

Pasture utilisation

Key actions

- Increase green pasture consumed in a sustainable manner, the ideal percentage that can be sustainably consumed will depend on the environment and the enterprise.
- Base your grazing management on plant growth rate and growth stage for high quality and yield of pasture.
- Use tactical grazing techniques to meet different animal and pasture objectives at various times of the year.
- Manage pastures to ensure adequate rest and regrowth before the next grazing.
- Consider how feed is allocated within the herd to improve profitability. Strategic allocation of feed to sale classes of stock or young growing stock can have significant economic benefits and, once pasture utilisation has reached a sustainable level, can be used as another tool.
- Ensure that soil fertility is non limiting for your environment.

Why is efficient utilisation of green pasture important?

Aim to increase green pasture utilisation by 10% to raise productivity

This module focuses on the utilisation of high quality green pasture. Increasing the use of green pasture can be the most cost-effective way of lifting the productivity for the majority of beef enterprises.

Grazing managers should aim to convert the largest amount of pasture energy and nutrients into saleable beef while leaving pasture residue in the best condition for rapid regrowth. Precise control of grazing pressure and herd structure across a total grazed area can achieve utilisation of up to 60% of green pasture grown in areas where the summer dry period is relatively short and there is some green pick over summer. Examples of these areas are Western Victoria and South Gippsland. This level is higher than current industry estimates of 30–40% utilisation of total green pasture grown.

Sustainable utilisation targets of 40–48% are suitable for areas with an extended dry period greater than 150 days and very little summer feed on annual grass-based pastures or clover-based pastures.

The dairy industry is achieving pasture utilisation levels of 65–70%; however, dairy farms are generally located in a longer growing season zone or have irrigation and can supplementary feed with grain very easily.

In a beef situation, the cost of supplements (hay or grain) often comes directly off the bottom line and there is a significant period of little or no pasture growth. The level to which pasture utilisation can be improved in a beef enterprise depends on enterprise type (ie breeding herd versus trading enterprise), length of dry period and pasture type.

In a beef trading enterprise, pasture utilisation of 50–60% is possible in most environments, if limited stock are carried over the dry period.

In a breeding operation, a sustainable pasture utilisation of 40–55% is possible, depending on pasture type. Tables 1–4 works through an example of the amount of pasture required at the start of summer to maintain a given stocking rate.

The first point is to maximise the amount of pasture grown, allocate the feed to the correct livestock class and determine the level of utilisation that fits your environment and production system (trading versus breeding enterprise).

Summer feed budget example for North East Victoria (Reference: McPee. M.J., Ransom. K.P. and Oddy V.H. 1995. Calibration of empirical models: simulation of pasture growth and decay. *Environmetrics* 6: 505–510.)

Assumptions:

- summer starts on 1 December
- need 1,200kg of DM/ha at 1 May
- 150 days of summer
- 1kg DM/DSE/day.

Table 1: Summer pasture loss is influenced by pasture species

Pasture type	Average rate of loss (kg DM/ha/day)
Clovers	21
Annual grasses	13
Perennial grasses	7



Table 2: Effect of pasture type on feed utilisation

Stocking rate (DSE/ha)	Feed consumed (kg)	Clover pasture	Annual grass pasture	Perennial grass pasture
8	2,880	7,230	6,030	5,130
10	3,600	7,950	6,750	5,850
12	4,320	8,670	7,470	6,570

Table 3: Feed required at the start of summer

Stocking rate (DSE/ha)	Clover pasture	Annual grass	Perennial grass
8	5,550	4,350	3,450
10	5,850	4,650	3,750
12	6,150	4,950	4,050

Table 4: Pasture utilisation (%) taking into account stocking rate and type of pasture

Stocking rate (DSE/ha)	Clover pasture (%)	Annual grass pasture (%)	Perennial grass pasture (%)
8	40	48	56
10	45	53	62
12	50	58	66

In summary, perennial-based pastures have higher utilisation because they decay less over the summer. Increasing stocking rate – given soil fertility is adequate – increases pasture utilisation independently of pasture type. Having a perennial-based pasture also enables quicker pasture growth on opening rains compared to annuals starting from seed because the plant is already established.

Summer management of tropical grasses – applicable from Newcastle to Gympie along the NSW coast

Recent work undertaken by Tom Amey (producer) and Nathan Jennings (NSW Department of Primary Industries) demonstrated the benefit of slashing tropical grasses (in this case setaria) towards the end of summer if they have grown out of control. It is the same principle as removing the excess dry matter in southern Australia prior to the autumn break, to encourage good sub clover germination, but perhaps with even greater effect.

In the study, setaria was slashed in late February in one section and compared to an unslashed area after 20 days, when digestibility, metabolisable energy and protein were measured. The slashed area (whole plants) had digestibility of 70%, metabolisable energy of 10.4 MJ/kg/DM and 21.9% crude protein. The unslashed area (whole plants) had digestibility of 55%, metabolisable energy of 7.0 MJ/kg/DM, and 7.8% crude protein.

When the same areas were assessed in September of the same year, the slashed area had 70% groundcover (clover) and the unslashed area had 10% clover. Using a grab technique to assess what stock were most likely to eat, the slashed area (whole plants) had digestibility of 70%, metabolisable energy of 10.4 MJ/kg/DM and 21.9% crude protein and the unslashed area had digestibility of 53%, metabolisable energy of 7.5 MJ/kg/DM and 8.0% crude protein. Table 5 shows pasture quality of setaria under two management techniques.



Table 5: Pasture quality of setaria under two management techniques

	Unslashed (whole plant)	Unslashed (leaf only)	Unslashed (stem only)	Slashed (whole plant)	Unslashed*	Slashed & white clover*
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Date sampled	24/03/2011	24/03/2011	24/03/2011	24/03/2011	14/10/2011	14/10/2011
Neutral detergent fibre (%)	70	67	81	56	71	44
Acid detergent fibre (%)	43	38	46	31	43	25
Crude protein (%)	7.8	9.7	< 2.0	21.9	8.0	22.7
Digestibility (%)	55	57	41	70	53	74
Metabolisable energy (MJ/kg DM)	7.0	8.1	5.4	10.4	7.5	11.2
Yield (kg DM/ha)	7,891	1,848	6,043	2,016	5,145	2,257

* Grab sample

This case study highlights that wherever your farming system, one of the keys is to divide the property into land classes (capability units) based on soil type and topography. The EverGraze program is a great example of 'plant for place' thinking in southern New South Wales, Victoria, Tasmania, south-east South Australia and southern Western Australia.

In the NSW coastal area from Newcastle to Gympie, management of summer tropical grasses is key to improving pasture quality. Combining this with the 'plant for place' principles gives great opportunities to grow everything from annual ryegrass, tropical grasses, white and red clover, and trailing vine legumes.

Better pasture utilisation increases pasture growth and quality

Intake of green pasture by cattle and subsequent beef productivity is influenced by the height, bulk density, total herbage mass per area and digestibility of the sward. Increasing utilisation can also improve pasture growth and quality, leading to better feed conversion efficiency, increased beef production per unit area and a decrease in unit cost.

The most important factor in improving profitability is identifying the stock numbers (stocking density or head/ha) that the enterprise is likely to sustain when utilisation of high quality (greater than 70% digestibility) green pasture is increased. Another key factor is to allocate the highest quality feed to the stock class that required the best quality feed (ie growing heifers, stock being finished for slaughter, or cows with young calves). High quality feed is wasted on dry pregnant cows in good condition. Focus on allocation of the feed base within the herd to optimise use (see **Module 5: Weaner throughput** for detail).

The number of animals (head/ha) will depend on the nature of the enterprise (breeding versus trading) but should be sufficient to ensure high utilisation of the pasture grown while maintaining the long-term sustainability of the pasture and the grazing system. To achieve an increase in pasture use, adopt a grazing management approach based on predicted seasonal plant growth patterns and the amount of residual feed required if carrying stock through the dry period.



Increase stocking rate and adopt a plant growth based approach to grazing management

- Graze enough animals to fully use available pasture without reducing animal intake below target requirements or grazing of new plant growing points.
- Ideally, time grazing to begin just before first leaf senescence (dying-off) occurs for desirable pasture species (refer to **Module 2: Pasture growth, Tool 2.7, Figure 1**) through autumn until mid-spring, then allow pasture to accumulate to the amount of feed required for your summer dry period in southern Australia.
- Monitor grazing and remove stock before critical limits for minimum pasture mass, height and groundcover are reached.
- Accurately assess the regrowth period before the next grazing occurs by monitoring pasture growth rates and the number of leaves per tiller through autumn until mid-spring.
- In areas where the growth is greater through the summer period, build a feed wedge before pasture growth slows.

A plant-based approach to grazing management ensures that pasture eaten by cattle during the growing season is of the highest possible nutritional quality (metabolic energy is greater than 11.5 MJ/kg DM), and allow the greatest opportunity for pasture regrowth after each grazing event.

Investment of time and capital is needed to intensify the grazing system in most beef enterprises. A grazing plan is essential for the progression of paddock sequences around the farm (see **Procedure 1**) to determine the level of investment that is operationally and economically justifiable. Careful management of less intensively grazed land using the same approach leads to further gains in productivity. The aim is for a sustainable and productive beef production system that maintains weed-free stable pastures and more than 70% groundcover on flat land and low slopes (100% on steep country) to reduce run-off, prevent erosion and improve the quality of water entering waterways.

Pasture mass limits

This module refers to various minimum and maximum limits for pasture mass (kg green DM/ha). It is important to understand the reasons for these variations.

- Pasture mass of 1,500kg green DM/ha is used as a minimum to maintain good conversion of pasture to beef.
- Grazing below this threshold, to a minimum of 1,000kg green DM/ha, will generally not harm the pasture or its potential rate of regrowth, but animal intake will start to be severely reduced. If a pasture is consistently kept below 1,000kg green DM/ha, persistence of the perennial pasture species will be reduced.
- At certain times of the year (eg autumn), good pasture management requires you to graze below 1,500kg DM/ha. In these cases, allocate animals that can tolerate low weight gain or loss of weight (eg dry or pregnant breeders). Under such circumstances, the stock may need to be supplementary fed.

How does this module assist you?

Application of the principles and procedures in this module, and use of the tools, will enable you to lift stock numbers and better manage green pasture utilisation on grazed land. This will increase your beef productivity (kilograms of beef per hectare) and decrease your unit cost of production (cents per kilogram of beef).

To achieve this you will need to:

- identify stock numbers (stocking density or head/ha) that the enterprise will sustain when green pasture utilisation is increased
- identify and monitor the most appropriate indicators to time the start of grazing
- stop grazing before pasture composition and groundcover are adversely affected
- use routine field measurements (pasture growth stage, mass and height) to estimate both the number of days' rest required before the next graze and the amount of pasture mass available during the bulk of the growing season
- if summer dry periods are a feature of your production system, set targets to carry a certain stocking rate through the dry period as a base for pasture measurements from late spring onwards
- manage grazing pressure to ensure that planned and efficient use of available pasture mass and energy content is achieved before regrowth is grazed
- plan the best balance of animal performance and pasture regrowth by grouping and allocating cattle according to their nutritional requirements, and determining the grazing sequence and duration for grazing units across each pasture area
- set pasture and animal targets and precision-manage the grazing of all pasture zones to achieve production targets, maintain pastures and prevent soil and environmental degradation.

Linkages to other modules

This module has a pivotal relationship with **Module 2: Pasture growth**, **Module 5: Weaner throughput** and **Module 7: Meeting market specifications**. It also relies on information from **Module 1: Setting directions** and **Module 2: Pasture growth** to forecast the grazing sequence (see **Procedure 1** in this module) and rest period (see **Procedure 5** in this module) for each grazing unit.

Principles of pasture utilisation

- Maximum cattle performance is achieved by managing the pasture to maintain 1,500–2,500kg green DM/ha.
- Pastures grazed in green leafy vegetative condition have the highest nutritional quality (ME > 11.5 MJ/kg DM).
- Animal intake and pasture quality decline when pasture mass exceeds 3,000kg green DM/ha.
- Maintaining pasture mass above 1,000kg green DM/ha promotes rapid growth and avoids overgrazing or patch grazing.
- If carrying stock over summer, building residual pasture above 3,000kg green DM/kg for most classes of stock will avoid supplementary feeding.

Procedures for maximising the efficiency of pasture utilisation

- Procedure 1 - Determine stocking rate
- Procedure 2 - Determine grazing duration
- Procedure 3 - Start grazing
- Procedure 4 - Stop grazing
- Procedure 5 - Rest periods

Note: these procedures assume a working knowledge of leaf emergence rates and the ability to estimate dry matter on offer. Such knowledge can be gained by undertaking a PROGRAZE course. Contact your state department of primary industries or agriculture for information about PROGRAZE in your state.

Procedure 1

Determine stocking rate, plan paddock sequences and use tactical grazing to maximise conversion of pasture into beef

Guidelines for tactical grazing by planning paddock sequences

This procedure is the essential link between planning stock numbers for the cattle enterprise and achieving the highest efficiency of green pasture utilisation.

Use pasture assessment techniques to plan and set targets for each paddock to be grazed, and to set the minimum and maximum limits for pasture mass and quality (see **Tool 3.1**).

Use assessment techniques to calculate pasture mass (kg green DM/ha)

- Ensure the pasture quality (MJ ME/kg DM) of all grazing units within a paddock grazing sequence is within the limits for energy criteria set for the herd (see **Tool 3.2**).
- Maintain the pasture mass (kg green DM/ha) of all grazing units above the minimum threshold that supports the intake set for the herd (see **Tool 3.2**). To assist you, **Tool 3.3** provides a guide to estimating daily pasture growth rates (kg DM/ha/day) in various regions across southern Australia. MLAs **Stocking Rate Calculator** and **Feed Demand Calculator** can also assist with this task – available on the MLA website: www.mla.com.au.
- Set a residual post-grazing pasture target to manage pasture mass over time.

The highest level of conversion of green pasture into beef can only be achieved when the paddock grazing sequences ensure that:

Balance grazing pressure by matching pasture availability with animal demand

- the most appropriate animals are allocated for grazing so that animal energy demand matches pasture energy supply
- pasture mass is maintained between 1,500 and 2,500kg green DM/ha for as long as possible
- the number of animals allocated for grazing enables the predicted grazing period to be achieved, while maintaining pasture mass above 1,000kg green DM/ha to prevent regrazing of new growth (ideally, animals should be removed when post-grazing pasture target reaches 1,500kg DM/ha).

MLA's **Stocking Rate Calculator** and **Feed Demand Calculator** can help you calculate appropriate stocking rates and length of paddock rotation.

The number of animals an enterprise can carry will be influenced primarily by pasture growth rate and growth patterns, preparedness to use supplementary feed, and the nutrient requirements of each class of animal. Critical information for decision-making about carrying capacity includes:

- annual pasture growth rate curve and variation across the farm
- likely variability in pasture growth curves over time based on historical weather data
- metabolisable energy value of the pasture when plant growth stage changes
- energy requirements for each class of livestock at each physiological state
- minimum energy content of grass that will meet the energy requirement for each class of livestock
- management strategies applied to the breeding herd (timing of calving and weaning, culling strategies, selling ages)
- fodder conservation and supplementation strategy.

This information can be used to establish the number of stock (stocking density or head/ha) the beef enterprise can sustain when maximising the efficiency of green pasture utilisation.

Maintaining pasture at the desired growth phase is necessary to keep the growth rate of cattle on track to meet production targets. Plan the grazing sequence of your paddocks to ensure pasture remains within the limits you set for pasture mass and quality. The growth curve of pastures can be simplified into three phases.

- **Phase I** – below 1,000kg green DM/ha (for a moderately dense pasture): pasture growth is slow because of insufficient leaf area; prolonged grazing depletes root reserves of perennials so plant survival is at risk and the development of bare areas leads to run-off, erosion and weed invasion; cattle growth rate and weight gain is low at best.
- **Phase II** – between about 1,000 and 3,000kg green DM/ha (for a moderately dense pasture): the most rapid pasture growth occurs when sunlight is caught by increased leaf area and converted efficiently into pasture growth; cattle productivity is highest; pastures are sustainable.
- **Phase III** – above about 3,000kg green DM/ha (for a moderately dense pasture): plants are mature, pasture growth is slowing and quality is lower; death and decay of plant material can be greater than the regrowth; root reserves are replenished and seed allowed to set; cattle

growth rate is slower as pasture quality declines.

Note: these pasture availability guidelines are indicative only. Very dense, closely grazed pastures will have a higher (up to + 25%) pasture mass at the same height. Conversely, more open, lightly grazed pastures have a lower pasture mass at the same height. The differences due to density are greater at pasture heights above 6cm. On-farm experience will help you determine what is appropriate for your pastures. Using your own data in the Feed Demand Calculator makes the output more valuable.

Manage the grazing system carefully to maintain optimum pasture levels. Use tactical grazing to meet different animal and pasture objectives.

Using tactical grazing prevents under- and overgrazing of individual paddocks. Check the pasture growth, and add or remove paddocks from the grazing sequence to slow down or speed up the rotation. (Supplementary feed can be provided if suitable pasture is not available and feeding is economically viable; a reduction in livestock growth rates may be more economical.) The use of a nitrogen based fertiliser, such as urea, is sometimes a very economical way to increase dry matter availability. Another option is to use gibberellic acid on suitable perennial grass-based pastures to promote winter pasture growth.

- Under-grazing of all or some areas of pasture will waste pasture, reduce the pasture growth rate as a result of senescence and shading, and lower pasture quality.
- Overgrazing of all or some areas of pasture will reduce animal intake and the growth rate of pasture regrowth.

Tactical grazing is easy to implement when a rotational system is already in place

Any failure to detect a change in pasture quantity and quality or animal demand will increase the risk of missing pasture and animal production targets. Overall productivity will be reduced by:

- an increase in predicted pasture growth leading to higher pasture mass and total pasture energy supply (additional pasture will be wasted if not used)
- a decrease in predicted pasture growth, or unplanned events that decrease pasture availability, which will lead to reduced pasture mass and animal intake, and eventually overgrazing
- repeated overgrazing without adequate rest, which leads to reduced pasture composition and groundcover, and soil and environmental degradation.

The loss of a perennial-based pasture is a large economic loss. For example, it costs more than \$400/ha to re-sow a perennial pasture when taking into account agistment, seed and lime, if required (refer to the Pasture Improvement Calculator on the EverGraze website: www.evergraze.com.au/tools.htm).

Tactical grazing

Use tactical grazing to meet different animal and pasture objectives

Successful beef producers find that strict adherence to either set stocking or rotational grazing is not the best way to achieve herd or enterprise targets. **Tactical grazing** is the preferred grazing technique.

Tactical grazing uses many grazing methods, including set stocking and rotational grazing, throughout a single year or series of years, to meet different animal and pasture objectives at various times. A tactical approach to grazing must be flexible to adapt to different animal and pasture objectives. This enables a balance to be struck between the demands of various classes of stock for growth rate, reproduction and maintenance, and balances pasture supply with animal demand.

Tactical grazing is a relatively easy concept to implement on farms that already have some form of rotational or deferred grazing system. Such farms will already have the infrastructure (ie fencing and water supplies) to use any grazing method and to switch between methods to meet production targets. For example, management changes are simpler to implement if moving from a rotational grazing system to set stocking during calving.

Further information on successful grazing management practices and tactical grazing is provided in 'Chapter 8: Grazing management' of MLA's *Towards Sustainable Grazing: The Professional Producer's Guide*.

What to measure and when

- Regularly check pasture growth and livestock performance and assess against targets set in the grazing plan. **Tool 3.3** provides a guide to estimates of daily pasture growth rates across southern Australia.
- Use a range of pasture assessment techniques (**Tool 3.1**) to plan and set appropriate targets for each paddock to be grazed.
- Aim to balance the level of animal intake (ie head/ha x intake/head should be equivalent to pasture growth/ha) in relation to predicted pasture growth rate to give the best pasture utilisation in targeted and longer grazing events.
- Review and revise fortnightly or weekly, according to the needs of the stock class and pasture management.

The longer the grazing period, the more critical monitoring becomes as other controls, such as grazing duration and manipulation of grazed areas with temporary fencing, decline in effectiveness.

Planning data

Includes:

- area to be grazed (ha)
- target graze period for the paddock/s (days)
- daily pasture growth estimates (see **Tool 3.3** or pasture curves from the **Feed Demand Calculator**)
- initial pasture herbage mass (kg DM/ha)
- initial pasture quality (MJ ME/kg DM, or simply M/D)
- predicted pasture growth for the graze period (kg DM/ha/day)
- predicted animal intake for each class of allocated animals (kg DM/day).

Monitoring data

Includes:

- **pasture assessment**
 - assessed pasture mass in paddock/s (kg green DM/ha) (see **Tool 3.1**)
 - estimated pasture energy content (MJ ME/kg DM, or simply M/D)
- **animal assessment**
 - individual and average initial body condition (fat) score
 - current (field) estimate of range in condition score
 - weight of animals at last weighing
 - current (field) estimate of weight range
 - current liveweight.

Further information

- *Towards Sustainable Grazing: The Professional Producer's Guide* available from MLA at www.mla.com.au or by phoning 1800 023 100.

Procedure 2

Select a paddock and determine grazing duration to achieve best utilisation and animal performance targets

Guidelines to achieving best utilisation and animal performance

Select grazing paddocks to meet production targets

Select a paddock using pasture objectives (growth phase, mass and quality) that meet animal production targets. Complete the following tasks to determine predicted production levels and expected daily pasture intake by cattle:

1. Define the class of cattle (sex, weight, stage in reproductive cycle for females) and daily growth target (to gain or lose weight at a specified rate).
2. Use the MLA Pasture Ruler (see [Tool 3.1](#)) to look up the pasture performance criteria (minimum quantity and quality) required to achieve production targets.
3. Refer to [Tool 3.5](#) to determine the average daily gain of steers for a range of liveweights, and pasture quantity and quality options.
4. Use the partial budget spreadsheet in MLA's Stocking Rate Calculator to calculate appropriate stocking rate and length of paddock rotation – available from www.mla.com.au.

Best production is achieved when paddocks are grazed no longer than three days

In most grass and legume-based pastures, the best utilisation and animal productivity are achieved when grazing is completed between a minimum of one day and a maximum of three days in each paddock of the planned grazing sequence. In some paddocks, tactical grazing may be applied to achieve seasonal objectives, for example, to encourage desirable species (eg clover) to set seed and to discourage undesirable species.

[Tool 3.4](#) recommends information that provides the knowledge and skills to lift the efficiency of pasture utilisation, as do 'Chapter 5: Managing pasture weeds' and 'Chapter 8: Grazing Management' of MLA's *Towards Sustainable Grazing: The Professional Producer's Guide*.

In practice

Where the graze duration is more than three days:

- pasture regrowth will be re-grazed before leaf area has recovered, reducing stores of soluble carbohydrate in roots and slowing the regrowing process (repeated re-grazing can cause plant death and loss of productive pasture species)
- animal performance is lowered through wastage (fouling and trampling) of pasture.

Where the graze duration is less than one day:

- labour and capital (fencing and water) costs are high to accommodate more frequent movements of herds.

If stock numbers are insufficient and grazing pressure is too light:

- useable pasture is not fully utilised and pasture energy is wasted due to an increasing rate of leaf senescence (death) before the next grazing
- patch grazing can occur and lead to under- and overgrazing of pasture areas within the grazing unit.

Tactical grazing ensures best pasture use and animal productivity

A combination of tactical grazing and adjusting the cattle class or herd size is the most practical method of ensuring that the grazing duration will achieve best pasture use and animal performance targets. If pasture mass exceeds the desired maximum and a larger herd is not available, consider maintaining pasture quality through fodder conservation (if cost-effective) or pasture topping by mowing, slashing or spray-topping (late herbicide application to prevent weed seed-set). Generally, spray-topping or leaving the standing dry matter to be eaten later is your best option if this is a feed surplus heading into summer or a period of limited growth.

What to measure and when

Calculations are based on:

- available pasture for cattle to graze (see [Tool 3.1](#))
- an estimate of short-term stocking rate (see [Tool 3.5](#))
- pasture allowance, including wastage, required for growth or maintenance of various classes of cattle (see Step 2 of [Tool 3.5](#) for a guide)
- stocking rate over short grazing periods (one day) (see [Tool 3.5](#))

- stocking rate over longer grazing periods (three days or more) (see **Tool 3.5**).

The more frequently these calculations are made in the lead up to grazing a paddock in the planned sequence, the greater the precision in determining the grazing duration to achieve best utilisation and animal performance targets.

Procedure 3

Aim to graze at a pasture mass between 1,500 and 2,500kg DM/ha

Guidelines for determining the start of grazing

Accurately timing the start of grazing is critical to the efficiency of converting green pasture into product and the overall productivity of a beef herd. Assess the grazing start date by adopting a plant growth-based approach to grazing management. Using this approach, the best time to start grazing a unit (paddock) is just before senescence (dying-off of the first leaf) occurs in the most desirable pasture species. This is just before the pasture energy content peaks and growth starts to decline.

- See **Tool 3.6** for the lower and upper pasture mass limits (kg green DM/ha) or the leaf growth stage to determine when to start grazing exotic (introduced) grass-based pastures. In legume-based pastures, the criterion measured is either the leaf area index (a percentage relating to the plant's ability to capture the energy from sunlight) or the condition (senescence) of the lower leaf. For further information on grazing management of grass and clover-based pastures, visit www.mla.com.au for *Tips & Tools* factsheets on pastures, weeds, and grazing management (see **Tool 3.4** for a list of relevant titles).
- Use the MLA Pasture Ruler (see **Tool 3.1**) to measure pasture height and convert it to herbage mass. As a guide, the preferred pasture mass for grazing is between 1,500 and 2,500kg DM/ha. At this level, pasture has the highest nutritional quality (ME > 11.5MJ/kg DM) and provides the best opportunity for pasture regrowth after each grazing event.
- Aim to graze paddocks to maintain pasture in green leafy vegetative condition with a maximum pasture mass of 3,000kg green DM/ha.

Correct timing for the start of grazing is critical to both efficiency of pasture utilisation and stock performance. When grazing begins too early:

- the pasture regrowth period is reduced, and plant health and survival may be affected through a lowering of soluble carbohydrate reserves (grasses) and reduced leaf area (legumes)
- animal growth is reduced through less energy accumulation and reduced animal intake on short pastures.

These issues can be corrected by removing cattle after a short period of grazing (where animal performance is the target) or stopping grazing before pasture reaches the minimum post-graze pasture mass limit (see **Tool 3.2**). To ensure plants rebuild carbohydrate reserves, an alternative approach is to extend the regrowth period by delaying the start of the next grazing. **Tool 3.3** provides a guide to the estimates of daily pasture growth rates. The MLA **Feed Demand Calculator** provides a more complete set of estimates for different pasture types.

Animal intake and productivity decline when pasture mass exceeds 3,000kg green DM/ha

When pastures exceed 3,000kg green DM/ha:

- it is possible to increase stocking density to use the extra feed, if pasture is growing rapidly
- pasture quality (energy content) starts to decline as older leaves begin to die (senesce), reducing animal performance per kilogram of pasture consumed
- pasture growth (rate of energy accumulation) slows as shading of green tissue, senescence (dying-off of the first leaf) and seed head formation occur
- output of animals to meet target specifications is lower through reduced energy intake and efficiency of utilisation.

What to measure and when

- **Plant growth stage:** the number of live leaves (for grasses), or leaf cover or condition of the lowest leaf (for legumes except lucerne). Lucerne grazing should stop prior to the emergence of the new bud on the crown. The emergence rate is temperature driven (see *EverGraze Action* factsheet, **Growing and using lucerne in southern Australia** on the EverGraze website).
- **Pasture mass:** where seasonal indicators are not yet identified or not appropriate.

The recommended frequency of measurement is fortnightly, and then daily once the predicted time to start grazing is less than seven days away.

Further information

- See **Tool 3.2** and **Tool 3.6** for methods of setting pasture grazing targets
- See **Tool 3.3** for daily pasture growth estimates across southern Australia
- MLA's **Feed Demand Calculator** provides a wider selection of pasture options.

Procedure 4

Stop grazing before pasture regrowth potential is affected

Guidelines to cease grazing

In pasture-based grazing systems, ceasing to graze a paddock is a critical procedure to prevent under- or overgrazing and the associated impact on stock productivity, pasture regrowth and resource management.

Good pasture management ensures adequate rest and regrowth

Correctly timing the cessation of grazing is critical to both efficiency of pasture utilisation and stock performance. **Tool 3.6** helps to implement a plant-based approach to grazing management and defines the lower pasture mass limit for cattle.

Timing when to stop grazing is critical to pasture and animal productivity

- Use the MLA Pasture Ruler (see **Tool 3.1**) to measure pasture height and convert it to herbage mass. As a guide, the preferred pasture mass for stopping grazing on improved perennial pastures is 1,000kg DM/ha, depending on pasture type and season (see **Tool 3.2** and **Tool 3.3**). At this level, pasture recovers rapidly and overgrazing or patch grazing is avoided.
- Rest native pastures at critical times depending on the grasses present, their characteristics and the annual rainfall pattern.
- The management principles and special requirements of native-based and improved perennial pastures are presented in 'Chapter 6: Making the most of native pastures' and 'Chapter 7: Improved perennial pastures' of *Towards Sustainable Grazing: The Professional Producer's Guide*.
- For more information on grazing management of grass and clover-based pastures, go to www.mla.com.au for fact sheets on pastures, weeds and grazing management. See **Tool 3.4** for a list of relevant *Tips & Tools* factsheets available from MLA.

Overgrazing affects rate of pasture regrowth, composition and persistence

Repeatedly stopping grazing too late (overgrazing) can have the following consequences.

- Grass carbohydrate reserves and legume leaf area are decreased and the rate of pasture regrowth is depressed.
- Persistence of desirable perennial grasses or legumes is reduced.
- Plant growing points are damaged, which may adversely affect pasture composition.
- Groundcover eventually falls below 70%, exposing the soil to erosion.

What to measure and when

Use the MLA Pasture Ruler to check post-grazing pasture height and determine residual pasture quantity in kg DM/ha. At the same time, assess the groundcover and pasture mass to determine management options to protect the natural resources. These measurements and observations are taken when stock are removed from the paddock.

Further information

- *Towards Sustainable Grazing: The Professional Producer's Guide* published by MLA.
- MLA Tips & Tools factsheets on a variety of subjects can be accessed through the publications database: www.mla.com.au/publications.

Procedure 5

Determine rest period required to maximise regrowth between grazing events

Guidelines to determine rest period

Rest from grazing enables pastures to regrow and store energy reserves before the next grazing event. The main predictors of regrowth rate are temperature (maximum and minimum) and rainfall. As a rule, when pasture growth is slow (winter and dry periods), the rest period needs to be longer; when pasture growth is fast (spring), the rest period can be shorter, but generally not less than 20 days.

Rest pastures after grazing for regrowth and to rebuild energy reserves

Post-grazing pasture phase (see **Procedure 1**) and groundcover are the major drivers for predicting the rest (regrowth) period required before the pasture is ready to graze again. Plan the grazing sequence of paddocks so that each paddock will be at the desired pasture quantity (kg green DM/ha) and quality (MJ ME/kg DM) at the start of grazing. See **Tool 3.6** for plant-based grazing management methods.

Use pasture growth phenology to predict the date of regrazing each paddock

- When the planned start date is too early (ie insufficient regrowth), slow the rotation by adding extra paddocks to the planned sequence, provide supplementary feed or consider the use of either a nitrogen-based fertiliser or gibberellic acid to promote growth of suitable perennial grass-based pastures.
- When the predicted start date is too late (ie excessive growth), speed up the rotation by removing paddocks from the planned sequence.
- Allocate any removed grazing units to other stock based on their grazing needs, or plan for fodder conservation, reseeding or later use as dry standing feed.

Determine the pasture rest (regrowth) period for your farm

Use a minimum pasture base of 1,000kg DM/ha and the formula:

(Number of days in the month) × (daily pasture growth rate*) = total monthly pasture growth (kg green DM/ha) for ungrazed pasture

* **Tool 3.3** provides estimates of daily pasture growth rates across southern Australia that can be used to determine the rest (regrowth) period for your region.

The number of days' rest can be estimated for any month by calculating each monthly pasture growth and adding these monthly totals to achieve a target of say, 2,500kg green DM/ha, at the start of grazing.

For further information on grazing management of grass and clover-based pastures, go to www.mla.com.au for *Tips & Tools* factsheets on pastures, weeds and grazing management (see **Tool 3.4** for a list of relevant titles).

What to measure and when

When checking each grazed paddock, post-grazing pasture quantity and groundcover are the main indicators for predicting the rest (regrowth) period. Based on your measurements and observations, aim to predict the start of grazing to within +/- two days of the actual start date (see **Tool 3.6** for methods).

The predicted rest period and planned start for the next grazing event can be delayed or advanced according to the:

- monthly rate of pasture growth (see **Tool 3.3**)
- growing season (good, average or poor, see **Tool 3.3**)
- species composition of the pasture (see **Tool 2.7**)
- measurement of post-grazing herbage mass (see **Tool 3.1**)
- resource management requirements to maintain a productive pasture base.

Observations begin after removal of stock. When the planned or predicted start of the next grazing event is about seven days away, check more frequently to ensure grazing begins just before pasture energy content and growth starts to decline.

Commonly used grazing terms

Digestibility – a measure of the proportion of pasture or feed that, once consumed, can be used by the animal. Higher digestibility usually means higher animal production.

Dry matter (DM) – plant material without water. Usually expressed as a percentage of total weight of feed.

Fat score – an objective score of the extent of fat cover in live animals.

Feed intake – amount of feed eaten by an animal, measured in kilograms of dry matter per head per day (kg DM/head/day).

Feed on offer (FOO) – the total amount of above-ground, attached plant material, measured in kilograms of total dry matter per hectare (kg DM/ha).

Grazing unit – a set of paddocks that forms a distinct grazing management unit for one or more herds. It may be a rotation where a planned movement of the herd/s ends at the starting point, or an open-ended planned sequence within a planning timeframe.

kg DM/ha – kilograms of total dry matter of pasture per hectare, a measure of feed on offer (FOO).

kg green DM/ha – kilograms of dry matter of green pasture per hectare.

M/D – metabolisable energy content in feed dry matter, measured in MJ ME/kg DM.

Metabolisable energy – energy from feed that can be used for animal production.

MJ ME/kg DM – megajoules of metabolisable energy per kilogram of dry matter, a measure of the energy content of feed, directly related to feed digestibility.

Pasture availability – feed on offer (FOO), measured in kilograms of total green pasture per hectare (kg green DM/ha).

Pasture allowance (PA) – estimated maximum food intake plus an allowance for trampling and fouling, measured in kg DM/head/day. Also the pasture available divided by the number of stock.

Pasture growth rate (PGR) – daily growth measured in kilograms of dry matter of green pasture per hectare (kg green DM/ha/day).

Pasture quality – a measure of the energy content of feed, directly related to feed digestibility, measured in megajoules of metabolisable energy per kilogram of dry matter (MJ ME/kg DM). It can be calculated as $0.15 \times \text{dry matter digestibility \%}$, or $0.16 \times \text{organic matter digestibility \%}$.

Plant phenology – the growth stage a plant has reached in its maturation process. This term can be non-specific regarding observable measurements such as plants in growth phase I, II and III, or specific and measurable by terms such as number of live leaves per grass tiller, or the nature of lower clover leaves (alive or dead).

Plant senescence – the point at which ageing of a plant results in growth stopping in the plant or part of the plant. At this stage, energy accumulation ceases and net utilisable energy starts to drop in the plant or plant part.

Stocking density – the number of stock per hectare on a grazing area or unit at any one time, measured in head per hectare (head/ha); usually used to describe the number of stock per unit area in a high-density grazing situation.

Stocking rate – the number of stock on a paddock or a whole farm, measured in dry sheep equivalents per hectare (DSE/ha); usually used to describe the long-term stocking rate, at least on an annual basis.

Tactical grazing – the practice of using a range of grazing methods, through a single year or series of years, to meet different animal and pasture objectives at different times. Now recognised as the best grazing method.

Pasture rulers, sticks and meters

Various paddock aids are available to assist with assessing pasture, ranging from the MLA Pasture Ruler and the PROGRAZE® stick to commercially available pasture meters:

- Pasture rulers or sticks that measure height and equate to pasture mass – calibrated to read green dry matter when 100% green and capable of conversion to dry matter, using PROGRAZE information. These aids are simple to use and very cheap.
- Rising plate meters that measure total dry matter – most sophisticated models will store and average readings over a number of paddocks.
- Electronic probes that measure green dry matter – may collect additional manual input, such as phenology descriptors, store and average readings over a number of paddocks and download direct to office computers.

Note that both plate meters and electronic probes require calibration cuts for specific pasture types and compositions don't rely on the calibration data that comes with either.



Figure 1: The MLA Pasture Ruler - order your copy [here](#) for free.

Also have a look at these handy **Tips & Tools** to understand how to get most out of the Pasture Ruler.

For more information on use of pasture meters and measurement of pasture mass see *Tool 2.7*.

Setting pasture targets

The following list outlines the critical pasture limits for production and environmental protection:

- To maintain maximum pasture growth, have a:
 - minimum pasture mass of 1,000kg green DM/ha
 - maximum pasture mass limit of 2,500kg green DM/ha, except when determining how much feed needs to be carried into a summer dry period when livestock is being carried over this period (ie breeding operations and often trading operations don't carry stock through this period).
- To optimise pasture performance throughout the year and minimise pasture decline, have a:
 - maximum total pasture mass of 1,500kg DM/ha prior to the autumn break to promote clover germination and growth and to maximise tillering of perennial grasses and to prevent aerial tillering of perennial ryegrass.
 - minimum pasture mass during the growing season of around 1,000kg DM/ha for high pasture quality and yield.
- To prevent water and wind erosion and protect the resource base:
 - minimum residual pasture mass of around 800kg DM/ha depending on pasture density
 - depending on rainfall (pattern and intensity) and soil type, maintain at least 70% groundcover (including leaf, dead and litter material plus dung) on grazed lower to middle slopes (landclass 3) and a minimum of 100% groundcover on non-arable upper to steep slopes (land classes 4 and 5).

For more detailed information, refer to the Tips & Tools published by MLA. Visit www.mla.com.au/publications to search for these for handy factsheets on pastures, weeds and grazing management.

Pasture growth estimates

The mid-monthly estimates of pasture growth rates (kg DM/ha/day) below are for average seasonal conditions for a range of localities and regions across southern Australia. They are from state PROGRAZE manuals, available from your state department of agriculture and based on a combination of research results, growth predictions and practical experience.

Although there is a large variation in rainfall pattern and feed supply within any year, when put together, these monthly values reflect pasture growth in a 'typical' year for the locality or region without a reference to what growth occurred in the previous month. Also included are two tables demonstrating that there is a significant difference between varieties within species. The examples given are Meridian perennial ryegrass compared to Victorian perennial, and Holdfast GT phalaris compared to Australian phalaris.

These estimates provide a basis to assist with the calculations for short- to medium-term decision making in the beef business. They are **intended as a guide** and will assist with the calculations in **Tool 3.5**. It is recommended that the **MLA Pasture Ruler** (or equivalent) is used to generate similar estimates of pasture growth rates for selected paddocks or the whole farm.

Assumptions

The following assumptions are made for the range of pastures/pasture mixes unless otherwise stated in the estimates:

- Pastures are of moderate to high density.
- Soil has good moisture holding capacity, such as a clay loam.
- Pasture is maintained in an active growth phase at all times during the growing season.
- Pastures are well managed and fertilised to avoid nutrient deficiencies. This is key to having good pasture production and persistence. A well fertilised pasture in a low rainfall situation will grow significantly more pasture than a low fertility pasture of the same type.

For example: 1kg phosphorus (P)/ha applied in a typical season grew 6.70t of pasture at 12DSE and in the drought of 1982, grew 4.14t of pasture, a reduction of 40%. The pasture receiving 15kg P/ha grew on average 14.00t of pasture at 12DSE and in the drought year of 1982, grew 9.38t of pasture a reduction of 30%. This demonstrates that a fertile pasture grows more pasture regardless of rainfall, but most importantly is more resilient in dry years and can be considered a risk minimisation tool.

- Estimates are for the middle of each month.

The following important variables need to be considered and adjusted against the expected local, district or regional patterns and practical experience:

- climate (rainfall and temperature)
- soil type and variability
- pasture species
- fertiliser (nutrient) requirements (ie adequate or limiting); adjustments for expected pasture growth may be required (see **Module 2: Pasture growth**)
- grazing management.

Estimates of pasture growth rate

Unless otherwise stated, the estimates are for expected availability of feed of adequate quality and are based on:

- pastures or pasture mixes with a good balance of legumes, grown on suitable soils
- pastures that are well managed to be maintained in the active growth phase so that quality is at a high level
- soil fertility is non limiting (**Module 2: Pasture growth** outlines adequate nutrient levels)
- using some form of rotational grazing to enable pastures to rest and grow between grazing events
- growth rate of the pasture, stocking rate, degree of wastage through trampling and fouling and the previous management of the pasture.

In any period, the pasture type is capable of growing pasture mass of adequate quantity and quality to suit the requirements of seasonal conditions.

In the following tables, estimates are presented for localities or regions in NSW, Victoria, Tasmania, South Australia and Western Australia.

*More detailed pasture growth rates are available from the look-up tables for cattle from the **MLA Feed Demand Calculator***

Feed year growth rate patterns:

- New South Wales
- Victoria
- Tasmania
- South Australia

With species pasture growth variations

Heritage data new cultivars cf to Victorian perennial ryegrass

	Dry matter, winter 2010	Dry matter, early spring 2010	Dry matter, late spring 2010
2 – Vic Rye	2,239.0	2,668.9	1,916.2
8 – Meridan AR1	3,631.6	2,337.1	2,707.0
%CV	10.3	11.7	6.9
LSD (5%)	485.3	405.7	346.7
Trial mean	3,013.3	2,367.3	2,583.2

Basal frequency in spring 2006 and autumn 2007, and herbage mass after plots were spelled during winter 2006 and after opening rains in 2007

	Basal frequency (%)		Herbage (kg DM/ha)	
Cultivar	12 Sep 2006	23 Mar 2007	Winter 2006*	Autumn 2007*
Holdfast GT	64.1	58.1	2,190	938
Holdfast	57.4	47.8	2,179	834
Landmaster	60.0	46.3	1,899	685
Australian II	60.4	46.2	1,508	540
Isd ($P=0.05$)	5.7	5.3	281	177

* Data from CSIRO/AWI/Seedmark (2008), Phalaris Breeding Program Holdfast GT Technical Report

NSW feed year growth rate patterns

New South Wales – Feed year growth rate patterns

Source: NSW PROGRAZE Manual, Appendix 4, NSW Agriculture (for further information and assumptions on which these tables are based, see NSW PROGRAZE Manual or visit the Department's website, www.agric.nsw.gov.au).

Northern Tablelands

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Fescue/white and sub-clover	58	57	51	28	12	9	9	11	23	38	51	59
Phalaris white/sub-clover	26	30	36	34	13	9	9	11	22	37	49	51
Red grass dominant pasture*	33	33	29	9	2	1	1	1	7	27	33	34
Microlaena	39	36	29	18	8	3	3	7	19	33	40	44
Perennial ryegrass/white sub-clover	20	28	38	34	13	9	9	11	23	43	47	35

*Quality of red grass (with low leaf to stem ratio and rapid maturity) may not be adequate to meet livestock production targets.

The predicted growth rate could vary markedly between good and poor growing seasons.

	Good growing season	Poor growing season
Spring	30% above	40% below
Summer	30% above	40% below
Autumn	75%+ above	60%+ below
Winter	30% above	40% below

Central Tablelands

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Temperate perennial grass* + sub-clover	15	12	16	20	20	10	6	10	27	61	69	45
Microlaena/Austrodanthonia grass + sub-clover	19	15	19	22	19	7	5	8	18	52	62	51
Microlaena/Austrodanthonia grass	15	14	19	21	15	3	3	3	9	34	51	32
Summer grass*/sub-clover	24	10	15	16	12	7	4	8	28	38	25	23
Summer grass*	24	10	14	14	2	2	2	2	2	4	16	23
Annual grass/sub-clover	0	0	2	6	12	11	9	17	45	74	10	0

*Phalaris, cocksfoot, fescue or perennial ryegrass based with at least 20% clover.

#Mainly frost sensitive grasses such as red grass.

The predicted growth rate could vary markedly between good and poor growing seasons.

	Good growing season	Poor growing season
Spring	50% above	40% below
Summer	100%+ above	70% below
Autumn	65% above	60%+ below
Winter	40% above	60%+ below

Southern Tablelands and Monaro

Estimatedaily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Perennial and annual grass* and clover +fertiliser 1-in-2 or 3 years	7	5	7	15	13	8	7	12	32	45	20	10
Microlaena, Austroanthonia, # clover + fertiliser 1-in-2 or 3 years	16	14	10	8	7	5	5	6	15	30	24	18
Red grass, kangaroo grass, no fertiliser applied	10	6	3	3	2	1	1	1	7	15	21	13
Introduced perennial grass and clover + annual fertiliser	10	80	20	26	20	12	10	15	45	75	55	20

* Established perennial pasture (30% introduced grass, ie phalaris, 20% annual clover and 20% annual grass).

Microlaena and austroanthonia grass 50–60% pasture, 25–30% clover and 10-20% annual grass.

The predicted growth rate could vary markedly between good and poor growing seasons.

	Good growing season	Poor growing season
Spring	50% above	40% below
Summer	50% above	40% below
Autumn	50% above	30% below
Winter	80% above	60% below

North West Slopes and Upper Hunter

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Phalaris/sub-clover	8	12	16	17	14	13	14	20	34	43	32	10
Summer grass dominant*	35	29	17	6	2	2	2	2	3	8	17	27
Austroanthonia / sub-clover	19	16	11	7	5	5	7	12	24	28	22	18
Lucerne	30	29	26	21	15	10	10	14	25	40	34	31
Sub-clover dominant	0	1	1	3	4	5	6	11	28	38	28	3
Medic dominant	0	2	2	3	5	4	4	7	27	38	15	0
Tropical grass only#	48	43	32	17	3	2	2	3	4	18	34	48

*Mainly frost sensitive grasses such as red grass.

#Mix of bambatsi panic and purple pigeon grass with less than 5% sub clover or medic.

The predicted growth rate could very markedly between good and poor growing seasons.

	Good growing season	Poor growing season
Spring	50% above	50% below
Summer	100% above	50% below
Autumn	100% above	60% below
Winter	30% above	50% below

Central West Slopes

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Temperate perennial grass* + sub-clover	3	2	1	7	14	16	10	11	18	41	41	17
Sub-clover	0	0	0	2	7	4	8	8	15	27	10	0
Summer grass	20	24	9	2	2	2	2	2	2	3	11	25
Lucerne / sub-clover	25	25	28	31	26	17	10	10	22	45	43	26
Lucerne	25	25	28	31	24	13	9	9	18	45	43	26
Annual grass / sub-clover	5	3	1	6	16	18	12	12	23	42	10	5
Tropical grass only#	35	34	24	8	3	2	2	2	2	8	24	35

*Phalaris, cocksfoot, fescue or perennial ryegrass based with at least 20% clover.

#Mix of bambatsi panic and purple pigeon grass with less than 5% sub clover or medic.

The predicted growth rate could very markedly between good and poor growing seasons.

	Good growing season	Poor growing season
Spring	70% above	80% below
Summer	100%+ above	80% below
Autumn	100%+ above	60%+ below
Winter	70% above	60% below

South West Slopes

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Phalaris / sub-clover	5	7	16	25	24	17	16	26	47	64	43	12
Cocksfoot/ sub-clover	9	8	16	25	24	17	16	26	47	64	43	15
Lucerne / sub-clover	12	10	17	28	26	14	11	25	49	69	54	21
Annual grass / sub-clover	3	4	10	23	24	14	10	25	45	64	35	7
Native grass*, no fertiliser	8	6	5	11	10	4	3	3	7	15	23	13
Native grass + fertiliser	11	9	11	15	14	6	5	7	17	35	26	14

*Quality of red grass (with low leaf to stem ratio and rapid maturity) may not be adequate to meet livestock production targets.

The predicted growth rate could vary markedly between good and poor growing seasons.

	Good growing season	Poor growing season
Spring	30% above	60% below
Summer	200% above	70% below
Autumn	30% above	60% below
Winter	80% above	20% below

North Coast

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Naturalised Pasture*	25	30	25	10	3	0	0	0	3	5	9	15
Naturalised /clover and fertiliser	30	35	30	15	8	6	5	6	10	15	20	25
Kikuyu dominant	34	54	50	30	16	10	3	2	8	18	25	30
Kikuyu + nitrogen	80	128	146	100	45	15	3	4	14	30	40	60
Setaria/rhodes grass + clover	30	55	45	25	6	2	2	4	8	20	28	30
Forage ryegrass + nitrogen	0	0	0	30	40	30	30	30	28	10	8	5

*Dominated by carpet grass and with no introduced legumes.

The predicted growth rate could vary markedly between good and poor growing seasons.

	Good growing season	Poor growing season
Spring	70% above	60% below
Summer	60% above	60% below

Autumn	120% above	90% below
Winter	150% above	70% below

Mid North Coast and Lower Hunter

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Naturalised Pasture*	17	25	23	9	2	0	0	0	2	4	8	9
Naturalised /clover and fertiliser	20	29	27	12	4	2.5	2.5	2.5	6	9.5	12	12
Kikuyu dominant	27	45	50	33	16	6	2	3	11	10	10	12
Paspalum	23	33	32	16	5	5	5	5	10	15	15	15
Setaria	29	38	44	23	8	5	5	5	10	11	11	13
Forage ryegrass + nitrogen	0	0	0	5	20	36	35	40	40	25	0	0

*Dominated by carpet grass and with no introduced legumes.

The predicted growth rate could vary markedly between good and poor growing seasons.

	Good growing season	Poor growing season
Spring	145% above	73% below
Summer	114% above	46% below
Autumn	70% above	80% below
Winter	89% above	67% below

Victoria feed year growth rate patterns

Victoria – Feed year growth rate patterns

Source: Victoria PROGRAZE Manual, adapted from Figure 8, *Pasture growth rates in kg/DM/ha/day for different areas of Victoria*, pp 20–22 as well as adjustments from the Feed Demand Calculator after ground truthing the PROGRAZE data (for further information and the assumptions on which these tables are based, see Victorian PROGRAZE manual or visit www.dpi.vic.gov.au)

Western Victoria – Hamilton

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/h)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Good pasture	5	5	5	7	14	19	22	37	69	100	78	14
Poor pasture	0	0	0	7	14	20	20	20	58	81	50	10

Good pasture = dense, introduced grass/sub-clover based pasture

Poor pasture = less dense, annual grass/sub-clover/annual weed based pasture

Western Victoria – Balmoral

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Good pasture	0	0	0	16	12	16	18	35	55	70	60	5
Poor pasture	0	0	0	8	15	20	15	30	40	50	45	2

Central West Victoria – Ballarat

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Good pasture	0	0	15	20	30	20	20	35	50	90	80	70
Poor pasture – bent grass based	10	10	5	5	5	5	5	20	40	60	40	30

North East Victoria – Rutherglen

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Average pasture	0	0	0	0	30	20	20	35	70	80	20	0

Average pasture = moderately dense annual grass/sub-clover/annual weed based pasture

Gippsland Victoria – Ellinbank

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Average pasture	18	10	19	20	18	16	10	20	55	80	70	59

Average pasture = moderately dense pasture

Gippsland Victoria – Maffra

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Average dryland pasture	5	5	0	20	17	10	2	15	30	38	30	2

Average dryland pasture = moderately dense pasture

Tasmania feed year growth rate patterns

Tasmania – Feed year growth rate patterns

Source: Darryl Johnson, Department of Primary Industries, Water and Environment, Tasmania.

Pasture composition

The measured and potential daily growth rates are for typical pasture mix of perennial ryegrass and cocksfoot with white and red clover in the high rainfall areas and grading to sub-clover in the lower rainfall areas. The measurements were taken over four years (1992–1995) at trial sites.

North West – 900mm rainfall (Elliot Research Station)

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Trial site measurements	25	9	5	14	9	8	8	7	19	54	51	35

North Central – 700mm rainfall (Cressy Research Station)

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Trial site measurements	14	5	2	8	6	7	6	6	31	65	46	22

Southern Midlands – 500mm rainfall (Jericho)

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Trial site measurements	0	0	0	3	3	3	3	5	15	45	35	15

South Australia feed year growth rate patterns

South Australia – Feed year growth rate patterns

Source: South Australia PROGRAZE manual, Appendix D (for further information and the assumptions on which these tables are based), see the South Australian PROGRAZE manual and the Feed Demand Calculator or visit www.pir.sa.gov.au).

Mount Gambier

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Australian Phalaris, annual grass, sub-clover – high fertility	3	3	8	17	28	27	27	39	56	57	46	11
Australian Phalaris, annual grass, sub-clover – low fertility	2	2	6	11	18	17	18	35	50	60	40	5

Lucindale

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Australian Phalaris, annual grass, Capeweed, sub-clover	0	0	3	9	21	24	27	34	41	50	21	4

Keith

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Australian Phalaris, annual grass, capeweed sub-clover – high fertility	0	0	3	10	21	25	26	32	35	27	17	4
Australian Phalaris, annual grass, capeweed sub-clover – low fertility	0	0	0	5	10	15	20	35	69	4648	12	02

Adelaide Hills (dryland)

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Perennial grass, sub-clover	0	0	0	9	28	25	23	31	42	54	33	10

Fleurieu Peninsula

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Perennial grass, sub-clover – good	0	0	0	30	25	25	25	35	55	60	35	10
Perennial grass, sub-clover – average	0	0	0	10	20	20	20	30	45	50	30	5
Perennial grass, sub-clover – poor	0	0	0	0	15	15	15	25	35	40	25	0

Kangaroo Island (Parndana)

Estimated daily pasture growth rate (mid-month) of specific pasture types (kg DM/ha/day)

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Annual grass, sub-clover – fertiliser	0	0	0	5	13	22	28	41	52	42	16	0
Annual grass, sub-clover – no fertiliser	0	0	0	1	4	11	14	19	31	63	35	0

Western Australia feed year growth rate patterns

Source: Western Australia PROGRAZE manual, Appendix E (for further information and the assumptions on which these tables are based), see the Western Australian PROGRAZE manual or visit www.agric.wa.gov.au).

West Midlands

Estimated daily pasture growth rate (mid-month) in kg DM/ha/day

Pasture Type – annual grass, sub-clover and annual weeds	J	F	M	A	M	J	J	A	S	O	N	D
Dandaragan	0	0	0	2	15	26	28	36	57	51	10	10
Gingin	0	0	0	3	19	28	29	36	55	51	11	0
Irwin	0	0	0	1	16	25	28	39	44	37	8	0
Moora	0	0	0	1	7	13	17	28	44	32	7	0
Three Springs	0	0	0	1	6	12	17	29	36	17	8	0

Central

Estimated daily pasture growth rate (mid-month) in kg DM/ha/day

Pasture Type – annual grass, sub-clover and annual weeds	J	F	M	A	M	J	J	A	S	O	N	D
Northam	0	0	0	2	8	13	15	29	48	24	9	0

Southern

Estimated daily pasture growth rate (mid-month) in kg DM/ha/day

Pasture Type – annual grass, sub-clover and annual weeds	J	F	M	A	M	J	J	A	S	O	N	D
Busselton	0	0	0	6	23	26	28	37	53	58	42	0
Boyup Brook	0	0	0	4	13	17	20	31	37	34	26	0
Katanning	0	0	0	1	11	15	16	28	51	45	15	0
Lake Grace	0	0	0	2	6	11	13	26	45	34	11	0
Narrogin	0	0	0	1	7	12	14	26	50	36	12	0
Plantagenet	0	0	0	8	21	23	20	25	45	58	42	0

South East

Estimated daily pasture growth rate (mid-month) in kg DM/ha/day

Pasture Type – annual grass, sub-clover and annual weeds	J	F	M	A	M	J	J	A	S	O	N	D
Ravensthorpe	0	0	0	5	10	13	17	29	52	40	23	0
Esperance	0	0	0	7	12	16	18	29	47	35	23	0

Pasture utilisation

Selected information sources and training workshops to lift the efficiency of pasture utilisation.

1. Towards Sustainable Grazing – The professional producer’s guide

Published by MLA, this guide describes in practical detail how to manage a more productive and sustainable grazing business. The chapters on grazing management and native and improved perennial pasture production provide further information related to this module and the publication also presents growth pathways to successful market outcomes. The guide can be accessed online at www.mla.com.au

2. State PROGRAZE manuals

3. MLA calculators

MLA has produced a range of calculators that can assist in determining pasture utilisation. These are available under the *Publications, tools & events* section of the website:

- Cost of Production Calculator
- Feed Demand Calculator
- Stocking Rate Calculator

4. MLA Tips & Tools

The Tips & Tools range of free factsheets produced by MLA provide producers with straightforward practical information to apply on-farm. The following list includes the Tips & Tools that are relevant to this module for further information on improving pasture and grazing management. Visit www.mla.com.au/publications to download your free copies.

- Grazing management titles
 - *Grazing management 1: Tactical grazing to maximise whole farm pasture and animal productivity*
 - *Grazing management 2: Getting the best out of set stocking*
 - *Grazing management 3: Getting started in simple time-based rotational grazing*
 - *Grazing management 4: Intensive rotational grazing systems*
 - *Grazing management for mixed perennial-based pastures*
 - *Grazing management for productive native pastures*
- Pastures and weeds titles
 - *Looking after your pastures in drought*
 - *Making perennial ryegrass-based pastures productive and persistent*
 - *Making phalaris-based pastures more productive and persistent*
 - *Making the most of phosphorus fertiliser applied to soil*
 - *Managing annual grasses to boost pasture production*
 - *Maximising production from kikuyu-based pastures*
 - *Strategies to boost the productivity of native pastures*
 - *Managing Paterson's curse to boost pasture production*
 - *Managing saffron thistle boosts pasture production*
 - *Managing scotch, nodding and spear thistles boosts pasture*
 - *Managing St John's wort-infested pastures to boost production*
- Natural resource management titles
 - *Encouraging biodiversity benefits*
 - *Encouraging birds on to your farm*
 - *Increasing earthworms in pastures*
 - *Managing deep drainage*
 - *Managing ground cover to reduce run-off and water loss*
 - *Managing soils to keep them healthy and productive*
 - *Native vegetation 1: Assessing the condition of remnant vegetation*
 - *Native vegetation 2: Improving the value of remnant vegetation*
 - *Native vegetation 3: Revegetating the farm*

5. EverGraze Actions

The EverGraze Actions range of free factsheets provide producers with straightforward practical information to apply on-farm. The following list includes the factsheets that are relevant to this module for further information on improving pasture and grazing management. Visit Evergraze to download your free copies.

- *Growing and using Chicory on the East Coast*

- *Growing and using Chicory in Western Australia*
- *Growing and using Lucerne*
- *Growing and using Kikuyu in Western Australia*
- *Growing kikuyu for summer feed and soil cover*
- *Grazing Phalaris for production and persistence*
- *Growing and using summer active Tall Fescue*
- *Growing and using winter active Tall Fescue in southern Australia*
- *Native pastures of the Eastern Namoi*
- *Management of native pastures in Victoria*

6. **Agriculture Notes**

Produced by the State of Victoria, Department of Primary Industries, the *Agriculture Note: Using nitrogen to grow extra feed for cows* provides useful information for producers that can be applied to beef cattle. The Note can be downloaded from <http://www.dairyaustralia.com.au>

7. **PRIMEFACTS**

Produced by the New South Wales Department of Primary Industries, Primefact 281: *Cocksfoot*, provides useful information for producers on Cocksfoot. that can be applied to beef cattle. The document can be accessed online: <http://www.dpi.nsw.gov.au/primefacts>

Grazing management options

Successful pasture utilisation requires precise control of the grazing pressure and herd structure of the beef business. This tool provides the basis to determine how pasture can be successfully turned into saleable beef to profit the farm business.

By using the formulas provided, following the examples and then inserting your own working examples, you will be able to:

- Estimate stocking rate over short periods;
- Make tactical grazing decisions about the short-term stocking rate/ha;
- Plan seasonal pasture and animal performance to achieve targets; and
- Calculate the gross financial benefit to the grazing business.

This information enables the grazing operation to be more precisely managed. The conversion of pasture energy and nutrients into saleable beef is achieved while leaving pasture residue in the best condition for rapid regrowth. It will also better match the seasonal feed supply with beef enterprise opportunities and business objectives.

PROGRAZE information

To make the best grazing management decisions, some basic PROGRAZE or equivalent information is required:

- amount of pasture (kg DM/ha) in a paddock, grazing block or whole farm
- pasture quality (MJ ME/kg DM)
- pasture growth rate (kg DM/ha/day)
- stock to be grazed and the target weight gain required (kg/head).

The following estimates are used in the practical working examples:

Pasture at the start of grazing	2,500kg DM/ha
Pasture at the end of grazing	1,500kg DM/ha
Pasture quality	10MJ ME/kg DM
Pasture growth rate	30kg DM/ha/day
Pasture allowance (kg DM/day)	Estimate of maximum intake + 20% for wastage
Steers or unjoined heifers	300kg grown to 400kg at sale
Mature cows (British breed)	500kg, fat score 2.5–3.0

kg DM/ha = kilograms of dry matter per hectare

MJ ME/kg DM = megajoules of metabolisable energy per kilogram of dry matter

The tables below provide further estimations for use in calculating the important components of managing the grazing system.

The **Feed Demand Calculator** available on the MLA website will help you calculate the appropriate stocking rate and length of paddock rotation.

Step 1: How much pasture is available for cattle to graze?

This involves estimating the 'grazing opportunity' in kilograms dry matter per hectare (kg DM/ha) by assessing pasture height and related density using the MLA Pasture Ruler or equivalent measurement tool. Refer to MLA **Tip & Tool: *Improving pasture use with the MLA Pasture Ruler*** for information on how to use the MLA Pasture Ruler to convert the height of a moderately dense pasture into an accurate estimate of kilograms of green dry matter per hectare.

In practice, the conversion of pasture into beef product is greatest when the paddock grazing sequences ensure:

- The most appropriate class of cattle is used to meet production targets.
- Pasture energy supply matches animal energy demand.
- Pasture mass is maintained in a green, leafy and vegetative condition across the paddock at 1,500–2,500kg green DM/ha (around 6–12cm high) and with the recommended number of live leaves and tillers for the grazing period.
- The number of animals allocated for grazing enables accurate prediction of the grazing period, while maintaining pasture mass above 1,000kg green DM/ha (3cm high) to ensure rapid regrowth and to prevent grazing of new growth.

An estimate is needed of how much pasture is wasted through animals trampling and fouling during grazing. Around 20% wastage is a reasonable estimate and is used in the worked examples.

Step 2: What pasture allowance is required for various classes of grazing cattle?

Pasture allowance is described as food needed for growth and maintenance of the stock (intake) plus an allowance (20%) for trampling and fouling. Pasture allowance is based on a pasture of at least 10MJ ME/kg DM and is not applicable to pastures of lesser quality.

Table 1: Guide to pasture allowance for steers and unjoined heifers, at a range of weights, grazing pasture of at least 10MJ ME/kg				
Liveweight (kg)	200	300	400	500
Pasture allowance (kg DM/head/day)	8	10	12	12

As an example, a 300kg steer or heifer requires a pasture allowance of 10kg DM/day to achieve potential animal growth from pasture quality of 10MJ ME/kg DM.

Table 2: Guide to pasture allowance for 500kg cows in different physiological conditions			
Mature British breed cows (500kg, fat score 2.5–3.0)	Dry/late pregnant	Early lactation * (2 months)	Lactating * (5 months)
Pasture allowance (kg DM/head/day)	10	15	20

* Includes an allowance for calf

As an example, a 500kg cow, fat score 2.5–3.0 in early lactation requires a pasture allowance of 15kg DM/day.

Table 3: Average daily gain for a range of feed quality and steer liveweights

Open PDF

Feed available (kg DM/ha)	1,000			1,500			2,000			2,500			3,000		
M/D (MJ ME/kg DM)	9	10.5	12	7.5	9	10.5	12	7.5	9	10.5	12	7.5	9	10.5	12
Digestibility %	60	70	80	50	60	70	80	50	60	70	80	50	60	70	80
Steer liveweight															
200kg – ADG (kg/day)	0.06	0.54	1.07	-0.5	0.19	0.83	1.16	-0.2	0.32	0.99	1.23	-0.02	0.42	1.09	1.31
300kg – ADG (kg/day)	-0.29	0.36	0.95	-0.7	0.08	0.67	1.08	-0.4	0.21	0.86	1.14	-0.24	0.3	0.98	1.22
400kg – ADG (kg/day)	-0.48	0.25	0.82	-0.9	-0	0.55	0.95	-0.6	0.11	0.74	1.01	-0.44	0.2	0.86	1.09
500kg – ADG (kg/day)	-0.77	0.11	0.65	-1.12	-0.33	0.4	0.78	-0.9	-0.03	0.58	0.84	-0.72	0.07	0.7	0.92

ADG = average daily gain

Source: calculated using GrazFeed v 4.1.5

The following assumptions are used

- 1. The weights and ages are 200kg at 9 months; 300kg at 18 months; 400kg at 24 months; and 500kg at 30 months.
- 2. Breed type is British (Angus, Hereford, Shorthorn, etc.) and their crosses.
- 3. Mature weight of cows of same breed type 500kg.
- 4. There is no cold stress.
- 5. Pastures are manipulated for the calculation by setting dead material at 5% for 12.0, 10.5 and 9.0MJ ME/Kg DM (M/D) and green at 1% for 7.5 and 6.0MJ ME/kg DM (M/D). The availability refers to amount present in the major component, eg MJ ME/kg DM 10.5 (or M/D 10.5). The green component was varied from 1.0, 1.5, 2.0, 2.5, 3.0t DM/ha.

Step 3: Calculate the stocking rate over short grazing periods

Follow the example to calculate the stocking rate for a 2,500kg green DM/ha pasture with a nutritional quality of ME >10.5MJ/kg DM for 300kg steers growing at 1kg/day.

Example for 1 day grazing

Information for calculation:

- Pasture at start of grazing 2,500kg DM/ha
- Pasture at end of grazing 1,500kg DM/ha
- Pasture allowance (PA) 10kg DM/day/steer (see Table 2)
- Number of grazing days 1 day

To estimate use the formula:

$$\text{Animals/ha} = (\text{pasture mass at start of graze} - \text{pasture mass at end of graze}) / \text{pasture allowance}$$

$$\text{Animals/ha} = (2,500\text{kg DM/ha} - 1,500\text{kg DM/ha}) \div 10\text{kg DM/day/steer PA} = 100$$

Answer: 100 steers/ha for 1 day grazing

Example for 5 days grazing

Grazing a pasture of the same quantity and quality for 5 days:

$$100 \text{ steers/ha} \div 5 \text{ days grazing} = 20$$

Answer: = 20 steers/ha stocking rate

Note: When calculating the short-term stock numbers while using short-term, high density grazing (1–5 days), there is no need to make an allowance for any pasture growth.

When grazing pasture for longer periods, an allowance needs to be made for the expected pasture growth during the grazing period. As a guide to mid-monthly pasture growth estimates, refer to **Tool 3.3** for estimates of daily pasture growth rates (kg DM/ha/day) for typical conditions in a range of localities and regions across southern Australia.

Calculate the stocking rate over short grazing periods

Pasture at start of grazing	<input type="text"/>	kg DM/ha
Pasture at end of grazing	<input type="text"/>	kg DM/ha
Pasture Growth Rate (PGR) See Tool 3.3 for more information.	<input type="text"/>	DM/ha/day
Pasture allowance (PA)	<input type="text"/>	DM/day/steer
Number of grazing days	<input type="text"/>	day
Stocking rate	<input type="text"/>	steers/ha

Note: When calculating the short-term stock numbers while using short-term, high density grazing (from 1 to 5 days), there is no need to make an allowance for any pasture growth.

When grazing pasture for longer periods, an allowance needs to be made for the expected pasture growth during the grazing period. As a guide to mid-monthly pasture growth estimates, refer to **Tool 3.3** for estimates of daily pasture growth rates (kg DM/ha/day) for typical conditions in a range of localities and regions across southern Australia.

Step 4: Determine the stocking rate/hectare over longer grazing periods

The big challenge in grazing management is being able to predict the stocking rate that takes advantage of any period of rapid feed growth. The question to be answered is “How many cattle are required to achieve the combination of productivity and profitability?”. MLA’s Stocking Rate Calculator along with the Feed Demand Calculator can help you calculate the appropriate stocking rate for the nominated grazing period. Both calculators are available online from <http://www.mla.com.au>

In this example, the stocking rate/ha (for number of days grazing) is estimated by the calculation:

$$(\text{pasture mass at start of graze} - \text{pasture mass at end of graze}) + (\text{pasture growth rate} \times \text{number of days intending to graze paddock}) \div (\text{pasture allowance} \times \text{number of days intending to graze paddock})$$

Information for calculation:

- Pasture at start of grazing 2,500kg DM/ha
- Pasture at end of grazing 1,500kg DM/ha

- Pasture growth rate (PGR) 30kg DM/ha/d (see Tool 4.3 for state regions)
- Pasture allowance (PA) 10kg DM/day/steer
- Number of grazing days 7 days

To estimate use the formula:

Stocking rate = [(pasture at start of graze – pasture at end of graze) + (PGR × number of graze days)] ÷ (PA × number of graze days)

Example for 300kg steers or unjoined heifers for 7 days grazing

Where the estimated pasture mass at the start of grazing is 2,500kg DM/ha and expected end of grazing pasture mass is 1,500kg DM/ha, pasture growth rate is expected to be 30kg DM/ha/day and the pasture allowance is 10kg DM/day.

$$(2,500 - 1,500) + (30 \times 7) \div (10 \times 7) = 17$$

Answer: The stocking rate for the 300kg steers is 17 steers/ha for 7 days grazing

This calculation is suited to a wider application and can be applied to many different pasture and grazing scenarios and stock classes.

Example using the same pasture information for cows in early lactation for 30 days grazing

Information for calculation:

- Pasture at start of grazing 2,500kg DM/ha
- Pasture at end of grazing 1,500kg DM/ha
- Pasture growth rate (PGR) 30kg DM/ha/day (see Tool 4.3 for regions)
- Pasture allowance (PA) 15kg DM/day/steer
- Number of grazing days 30 days

To estimate use the formula:

Stocking rate = (pasture at start of graze – pasture at end of graze) + (PGR × number of graze days) ÷ (PA × number of graze days)

$$\text{Stocking rate} = (2,500 - 1,500) + (30 \times 30) \div (15 \times 30) = 4.2$$

Answer: The stocking rate for lactating cows = 4.2 cows/ha for 30 days

In this example, a 30ha paddock with a pasture growth rate of 30kg/ha/day is capable of running (30ha × 4/ha) = 120 cows for 30 days; and a 50ha paddock could run 200 cows for 30 days.

Example for a 3-day rotational grazing system

Use the same calculation for the 30-day example applied to a 3-day grazing rotation to work out the stocking rate for lactating cows:

$$\text{Stocking rate} = (2,500 - 1,500 + 0 \text{ for pasture regrowth}) \div (15 \times 3) = 22$$

Answer: Stocking rate 22 cows/ha

A 10ha paddock is capable of running 220 cows (10ha × 22/ha) for the 3-day grazing period in the rotation.

A 30ha paddock with nil pasture regrowth is capable of running 660 cows (30ha × 22/ha) for 3 days and a 50ha paddock could run 1,100 cows for 3 days grazing.

Plan seasonal pasture and animal performance to achieve targets

Information required for the calculation:

- Average pasture growth rate over the season
- Number of grazing days

Be sure to make adjustments to suit the local seasonal and pasture growth conditions:

- In dry seasons, reduce the estimate of kg DM/ha/day, in drought years good soil fertility will have a positive impact on amount of pasture grown.
- Adjust estimates according to the growing conditions, pasture density or when there is more than 30% bare ground.

Step 1: Calculate the accumulated pasture growth over the season

Example for calculating the total pasture growth

Information for calculation:

- Average pasture growth rate 40kg DM/ha/day (see Tool 4.3 for regions)

- Number of grazing days 100 days

In this example, there is an average pasture growth rate of 40kg DM/ha/day for 100 days for a normal spring season in southern Australia. Refer to **Tool 3.3** for a guide to the daily mid-monthly pasture growth estimates (kg DM/ha/day) for typical conditions at a range of localities and regions.

The estimate of **total pasture growth** is $40 \times 100 = 4,000\text{kg DM/ha}$

Answer: 4,000kg DM/ha (growth over 100 days)

Step 2. Calculate the number of grazing animals required/ha

Example for calculating the number of grazing animals required

Information for calculation:

- Total pasture growth 4,000kg DM/ha (Step1 – total pasture growth calculation)
- Pasture allowance 10kg DM/day/steer
- Number of grazing days 100 days

To estimate use the formula:

Number of animals = pasture growth ÷ (pasture allowance × no. of days grazing)

A herd of 300kg steers with an estimated 4,000kg DM/ha total growth over the 100 days spring growth and a pasture allowance of 10kg DM/head.

Number of animals = $4,000 \div (10 \times 100) = 4$

Answer: Number of animals = 4 animals /hectare

In this example, 120 animals (4 animals/ha × 30ha) are required in a 30ha paddock to have the same amount of pasture mass at the start and finish of grazing through 100 days of pasture growing at 40kg DM/ha/day.

Step 3. Estimate the stock growth rate and weight gain (kg/head/day)

Example for estimating growth in 300kg growing steers or unjoined heifers in 100 days grazing

Information for calculation:

- Steer liveweight at start 300kg
- Pasture at start of grazing 2,500kg DM/ha
- Pasture growth rate 30kg DM/ha/day (see Tool 4.3 for regions)
- Quality of feed 10.5MJ ME/kg DM
- Average daily gain 0.98kg/day (or approximately 1kg/day – see Table 3*)
- Number of grazing days 100 days

Answer: In 100 days grazing expected weight gain is 100kg liveweight/head

Calculating the gross financial benefit/hectare to the grazing business

Once you have an estimate of the stocking rate and the number of days that stock will be grazing the pasture to achieve the target weight gain, the gross return per hectare can be calculated.

Example for calculating gross financial benefit

Information for calculation:

- Purchase price \$600 (300kg × \$2/kg)
- Sale price \$760 (400kg × \$1.90)
- Difference sale and purchase \$160 (\$760 – \$600)

To estimate use the formula:

Gross financial benefit = number of cattle per hectare × (purchase price less sale price)

Answer: At a stocking rate of 4 steers/ha × \$160, the estimated gross return is \$640/ha

Note: This is simply the gross financial benefit to the grazing business. The operating costs need to be deducted to arrive at an estimated gross margin.

Grazing management methods

Plant phenology and pasture height based methods to start and stop grazing a paddock in a planned grazing sequence. Best practice tactical management of pastures may require slight variation of the limits to achieve seasonal objectives, for example, encourage desirable species and discourage undesirable species.

Process 1 – To start grazing

1. Based on phenology of major desirable species –for maximum productivity

- Perennial ryegrass – graze at the 2.5–3-leaf growth stage
- Annual ryegrass – graze at the 2.5–3-leaf growth stage
- Phalaris – graze at the 4–5-leaf stage of regrowth
- Cocksfoot – graze at the 4–5-leaf stage of regrowth
- Kikuyu – graze at 4.5 new leaves since previous grazing
- Prairie (brome) grass – graze at 4 new leaves since previous grazing

In mixed swards, use the limit for the species that you want to encourage to be more productive.

2. Based on pasture biomass (or height)

Use when phenology limits are not defined or inappropriate for the species present in the pasture

- Minimum mass of 1,500kg green DM/ha (5–6cm) for a moderately dense pasture
- Maximum mass of 3,000kg green DM/ha (14cm) for a moderately dense pasture
- Tall fescue – provide adequate rest and regrowth to around 2,000kg green DM/ha (8–10cm)

These pasture availability methods are indicative only. Very dense, closely grazed pastures will have a higher (up to +25%) kg green DM/ha at the same height. Conversely, more open, lightly grazed pastures have a lower kg green DM/ha at the same height. The differences due to density are greater at pasture heights above 6cm.

3. Legumes

In legumes the criterion measured is the percentage leaf area index (LAI) to capture the energy from sunlight or height in some species.

- Maximum limits:
 - All legumes – 95% LAI
 - White clover – height 20–25cm
 - Red clover – height 25–50cm
 - Lucerne just prior to the emergence of the new growth buds on the crown

4. Native based pastures

Graze more heavily in spring to utilise the green feed and to promote flowering of sub clover and control of annual grass. Avoid overgrazing in dry summers and in wet years manage rank growth in autumn.

Note that pasture intake of cattle will start to be depressed when grazing starts at pasture heights of less than 9cm (around 2,000kg green DM/ha). Achieving maximum intake of energy dense pasture per animal only occurs in that 9–12cm window (2,000–2,500kg green DM/ha). This only has impact if maximum growth rate of finishing animals is required to be above 1.5kg/day.

Process 2 – To stop grazing

In general:

- To maximise pasture regrowth rates – minimum limit of 1,000kg and maximum limit of 1,500kg green DM/ha (around 3–5cm height) for all introduced species other than phalaris. Aim towards the minimum of 1,000kg green DM/ha in spring for most rapid pasture growth and to maintain control of species such as ryegrass, fescue and kikuyu.
- For phalaris based pastures, the minimum limit is closer to 1,500kg green DM/ha.
- Across much of southern Australia, where the growing season is 5–8 months following the autumn break, the maximum limits for residual (post-graze) pasture mass will be lower than 1,000kg DM/ha in autumn and early winter; however, the sooner they are above 1,000 kg DM/ha the more pasture will be grown. Give consideration to feeding stock in containment area or several sacrifice paddocks to increase pasture on offer across the whole farm.
- To provide protection of a fragile resource base a minimum pasture mass of 800kg total DM/ha and minimum of 70% groundcover (100%

if slope is steep) is recommended.

Native-based pastures

In higher rainfall areas:

- recognise the special needs of desirable native grasses and use grazing systems that will encourage and maintain their productivity
- graze to maintain the legume content below 20% clover
- rest at critical times for re-seeding, depending on the growth characteristics of the desirable native species and predicted rainfall pattern;

Subdivide paddocks according to grassland type and monitor the available feed to ensure that overgrazing does not occur at critical times of the year