional pasture is very important to stock with high nutritional requirements such as lactating ewes and crossbred lambs.
- Once herbage mass rises above 1600 kg DM/ha, only small additions to sheep performance can be expected because herbage mass should no longer be a limit to a sheep's intake.

Pasture quality

There are numerous parameters of pasture quality that can influence intake by livestock. From a practical point of view, **digestibility** and the **proportion of legume** are probably the most useful measures, even though they do not always fully explain the observed variation in intake.

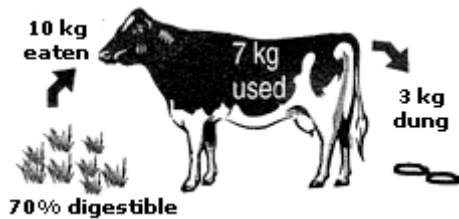
Figure 1. Correlation between herbage mass and intake for sheep and cattle



Digestibility

'Digestibility' is the most useful measure of pasture quality. It refers to the proportion of a feed an animal can use to satisfy its nutritional requirements. For example, if the digestibility of a pasture is 70%, then approximately 70% of the pasture consumed on a dry matter basis will be used by the animal for its own nutritional requirements, while 30% will eventually pass as faeces (see Figure 2).

Figure 2



Digestibility is a **useful measure of quality** for the following reasons:

- **It is directly and positively related to the energy content of the pasture.** Energy is needed by animals for body functions. Energy in feed is assessed in megajoules of metabolisable energy per kilogram of dry matter (MJ ME/kg DM). Figure 4 shows the relationship between digestibility and the energy content of pasture.
- **It is positively related to protein content.** When digestibility is high, protein content will also be high. However, there is variation in protein content between pasture species. For example, clovers are generally higher in protein than grasses at a similar stage of growth.
- **It directly relates to the speed of digestion and therefore the movement of feed through the animal.** In general, pastures with higher levels of digestibility will be digested more rapidly, allowing for higher intake and consequently higher levels of animal production.

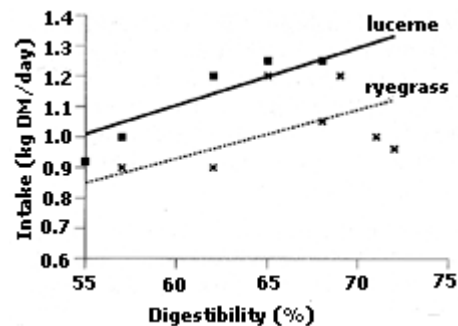
Species composition and the proportion of legume

'Species composition' refers to the species present, and the proportion of each of these species, in the pasture. What is important from a practical viewpoint is the **proportion of legume**.

Legumes usually have a higher digestibility than grasses at the same stage of maturity. In addition, cattle or sheep tend to consume a greater quantity of legume than grass when both the legume and grass are at the same digestibility. The graph in Figure 3 shows the relationship between digestibility and intake for grass (ryegrass) and

legume (lucerne). Animals will also tend to select legume in preference to grass. Protein levels in legumes are usually superior to those in grasses, especially as the legumes approach maturity.

Figure 3



Source: Greenhalgh (1979), *The management and diseases of sheep*, Commonwealth Agricultural Bureau, pp. 201–12.

Parts of the plant

Leaf material has a higher digestibility than the stems. Pasture management which maintains a high proportion of leaf will provide a pasture of higher digestibility and will increase livestock performance. In addition, if leaf area is maintained on a plant, the plant will recover more quickly following grazing.

Stages of growth

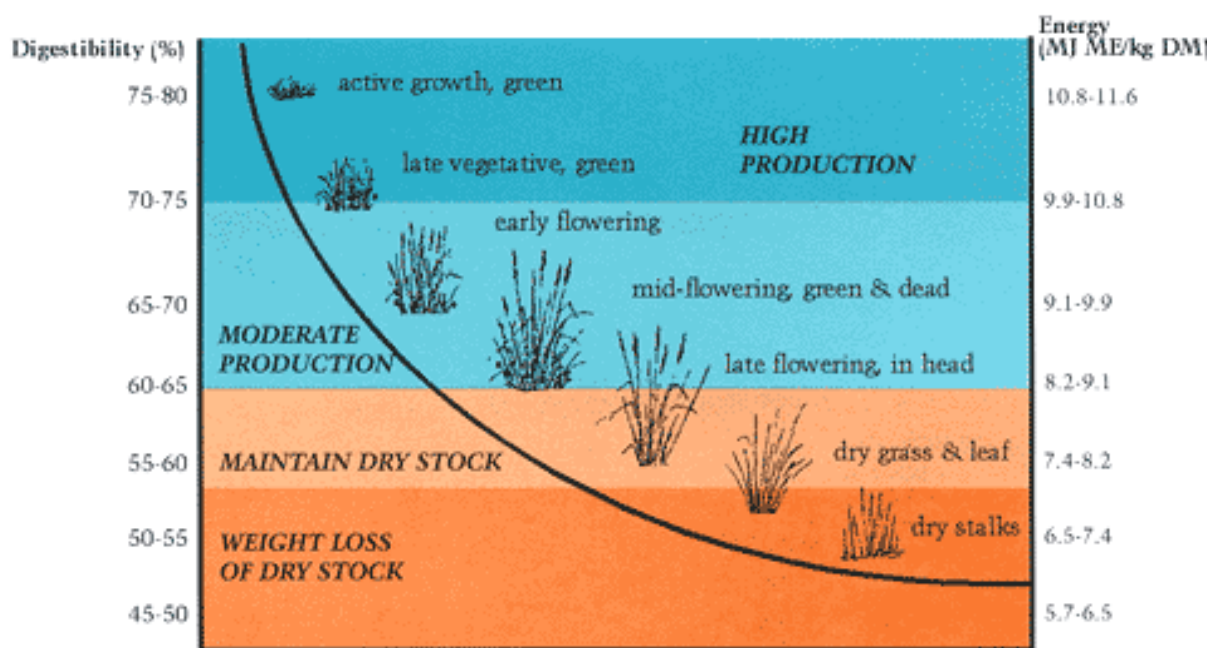
The **digestibility of a pasture plant declines as it matures** (see Figure 4). Therefore, as indicated above, where high levels of livestock performance are required, grazing management should aim to keep pastures in the growth phase for as long as possible, delaying the onset of flowering and the associated decrease in digestibility.

Species preference

Preference by livestock for one species over others in a pasture has important implications for the long-term stability of the pasture. **Highly preferred species are usually selectively grazed, and this can reduce or even eliminate these species from the pasture.** For example, the grazing pressure of continuous stocking or long periods of set stocking can reduce the presence of preferred species due to the limited opportunity for plants to recover following a stress period.

Managers should be aware of circumstances that place plant species at risk and should implement grazing procedures that ensure the long-term stability of the pasture.

Figure 4. A guide to digestibility decline as temperate pastures mature



Interaction of herbage mass and digestibility

Herbage mass and digestibility interact with each other in determining the amount of pasture that will be consumed by livestock:

- Where there is a **low herbage mass but its digestibility is high**, intake is limited because of small bite size — animals will only graze to a maximum of about 13 hours each day and under these circumstances they may not be able to eat enough to meet their nutritional requirements.
- Where there is a **high herbage mass but its digestibility is low**, intake is limited by the slow movement of feed through the animal.

Because of these interactions, there can be **trade-offs between herbage mass and digestibility** to achieve the same production outcome in livestock. The potential for trade-offs is greatest in those animals that have low nutritional requirements, for example maintaining dry stock, but there are fewer opportunities in high-demand animals.

Figure 5 indicates the trade-off between digestibility and herbage mass. Each class of animal is achieving the same production level along each line; for example, a dry sheep requires a pasture herbage mass of 4000 kg DM/ha at 55% digestibility to maintain weight, whereas at 70% digestibility, only 500 kg DM/ha is required

Note on Figure 5: Once digestibility declines below 65% for lactating stock and 55% for dry stock, then, no matter how much pasture is available, these stock are likely to experience unsatisfactory performance levels, i.e. increasing weight loss.

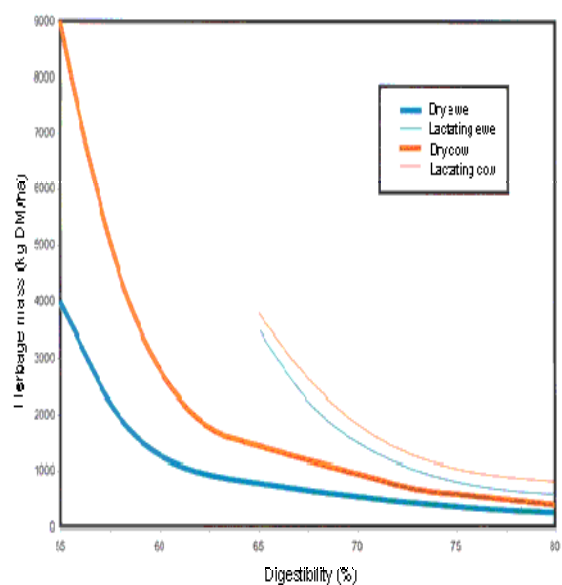


Figure 5. The trade-off between digestibility and herbage mass

Pasture benchmarks

Pasture benchmarks are an indication, a guide, of how much herbage mass is required for various classes of animals in order to gain a certain level of production.

The pasture benchmarks in Tables 2 and 3 indicate how much **green herbage mass** is required to satisfy the nutritional requirements of stock at various stages of their reproductive cycle and for growth.

Table 2. Minimum herbage mass (kg green DM/ha) to maintain satisfactory production levels in sheep

Sheep class	Pasture digestibility		
	75%	68%	60%
Dry sheep	400	600	1200
Pregnant ewes:			
mid	500	700	1700
last month	700	1200	ns
Lactating ewes:			
single	1000	1700	ns
twins	1500	ns	ns
Growing stock (% of potential growth):			
30 (75 g/d)*	400	700	1700
50 (125 g/d)	600	1000	ns
70 (175 g/d)	800	1700	ns
90 (225 g/d)	1600	ns	ns

*Predicted growth rates in brackets are based on a weaned 4-month-old crossbred lamb of approximately 32 kg from a ewe with a standard reference weight of 55 kg.

ns = not suitable; that is, at these digestibilities, no matter how much pasture is available, dry or pregnant stock are unlikely to maintain weight, lactating stock are likely to experience an unacceptable level of weight loss, and growing stock will not be achieving the targeted weight gain.

Table 3. Minimum herbage mass (kg green DM/ha) to maintain satisfactory production levels in cattle

Cattle class	Pasture digestibility		
	75%	68%	60%
Dry cow	700	1100	2600
Pregnant cow (7–8 months, not lactating)	900	1700	ns
Lactating cow (calf 2 months)	1100	2200	ns
Growing stock (% of potential growth):			
30 (0.39 kg/d)*	600	1100	2900
50 (0.61 kg/d)	800	1600	ns
70 (0.85 kg/d)	1200	2600	ns
90 (1.12 kg/d)	2200	ns	ns

*Predicted growth rates in brackets are based on a weaned 13-month-old steer of approximately 320 kg from a cow with a standard reference weight of 500 kg.

ns = not suitable, that is, at these digestibilities, no matter how much pasture is available, dry or pregnant stock are

unlikely to maintain weight, lactating stock are likely to experience an unacceptable level of weight loss, and growing stock will not be achieving the targeted weight gain.

Notes on Tables 2 and 3:

1. The benchmarks relate specifically to the nutritional requirements of livestock. At lower herbage masses, particularly those indicated for sheep, there is a risk of excessive run-off and soil erosion through lack of ground cover.
2. The predictions in Tables 2 and 3 are based on a pasture which also includes 500 kg DM/ha of dead pasture with a digestibility of 47% and a legume content of 15%.

There will be occasions when the benchmarks (Tables 2 and 3) are met and livestock still lose weight. For example, ewes can still lose weight during the peak of lactation, particularly when suckling twins, even when grazing highly digestible pastures and where herbage mass is not limiting intake.

Just because pasture is not meeting livestock nutritional requirements does not necessarily mean that supplementary feeding is necessary. Management has the option of utilising an animal's capacity to store fat reserves in the good times and to mobilise these reserves when pastures cannot fully supply their nutritional requirements. To be able to utilise this capacity, sheep and cattle must attain sufficient liveweight or fat reserves prior to seasonal declines in pasture production or before high nutritional demand periods occur, for example prior to lactation.

The **pasture benchmarks hold true regardless of stocking rate**. The stocking rate will determine how long a pasture can be maintained at any given herbage mass. If the stocking rate is such that the amount of pasture being consumed is greater than its growth, herbage mass will decline and the risk is that it will drop below a target benchmark.

If a paddock is **grazed below the target benchmark**, production is unlikely to be maintained.

- This lower production level can be accepted – it may be the appropriate management tactic or
- stock can be moved to a more suitable paddock or
- supplements can be fed.

If herbage mass falls below a critical level, the sustainability and viability of the pasture may be jeopardised. (See Primefact 325 *Pasture sustainability and management in drought* and Primefact 283 *Visually assessing pasture condition and availability in drought*.)

Managing stock based on the benchmarks should ensure that nutritional requirements are being met. **However, there will be occasions where it is not possible for the requirements to be met, or even desirable** – for example, when ewes are fat at the end of joining, it is better that they lose weight slowly during early pregnancy. Managed weight loss will occur if stock graze pasture that is below the maintenance (dry sheep) benchmark, or if stock are provided with a high herbage mass of low digestibility. The same principle applies to overfat heifers in late pregnancy.

CAUTION: Managed weight loss is acceptable only if it occurs slowly. This applies to all animals, whether or not they are pregnant. If weight loss is too fast, this can cause rapid mobilisation of fat, which can result in death.

When pasture is limiting and benchmarks are not able to maintain production levels, **supplementary feeding** may be required. The **program GrazFeed®** becomes extremely useful in determining the most appropriate supplement and the quantity that should be fed.

Producers can learn more about pasture assessment and livestock management by participating in a **PROGRAZE® course**. (Contact your local NSW Department of Primary Industries District Livestock Officer for more information.)

Further information

Refer to the following for more information on pasture assessment and availability:

- Primefact 325 *Pasture sustainability and management in drought*
- Primefact 283 *Visually assessing pasture condition and availability in drought*
- Primefact 324 *Measuring herbage mass – the median quadrat technique.*

© State of New South Wales
through NSW Department of Primary Industries 2006

ISSN 1832-6668

Replaces Agnote DPI-428

Check for updates of this Primefact at:

www.dpi.nsw.gov.au/primefacts

Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (December 2006). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

Job number 7107