Making More From Sheep

MODULE 7

Grow More Pasture

A joint initiative of Australian Wool Innovation and **Meat & Livestock Australia**

Procedures

Tools

7

Grow More Pasture

'Pasture' is any material being grazed by livestock, including annual and perennial pastures, forage crops, browse shrubs, dual purpose cereals and stubbles.

Although the pasture base and range of options differ, the procedures to ensure productive pasture systems are basically the same for properties with crop/pasture rotations and those with permanent pastures.

The components of pasture growth (this module) and pasture utilisation (***Turn Pasture into Product***) are strongly inter-related (see figure 7.1). All of the factors affecting pasture growth and utilisation (except rainfall) are within your control as the farm manager.

The productivity and profitability of many grazing enterprises in the high-rainfall and wheat–sheep zones of Australia can be greatly improved by increasing the amount of pasture grown. The quantity and quality of pasture, and when it can be grown, underpin strategic decisions such as time of lambing, flock structure, stocking rates and target markets. The health and fertility of the soil and stage of growth at which pasture is grazed have a major effect on pasture growth and quality. Developing your production system in areas that influence pasture growth and utilisation will boost your productivity and profitability.

About the procedures

Pasture is the cheapest source of feed for all grazing-based livestock enterprises; growing more of it at the right times of the year can create opportunities for you to increase stocking rates, increase lamb growth rates and reduce reliance on supplementary feeding.

This module contains three procedures, designed to help you grow more pasture on your property. It is often difficult to say where you will get the biggest gains in pasture growth.

Getting these procedures right will allow you to make best use of your farm's physical resources such as rainfall, sunlight and soil type. Even though the environment presents some constraints, management has a large impact on how much pasture can be grown throughout the year and between years. This makes it difficult for sheep producers to know where to invest their time and dollars. Tool 7.1 is a 'decision tree' to help you work through the options so you can move straight to the procedure that is most likely to give the biggest gains.

Pasture production and grazing management in context

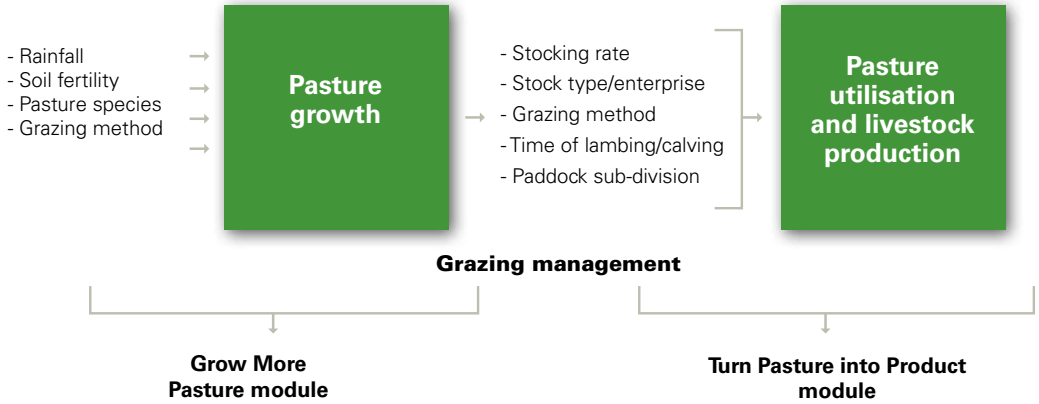


Figure 7.1 Pasture growth (this module) is the foundation upon which livestock production is built. Grazing management (see *Turn Pasture into Product)* is the set of management actions and decisions that link pasture production with pasture utilisation and livestock production.

Procedure 7.1

Build and maintain soil fertility

Background information

Building up and maintaining soil fertility is one of the most cost-effective investments than can be made in a grazing enterprise. Not only are many Australian soils inherently low in nutrients, these nutrients are constantly removed in animal products (meat and wool) as well as in hay, silage or crops.

Laboratory soil tests, plant tissue tests and the use of fertiliser test strips can all assist in making sure that the right amount of the correct fertiliser is being applied to meet your pasture growth objectives.

Introduction

The decisions relating to fertiliser application (such as the type that most suits your operation and the rates you might use) are essentially about pasture growth and maximising profit, and are dealt with in this module.

Tool 6.4 in ***Healthy Soils*** contains instructions for collecting soil samples for laboratory testing. Identifying soil health problems, and assessing the need for remedial action or special management are addressed in procedures 6.3 and 6.4 in ***Healthy Soils***.

Poor soil nutrient availability contributes to low pasture growth, low levels of desirable grasses and legumes and poor feed quality across most of the high-rainfall and wheat–sheep zones of Australia.

Key decisions, critical actions and benchmarks

Without gathering some objective information, it is very hard to assess the nutrient levels of the different soil types or management units on your property. There are three ways to get this information:

➜ A laboratory soil test will identify if the macro elements (phosphorus, P; potassium, K and sulphur, S), are limiting pasture growth. Standard laboratory soil tests are not useful for assessing nitrogen, N or trace element requirements. Tool 6.4 in ***Healthy Soils*** outlines the correct procedure for collecting soil for a laboratory test. Soil tests also give you information about soil health (acidity, salinity, sodicity, etc and whether your soil might be responsive to lime, gypsum or added nutrients). These issues are dealt with in procedure 6.3 in ***Healthy Soils***. Use tool 7.3 to help interpret soil tests.

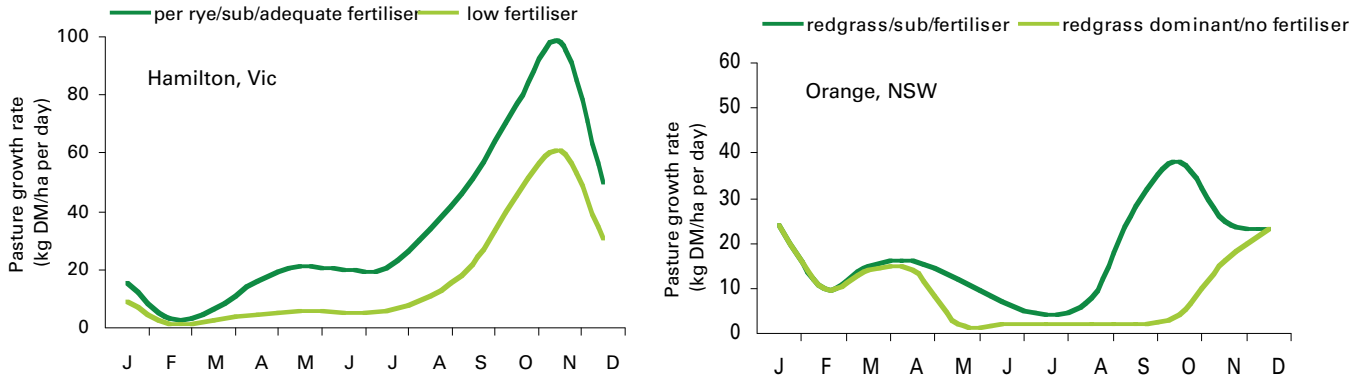
➜ Plant tissue tests are more effective than soil tests if trace elements are limiting pasture growth. Trace elements include molybdenum, copper, zinc and boron. Experienced local farmers, agronomists or veterinarians will know if trace element deficiencies are likely in your district. If you wish to assess the trace element requirements for pasture growth, take a sample of the most dominant clover in the paddock during spring and submit samples to a reputable laboratory (see signposts). You will need to contact the laboratory to get the correct sampling technique for the trace element you are testing for.

➜ Do it yourself, using fertiliser test strips. You can directly assess the likely response from fertiliser applications by laying out test strips in your paddock(s). Test strips can be used for any fertiliser

AT A GLANCE

- ➜ Develop a soil testing program for your property to determine if nutrients are limiting pasture growth
- ➜ Use the tools in this module to determine appropriate capital and maintenance fertiliser rates to address soil nutrient deficiencies.

Figure 7.2. The effect of fertiliser on average monthly growth rates at Hamilton, Western Victoria (winter rainfall area) and Orange, Central Tablelands NSW (uniform rainfall area). Hamilton data simulated from GrassGro; Orange data from NSW PROGRAZE®.



type and are particularly suited to situations where there is not a satisfactory laboratory test (eg, for N, trace elements or gypsum), where deficiency symptoms are not highly characteristic, or where you want to test non-traditional fertilisers. Use tool 7.2 to set up and monitor your own fertiliser test strip.

Understanding pasture responses to nutrients

Two examples of how much extra pasture can be grown, when nutrient deficiencies are corrected, are shown in figure 7.2 for an introduced pasture at Hamilton (Vic) and a native pasture at Orange (NSW).

Phosphorus and native pastures

Native pastures containing some legume (eg, sub clover, cluster clover, medics) will respond to low rates of phosphorus (P) fertiliser. However, native species can decline under competition from clover, annual grasses or broadleaf weeds if fertility levels are raised and the additional feed not utilised. For native pastures, about 20% legume content in spring is the recommended maximum level.

For native grass pastures in high conservation areas or where an increase in native species diversity is desired, do not apply fertiliser or legume seed as both will reduce the conservation value.

Phosphorus and introduced pastures

Introduced (also called exotic or improved) pasture species have a higher requirement for nutrients than native grasses so fertilising paddocks with these species will give a bigger response.

Generally, it is the legume component of the pasture which gives the immediate production and feed quality response to P fertilisers such as superphosphate if there are no other limiting factors such as acid soil. The legumes fix N, which becomes available to the grasses when the legume roots die off.

Nitrogen fertiliser

We usually rely on legumes to supply N to the grasses in the pasture, but applying N fertiliser to supply additional N is economical in some situations. Review the guidelines for the use of N in tool 7.4 to assess whether N fertiliser will be profitable for your sheep enterprise.

Protect the environment

Ensure the proposed nutrients do not adversely impact on the environment. Given the prevailing conditions in a paddock, e.g. proximity to drainage lines, amount of bare ground, etc, nutrients may be easily lost to erosion or leaching beyond the root zone. Use tool 7.4 to quickly assess any potential nutrient losses.

Economics of fertilising pastures

The economic benefit of correcting nutrient deficiencies was evaluated by more than 100 producers (in Vic, NSW, Tas and SA) who participated in the Grasslands Productivity Program (GPP) from 1993 to 1997 (table 7.1). Pasture types ranged from improved perennial to annual to native. The average return was $1.89 for every dollar spent on fertiliser and livestock.

Legume roots with poor nodulation or nodules that are white, not pink, inside, may need trace elements (see tool 7.4)

Table 7.1 The economic benefit of correcting nutrient deficiencies, for producers who participated in the Grassland Productivity Project (GPP) from 1993 – 1997.

Parameter	GPP (Vic, NSW, SA, Tas)	Victorian GPP sites	NSW GPP sites
Change in Stocking Rate	Data unavailable	+28%	+34%
Change in Gross Margin	+25%	+25%	+30%
$ Return per $ Spent	$1.89	$2.17	$2.28

Source: Grassland's Productivity Program. Final report to members (1998) prepared by J.Court. The Grassland Society of Southern Australia

Signposts

Read

The MLA Pasture Health Kit: a field kit for producers to assess pasture health in the paddock. The kit can be ordered from MLA by:

➜ Calling: 1800 675 717

➜ Emailing: publications@mla.com.au

➜ Ordering on-line: www.mla.com.au/publications

Making Better Fertiliser Decisions for Grazed Pastures in Australia: provides soil test – pasture response relationships and interpretations for the major soil tests P, K and S used in Australia, and the Farm Nutrient Loss Index tool (on CD). Get your free copy of the booklet and software tool by:

➜ Calling: 1800 675 717

➜ Emailing: publications@mla.com.au

➜ Downloading from: http://www.asris.csiro.au/themes/nutrient.html

Five Easy Steps to ensure you are making money from super phosphate tool: combines years of research, data and information and leads readers through a decision making process for investment in P. The tool was developed by CSIRO and Industry & Investment NSW with funding from AWI and Pastures Australia members. Available to download at: http://www.wool.com/Publications.htm?cat=Pastures or www.mla.com.au/nutrient

Soil Analysis, an interpretation manual (1999). Edited by K.J. Peverill, L.A. Sparrow and D.J. Reuter (CSIRO Publishing: Collingwood). Go to http://www.publish.csiro.au

Plant Analysis, an interpretation manual (1997) Second Edition, edited by D.Reuter and J.B Robinson (CSIRO Publishing). Go to http://www.publish.csiro.au

Towards Sustainable Grazing – the Professional Producer's Guide, Chapter 3, Soil Health and Nutrients: a collation of proven best practices for modern grazing enterprises in southern Australia. Order your copy from MLA by:

➜ Calling: 1800 675 717

Test strips can be used for any fertiliser type and are particularly suited to situations where there is not a satisfactory laboratory test

➜ Emailing: publications@mla.com.au

➜ Ordering on-line: www.mla.com.au/tsg

MLA Tips and Tools: Making the most of phosphorus fertiliser applied to soils. Get your free copy from MLA by:

➜ Calling: 1800 675 717

➜ Emailing: publications@mla.com.au

MLA's More Beef from Pastures – the producer's manual: the Pasture Growth module, one of eight modules and practical tools to build a more profitable beef business. Purchase a hard copy or CD version of the manual from MLA by:

➜ Calling: 1800 675 717

➜ Emailing: publications@mla.com.au

View

The Australasian Soil and Plant Analysis Council (ASPAC) website: provides a list of soil and plant testing laboratories that are part of the ASPAC testing proficiency program. Visit: www.aspac-australasia.com

Trace elements for dryland pastures: includes background information on molybdenum, boron, zinc, copper, cobalt and selenium requirements. Visit: http://www.dpi.vic.gov.au/agriculture and search for trace elements.

Grazclock: a spreadsheet-based tool that matches animal feed requirements with pasture growth throughout the year. It allows sheep (and cattle) producers to select key management times to correspond with feed demand. Contact NSW I & I by emailing: douglas.alcock@industry.nsw.gov.au

Web-based sources of technical information on ***soils, fertilisers, pasture species and growth rates, for each state*** can be found by searching the following state agency websites:

➜ www.dpi.qld.gov.au

➜ www.dpi.nsw.gov.au

➜ www.dpi.vic.gov.au

➜ www.dpiw.tas.gov.au

➜ www.agric.wa.gov.au

➜ www.pir.sa.gov.au

Attend

Paired Paddock Program (PPP)™, formerly called Grasslands Productivity Program: a farm-based course for sheep producers who want to look at the economics of improving soil fertility and the potential carrying capacity of paddocks on their farm. PPP is delivered by:

➜ Rural Industries Skill Training (RIST). Contact the RIST centre on:

- Telephone: (03) 5573 0943
- Email: ristvic@rist.com.au
- Website: www.rist.com.au.

➜ TAFE. Visit the website at: http://www.education.vic.gov.au/tafecourses

Procedure 7.2

Graze to keep desirable species productive and dominant

Background information

The way a pasture is grazed has a major bearing on the species that survive and dominate. Grazing strategies can be developed to maintain the desirable species and optimise their growth rates. Different grazing methods can also be used in more of a tactical, or short-term way to manipulate the composition of degraded or weedy pastures, reducing the need for herbicides or costly renovation.

The way a pasture is grazed also affects how evenly nutrients in dung and urine are distributed and recycled throughout a paddock. Sheep camps can be minimised and maintenance nutrient requirements can be reduced with the appropriate grazing system.

Introduction

Understanding how the desirable species grow helps you plan a grazing system that will encourage these species to become more dominant. Likewise, knowing the weak spots in a weed's lifecycle helps you plan grazing tactics to decrease their level in a problem paddock. For persistence, plants are most vulnerable during establishment and reproduction (flowering). For more information about matching plant growth and grazing management, see tool 7.5. For pasture assessment tips, see tool 7.6.

Establishing an effective process of grazing management is about tailoring the principles outlined in this procedure to meet your personal and business goals. There is no 'right' grazing management and considerable flexibility is needed to continually re-balance the needs of soil, pasture and animals.

AT A GLANCE

- Measure, manage and monitor pasture composition and the stage of regrowth being grazed to determine if you are limiting growth and survival of desirable species
- Match the grazing needs of the pasture species you want with the grazing tactics you employ

Key decisions, critical actions and benchmarks

There are three critical actions in this procedure:

➜ Assess your pastures to determine if your current grazing system is limiting the growth and persistence of desirable species. A number of pasture assessment techniques are described in tool 7.6. For mixed pastures (annual or perennial) based on introduced species, a good composition is: 60% desirable grasses, 30–40% clover and 0–10% weeds. Note: for native grass-based pastures, the optimum clover content is 20% or less.

➜ Clarify the particular requirements of the species you have in your pasture, especially those that you want to increase or decrease and apply the appropriate grazing management as outlined in tool 7.5. Note: most pastures are quite complex mixtures of species, and individual compromises for each paddock will be required.

➜ Measure, manage and monitor the impact of your actions on pasture composition. Monitor and record paddock management actions and changes in pasture composition using the MLA Pasture Health Kit (see signposts). Ensure your actions, eg, changed grazing pressure, fertiliser rates, tactical

Figure 7.3. Continuously grazed grasses will have small root systems; the more pastures are allowed to recover from grazing, the larger and stronger the root system. Photo by Christine Jones

herbicide use, etc, maintain or increase the proportion of desirable species in the pasture.

Shoots and roots

Plants are genetically programmed to maintain a set ratio between their shoots and their roots. When leaves and stems are removed by grazing, the plant sheds root material to re-balance the ratio. So, short, continuously grazed grasses will have small root systems like those on the left of the photo in figure 7.3, while pastures that are grazed and allowed to recover look more like the plant on the right hand side.

Pasture rests

All perennial species will be more productive and persistent under grazing that includes rest periods between periods of grazing. Growth rates of annual grasses such as annual ryegrass can also be improved by rest, but their persistence in a pasture obviously depends on seed-set in spring, rather than survival of individual plants over summer.

Deferred grazing

Deferred grazing is a tactic where livestock are excluded from pasture areas after the autumn break to maximise germination and establishment of pasture seedlings. Sheep can be concentrated into 'sacrifice' paddocks or laneways and hand fed. Sacrificial paddocks should have low erosion risk and you may need to pay extra attention to animal health. The length of deferment should be governed by pasture growth but, to be worth the cost and effort, grazing is best deferred until pasture has achieved at least 500 kg green DM/ha or, even better, 800 kg green DM/ha.

Pasture residues after grazing

The more green material (pasture residue) you leave after grazing the faster the regrowth, as photosynthesis is more quickly restored. During the growing season it is ideal to leave about 800 kg DM/ha (green material), but this is not always possible. This is also dependent on animal class, species and leaf number. If you cannot leave 800 kg/ha then place a higher priority on significant rest periods to encourage regrowth.

Seedling recruitment

Perennial ryegrass responds well to:

- ➜ Removing stock to allow the grasses to set seed in spring
- ➜ Running a big mob of stock in a paddock over summer to ensure the seeds are knocked to the ground and dead pasture is eaten off to 1,000–1,500 kg DM/ha, and
- ➜ Resting pasture after the autumn break to let new seedlings establish.

The exact tactics for other perennial grasses, including native species, are not so clear.

As the soil seedbank contains few perennial grass seeds, allowing seed set will be necessary for recruitment of most perennial grasses. Trampling by sheep to encourage seed/soil contact may help, along with reduced grazing if seedlings emerge.

Rest periods are also necessary for perennials such as lucerne to accumulate root reserves for growth persistence.

Signposts

Read

Towards Sustainable Grazing – the Professional Producer's Guide: a collation of proven best practices for modern grazing enterprises in southern Australia. Order your copy from MLA by:

➜ Calling: 1800 675 717

➜ Emailing: publications@mla.com.au

➜ Ordering on-line: www.mla.com.au/tsg

The MLA Pasture Health Kit: a field kit for producers to assess pasture health in the paddock. The kit can be ordered from MLA by:

➜ Calling: 1800 675 717

➜ Emailing: publications@mla.com.au

➜ Ordering on-line: www.mla.com.au/publications

MLA Tips & Tools: A large number of titles are available including: ***the MLA pasture ruler, grazing management of native pastures, phalaris, perennial ryegrass, fescue, cocksfoot, sub clover, tagasaste and kikuyu-based pastures.***

Get your free copies from MLA by:

➜ Calling: 1800 675 717

➜ Emailing: publications@mla.com.au

➜ Downloading from: www.mla.com.au/

Greener Pastures: information about deferred grazing for annual pastures.Visit: www.agric.wa.gov.au/PC_91890.html

Greener Pastures for South Western Victoria (2006) Zhongnan Nie & Geoff Saul, DPI Victoria. To order a copy call: (03) 5593 0791

Native Grasses – an Identification Handbook for Temperate Australia: photos and descriptions of 17 native grasses common across south-eastern Australia. M. Mitchell, 1994. (Speciality Press)

Green leaf grows grass - ensure you leave plenty of green leaf in the paddock after grazing

Ag Guide - A guide to pasture species in NSW (2010). Order by phone, call 1800 025 520. Cost $30.00

Quickchecks: Natural Resource Monitoring Tools for Woolgrowers: tools to measure the health of your pastures, soils, woody vegetation, farm watercourses, paddock production levels and birds. Order your free copy on-line at: www.lwa.gov.au/products and search for Quickchecks.

Pasture Legumes for Temperate Farming Systems – The Ute Guide: helps you identify pasture legumes and select the cultivars best suited to your environment and farming system. Purchase your copy from Ground Cover Direct by:

➜ Calling: 1800 110 044

➜ Ordering on-line at: www.grdc.com.au/director/events/bookshop

EverGraze Fact Sheets: EverGraze is developing and testing new farming systems in different environments across the high rainfall zone of southern Australia. The target is to increase profits of sheep and cattle enterprises by up to 50% and at the same time improve water management, use of perennials, biodiversity and soil health. Download the following EverGraze Fact Sheets at: http://www.evergraze.com.au/fact-sheets.htm

➜ EverGraze Exchange – Grazing Management Systems Explained (588kb)

➜ EverGraze Action – Growing and Using Chicory on the East Coast (455kb)

➜ EverGraze Action – Growing and Using Chicory in WA (461kb)

➜ EverGraze Action – Growing and Using Lucerne (475kb)

➜ EverGraze Action – Growing and Using Kikuyu in WA (458kb)

➜ EverGraze Action – Grazing Phalaris for production and persistence (419kb)

➜ Evergraze Action – Productive, persistent Perennial Ryegrass (481kb)

➜ EverGraze Action – Growing and Using summer active Tall Fescue (542kb)

➜ EverGraze Action – Native pastures of the Eastern Namoi (2MB)

➜ EverGraze Action – Management of Native Pastures in Victoria (452kb)

Attend

The MLA EDGE*network*® program is coordinated nationally and has a range of courses to assist sheep producers. Contact can be made via:

➜ Phone: 1800 993 343

➜ Email: edgenetwork@mla.com.au

➜ Website: www.mla.com.au/edgenetwork

Procedure 7.3

Establishing new pastures

Background information

While numerous studies have shown that sowing introduced pastures can be profitable, the exercise is highly sensitive to factors such as: how successful the establishment is; the life of the pasture; what increase in stocking rate or livestock production per hectare is obtained; the gross margin of the enterprise; and the cost of purchasing extra stock to eat the extra feed. A worked example of the factors you might include in a decision to increase pasture production and animal output, is given in tool 1.12 in ***Plan for Success.***

Introduction

Different land classes and production systems (eg, permanent pasture versus pastures in rotation with cropping) require different species mixtures. A practical way of combining soil and paddock information is presented as tool 6.1 in ***Healthy Soils***. Use tool 6.1 to assess the most appropriate pasture system for each area of the farm.

If there is a reasonable base of desirable species present, it is always cheaper and easier to use the grazing management practices outlined in procedure 7.2 to strengthen your existing pastures, rather than sowing a new pasture.

The aim of this procedure is to help sheep producers establish a new pasture in paddocks where there are insufficient desirable species present. This will require greater intervention.

While some clovers or medics and desirable annual grasses (eg, annual ryegrass) can volunteer in pastures in many regions if conditions are right, They are unlikely to be as productive as sowing a pasture mix well suited to the soil and rainfall conditions.

Introducing new species and cultivars can involve a large capital expenditure, typically $150 – $300/ha, depending on sowing method and inputs required. The main reason for poor establishment of new pastures is lack of preparation and unsuitable species selection. It can also be a risky exercise, particularly in regions where introduced perennial grasses, and even annual legumes, struggle to persist due to harsh or highly variable climatic conditions or soil.

The focus in this procedure is on establishing and managing permanent pastures. There are many different issues to be considered in selecting, establishing and managing pastures in cropping rotations, such as control of pests, diseases and herbicide resistant weeds or N fixation for following crops. These factors often influence pasture selection and management more than the potential for animal production.

AT A GLANCE

- Assess your pastures to determine if the existing species are limiting pasture growth and quality
- Weigh up the benefits, costs and risks of sowing new pastures and prepare a developmental budget before spending large amounts of capital

Key decisions, critical actions and benchmarks

Assess your pastures to determine if the existing species are limiting pasture growth and quality. A number of pasture assessment techniques are described in tool 7.6.

➜ Identify desirable perennial grass plants (tool 7.6). If there are some perennial grasses present, you might be able to improve their size, vigour, density and growth rates to the extent that you may not need to sow more plants. As a 'rule of thumb', if you have 5–10 phalaris, cocksfoot or fescue plants/m^2 or 10-15 perennial ryegrass plants/m^2 you have an opportunity to use grazing to improve the perennial content of the pasture

➜ Similar benchmarks probably also apply to native perennial grasses but, at this stage, there is no economic way to re-sow these pastures and therefore grazing management is the only option. Note: Replacing native species with introduced pastures is restricted by native vegetation protection legislation in some regions. Check with your regional natural resource management authority (see procedure 5.3 signposts in ***Protect Your Farm's Natural Assets***) before attempting to replace native pastures.

For sowing new pastures, the following three steps are critical to ensure the investment is profitable.

Ensure establishment succeeds the first time

Prepare for sowing at least 1-2 years before the proposed sowing date.

Choose species and cultivars that are well suited to the land class/soil conditions and the rainfall pattern/reliability, ie, tried and proven in your local area. There is a wealth of information on this topic. Sources relevant to different states/regions are listed in the signposts.

Ensure good weed control and an appropriate sowing method. A thorough weed control program in the 3-4 months prior to sowing is critical to success.

If an autumn sowing is planned, spray topping should be carried out in the previous spring to prevent seed-set.

Direct drilling (spray and sow) is a proven, reliable technique for establishing pastures for all regions, but is especially suitable in the high rainfall/permanent pasture zone. In the wheat–sheep zone, undersowing can be effective in lowering the cost, although competition from the crop usually results in lower numbers of pasture species establishing per square metre. Refer to the signposts for more information on pasture establishment methods.

Additional investment in improved pasture management skills can help ensure the extra investment in pasture establishment is profitable

Ensure the desirable species persist

The longer a pasture lasts, the more likely it is to be profitable. For long-term perennial pastures, appropriate grazing management and strategic use of fertilisers (see signposts in procedures 7.1 and 7.2) can help pastures persist almost indefinitely in the high rainfall zone (above 600mm of annual rainfall). Different rules and expectations apply to short-term pastures sown in rotation with crops, but the benefits in livestock production and grain yields still have to outweigh the costs.

Short-term or special-purpose pastures (e.g. cereals, brassica, chicory, plantain or legumes) have a role in filling specific feed gaps and for finishing lambs. The short-term nature of many of these pastures means that substantial increases in livestock production per hectare (higher stocking rate or heavier lamb turn-off weights or savings in supplementary feed) are required to make sowing the pasture profitable.

Increase livestock production

Pasture introduction cannot increase returns by itself. The value has to come from turning off more wool or meat per hectare or, in fewer cases, by increasing the value of the product. In many cases, the investment in the extra animals needed to utilise the increase in pasture will be greater than the investment in the pasture itself. An additional investment in improved management skills may also help ensure a strong profit flow from an investment in pasture establishment.

Feed supply can be varied to meet animal demand by introducing new pasture species at critical times, increasing pasture growth as described in this module, or through better alignment of animal demand with pasture supply (see procedure 8.3 in ***Turn Pasture into Product***).

Many native grasses, such as this red grass, can produce green feed in response to summer rainfall making it a valuable component of the pasture

Signposts

Read

Eight Steps to Successful Pasture Establishment: download your copy from the I&I NSW website: http://www.dpi.nsw.gov.au/agriculture/field/pastures-and-rangelands/establishment/eight-steps

The MLA Pasture Health Kit: a field kit for producers to assess pasture health in the paddock. The kit can be ordered from MLA by:

- ➜ Calling: 1800 675 717
- ➜ Emailing: publications@mla.com.au
- ➜ Ordering on-line: www.mla.com.au/publications

The Graziers' Guide to Pastures (2003): sowing and managing profitable pastures in the Southern Tablelands, Central Tablelands, Monaro and the Upper South West slopes of New South Wales. Download a free copy from Industry and Investment NSW website: http://www.dpi.nsw.gov.au/agriculture/field/pastures-and-rangelands/management/graziers-guide-pastures.

Perennial Pastures for Western Australia, 2007: covers all perennial options from herbaceous legumes to temperate and sub-tropical grasses, herbs, fodder shrubs and saltland pastures Download the order form from the DAFWA website: http://www.agric.wa.gov.au/content/past/dsc_chapter_1.htm

Evergreen Farming: a WA farmer group showing that perennials can substantially increase farm profitability and also combat water-logging, salinity and erosion. Visit their website at: http://www.evergreen.asn.au/

Species for Profit: will help you choose the most appropriate species and cultivars for your specific site, for pastures, forage or cash crops. Download a copy from the Department of Primary Industries, Water & Environment (DPIWE), Tasmania at: http://www.dpiw.tas.gov.au/inter.nsf/Publications/CART-6NA5S2?open

View

Grassland Society of Southern Australia Inc: sheep producers can access this website to find a listing of currently available cultivars of grasses and legumes. The list includes details on growth pattern of the cultivar, preferred soil conditions, annual rainfall required and sowing rates. Visit: http://www.grasslands.org.au/

A-Z listing of pasture species and varieties: information on over sixty species of pasture – temperate and tropical legumes and grasses, pasture herbs and forage shrubs. Visit: www.dpi.nsw.gov.au/agriculture/field/pastures-and-rangelands/species-varieties/a-z

Pastures: information on introduced and native pastures, mixtures, pasture management and weeds for Queensland sheep producers. Visit: www.dpi.qld.gov.au/pastures

Pasture Australia: Pasture picker www.pasturepicker.com.au

Grassland Society of NSW Inc: Provide information on a range of temperate and tropical pasture species. Newsletters and conference proceedings can be viewed online at www.grasslandnsw.com.au

EverGraze Pasture Improvement Calculator: This calculator helps work out the costs and benefits of resowing pastures, including cash flow implications, pay-back period and internal rate of return. The tool uses Microsoft Excel and allows for comparison of two different pasture improvement scenarios. Visit: http://www.evergraze.com.au/tools.htm

Website link not working?

Go to the Making More From Sheep website:

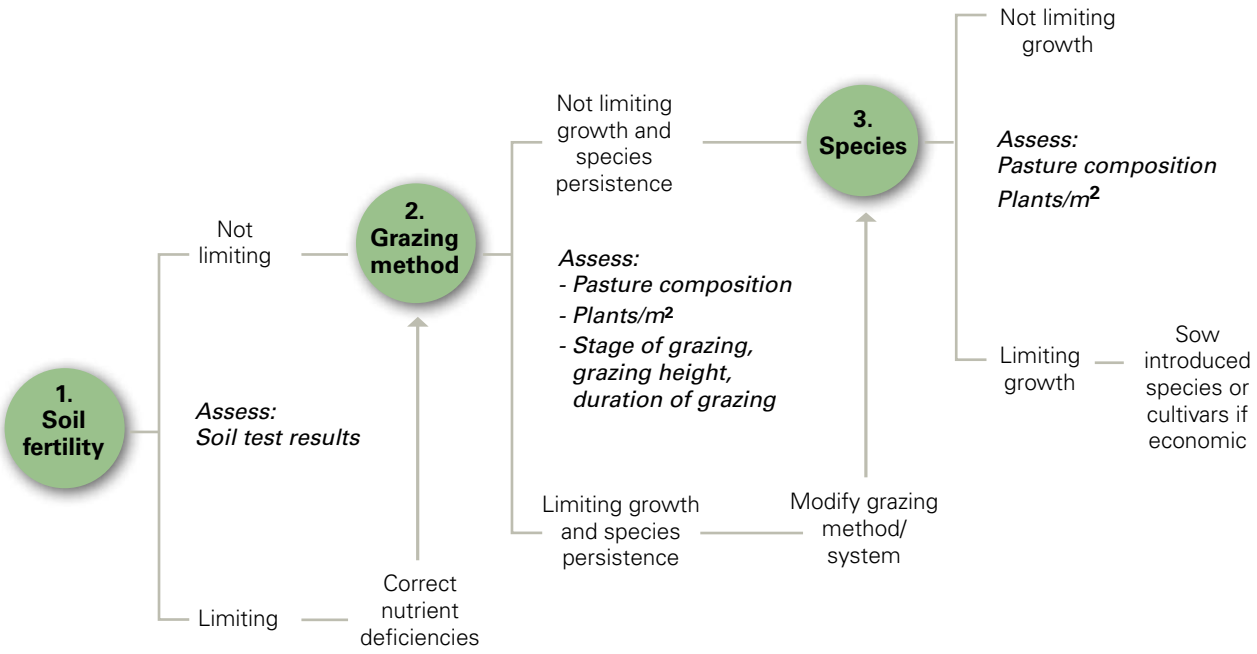
www.makingmorefromsheep.com.au

and follow the links to updated signposts

Tool 7.1

Determining priorities for growing more pasture

Use the decision tree (below) to help you determine if you can grow more pasture and to prioritise options. Measure your soils and pastures (activities indicated in bold and italics) to identify where you will get the biggest gains in pasture growth. This will then allow you to prioritise where to invest your time and dollars.



A decision tree to help you determine if you can grow more pasture and to prioritise options. Measure your soils and pastures (activities indicated in ***bold text***) to identify where you will get the biggest gains in pasture growth. This will then allow you to prioritise where to invest your time and dollars.

Tool 7.2
Fertiliser test strips

The two key questions regarding fertiliser use in pastures are:

- Which fertilisers will give a significant boost to pasture growth?
- At what rate should such fertiliser be applied?

For the macro-nutrients phosphorus (P), potassium (K), and sulphur (S), there is no substitute for laboratory soil tests when it comes to assessing both the likely responsiveness and the best rate of fertiliser to use. Soil tests are also invaluable for diagnosing many soil health issues (see tool 6.5 in ***Healthy Soils***).

However, laboratory soil tests are not as useful (in some cases not at all useful) for nitrogen (N), the trace elements or for soil conditioners such as gypsum, and this is where fertiliser test strips can be extremely valuable. They have the added advantage that they are 'free' and they provide specific information for your own paddock.

Test strips are ideal for testing which fertilisers will give a significant boost to pasture growth, but not as well suited to the question of fertiliser rate. It takes too many strips, and accurate cutting of pasture is required to assess an optimum rate. For this reason, test strips are usually given a higher than average rate of fertiliser to make it easier to see any responses. If you get a response in your test strips, seek local advice as to an appropriate rate.

Test strips are not suitable if a rapid decision is needed. Ideally, the test strips will be applied and assessed this year as the basis for fertiliser decisions in subsequent years.

For annual pastures, test strips are best put out before the break of season, but for high rainfall zone, perennial pastures, test strips can be put out any time between February and September.

There are two common methods of putting down fertiliser test strips:

Small, hand-spread strips.
A good size is 20m long and 2m wide – for this size, the sums are quite easy; simply divide the rate per ha you wish to test by 250 and apply that evenly to the test strip (i.e. 1 kg of fertiliser is equivalent to 250 kg/ha). Because the areas are quite small, it is advisable to put down two sets of test strips within a paddock. After you have weighed out the fertiliser, six of these small test strips can be put down in about 45 minutes.

- Mark the four corners of each strip and run twine around them to 'outline' the test strip
- Run the test strips down the slope to minimise the chance of nutrients washing from one strip to the next
- Apply the fertiliser as evenly as possible – going over the strip twice usually gives better uniformity than a single application
- Remove the twine but leave the corner posts so you can easily locate the strips (mark the strips on a map so you know what has been applied to each strip)
- Run the test strips parallel to each other and leave a good distance (say 5m) between strips to make assessing the growth response easier. Narrow test strips are not well suited to a criss-cross design because the area of overlap (2m by 2m) is too small.

Larger, machine-spread strips.
These should be at least 100m long (can run the length of the paddock) and the width of the spreading machine. [Note, this technique is only suited to 'drop' type spreaders as 'spinner' type spreaders don't have a definite 'edge'].

- As for hand-spread strips, it is essential to mark the corners of the strips and draw a map so you know what has been applied to each one
- Reasonably careful calibration of your spreader is important, as is cleaning out the spreader between different strips, especially if you are testing responsiveness to trace elements
- Leave at least 10m between strips to make assessment easier
- Machine-spread test strips (if the test strip is at least 5m wide) are suited to either parallel strips or to a criss-cross design. Criss-cross designs are useful if you want to test 'combinations' of fertiliser (say P and N, or P and molybdenum).

Assessing the test strips

Stock need to be kept off the test strips to make it easier to see the effects.

For annual pastures, the biggest effect will probably be seen in spring. Many producers close up the area where the test strips have been applied for hay cutting – this gives the best visual result.

For perennial pastures, paddocks can be closed up for hay, or for rotational grazing systems, and assessed before the stock enter the paddock each time.

Things to look for when comparing test strips to the rest of the paddock include:

- Height of the pasture
- Colour and 'healthiness' of the pasture sward
- Amount or density of the clover
- Size and colour of clover leaves
- Evenness of the pasture
- Any impact on pasture composition, including if there are more or less weeds in the test strips.

Tool 7.3
Interpreting soil tests

The levels described in the following tables apply to tests performed by accredited laboratories using procedures defined by the Australian Soil and Plant Analysis Council (ASPAC) proficiency testing program. Sheep producers are advised to use only ASPAC accredited soil testing laboratories. Check the accreditation status of your regular soil testing providers on the website: www.aspac-australasia.com

Tool 6.5 in the ***Healthy Soils*** module lists key benchmarks for problem soils, and signposts a number of resources to help you manage acid, saline, sodic and compacted soils, and non-wetting sands.

Extractable phosphorus

Most soils in Australia are responsive to applications of phosphorus (P) fertiliser.

The following tables show the responsive levels for commonly used P tests, for pastures that have been improved by the introduction of exotic legumes and perennial grasses.

High levels of P application can make it difficult to retain some native perennial grasses. As P levels increase, legumes and annual grasses may replace native grass species. Grazing management, involving pasture rest at critical times, can lessen the rate of loss. The potential reduction in native grass content and the likely change in profitability through the application of P fertiliser need to be considered.

Sheep producers wishing to optimise pasture productivity while retaining native grass species should seek advice from agronomists to establish grazing management strategies and minimum and maximum P limits for their region and soils.

Using P Olsen and P Bray extraction methods (based on 0–10 cm sample)

	Olsen P (mg P/kg)	Bray P (mg P/kg)
Responsive	<12	<12
Marginal response	12–15	12–15
Generally non responsive	>15	>15

Note that soil type (texture) has no impact on levels when using Olsen or Bray test procedures

Using P Colwell extraction method (based on 0–10 cm sample)

		Phosphorus status at 95% of maximum production		
		Low	Medium	High
Category	Phosphate Buffering Index	Critical Colwell soil test P (mg/kg)		
Extremely Low	> 10-15	<15	15-20	>20
Very,very low	>15-35	<20	20-25	>25
Very low	>35-70	<25	25-29	>29
Low	>70-140	<29	29-34	>34
Moderate	>140-280	<34	34-40	>40
High	>280-840	<40	40-55	>55

Note: the interpretation of Colwell soil test values is dependent on soil type, or more specifically the Phosphate Buffering Index (PBI) of the soil. Seek further advice before applying Phosphorus fertilisers to light sandy soils with a PBI below 10 (such as those in Western Australia).

The Phosphorus Buffering Index (PBI) typically increases with soil texture as it moves from sands through to heavy clays. Some laboratories now routinely supply a PBI with all analysis reports. The PBI affects the rate at which the soil test value changes with the addition of phosphorus fertiliser.

P is a relatively immobile nutrient once it has entered the soil, usually remaining within a few centimetres of where it was applied. Losses of P by fixation and leaching depend on soil type and rainfall and are generally greater as rainfall increases. Well fertilised pastures are generally protected from P loss associated with soil erosion as they retain high levels of groundcover throughout the year as P is attached to the soil particles.

Extractable sulphur (S)

Soil sulphur benchmarks using the KCl_{40} method for measuring soil sulphur levels are:

- Responsive — Less than 6mg/kg
- Marginal response — Between 6 and 8 mg/kg
- Non responsive — Above 8 mg/kg

Extractable potassium (K)

	Colwell or Skene K (mg/kg)			Exchangeable K (meq/100g)		
Soil texture	light	medium	heavy	light	medium	heavy
Responsive	<100	<140	<180	<0.25	<0.35	<0.45
Marginal response	100–150	140–220	180–300	0.25–0.4	0.35–0.55	0.45–0.75
Non responsive	>150	>220	>300	>0.4	>0.55	>0.75

From Brown et al. (1980)

Understanding Soil pH

To better understand the relationships between soil pH, pasture growth and availability of soil nutrients read the Acid Soil Action brochure from NSW Agriculture at: www.dpi.nsw.gov.au/agriculture/resources/soils/acidity/publications/ph

Acknowledgements

- Some information extracted from More Beef from Pastures manual (published by MLA).
- Tables of the critical levels compiled by Jim Shovelton (MS&A) using data from:
  - K.I. Peverill, L.A. Sparrow, and D.J. Reuter (1999). Soil Analysis — an interpretation manual (CSIRO), and
  - A.J. Brown, K.K.H. Fung, and K.I. Peverill, (1980). A manual on the soil testing service provided by the Division of Agricultural Chemistry, Department of Agriculture, Victoria, Tech Rep Series No 34.

Tool 7.4.

Guidelines for fertiliser application

Guidelines for the use of phosphorus

Capital applications

Capital applications of fertiliser are aimed at lifting the soil nutrient levels to target levels based on optimising growth and persistence of a particular pasture species. They involve making one or more applications over and above the level required for replenishing nutrients lost through export off the farm in products. Capital applications often involve phosphorus fertilisers or they can refer to lime. Expenditure on capital applications must be regarded as an investment of financial capital. To get a positive return on capital invested, the increased pasture grown must be converted into increased animal product/ha and profit. The speed at which nutrients are built up will depend on cash flow/access to capital and how quickly stock numbers can be

increased (purchase or breed) to utilise additional pasture. The extra capital required to invest in stock is often much larger than that invested in fertiliser. The higher the marginal return per unit increase in turn-off or stocking rate, the higher the return from capital applications. Average returns from capital applications of P fertiliser, for producers involved with the Grasslands Productivity Project, were $1.89 for every $1.00 invested in fertiliser and stock (see table 7.1 in procedure 7.1).

The amount of P needed to increase soil P by one unit varies with soil type. Heavier textured soils (clays) usually require more P than lighter, sandier soils. Depending on the soil's phosphorus buffering index (PBI), it may take 5–15 kg P/ha to increase Olsen P by 1 unit, or 2–4 kg P to shift Colwell P by 1 unit.

Maintenance applications

Maintenance applications of fertiliser are aimed at replacing the amounts of nutrients exported off the farm in produce (meat, wool, hay, silage) or tied up in the soil. Maintenance applications are designed to maintain the target soil levels for each nutrient and maintain the current level of productivity. Maintenance applications usually involve P and S, but may involve K in hay or silage paddocks. Maintenance rates of P are based on the PBI of the soil. For example:

- Apply 0.8 kg P/DSE when PBI is low (0–100)
- Apply 1.0 kg P/DSE when PBI is moderate (100–300) and
- Apply 1.2 kg P/DSE when PBI is high (>300).

Fertiliser principles

Prioritise applications on the basis of where you will get the best response. Newly sown pastures that have low levels of soil fertility are a high priority. Persistence of the sown species is essential to ensure pasture establishment is a profitable exercise. Introduced species of grasses and legumes have a higher requirement for phosphorus than native grasses so fertilising these paddocks will give a better response. While native grass pastures containing some legume will respond to some fertiliser, many native species will decline under competition from legumes, annual grasses or broadleaf weeds when phosphorus levels are raised.

Correct all nutrient deficiencies where economic responses are indicated. If P, S and K are all identified to be below critical levels, then a fertiliser blend containing all three nutrients should be applied. Correcting only one nutrient will limit the response in pasture growth.

Apply fertiliser when the pasture is most actively growing and you will get best response, eg, autumn for annual or sub clover/perennial grass pastures, or split autumn and spring applications for highly productive perennial pastures (eg, white clover/perennial ryegrass) or spring for summer-active perennial pastures (eg, lucerne).

Do not apply P to waterlogged soils or at the coldest time of the year as most of it will be rapidly converted into a form that is not available to plants.

Avoid applying fertiliser near waterways, waterlogged soils, and on steep slopes to reduce nutrient contamination of streams. Do not apply fertilisers when storm events are likely to increase risk of nutrient run-off. Applying fertiliser in low ground cover situations should also be avoided.

For native grass pastures in high conservation areas, do not apply fertiliser or legume seed.

Guidelines for the use of nitrogen

Nitrogen (N) fertiliser can be used to increase pasture growth rates and fill feed gaps in autumn and winter. It can also be used to boost spring growth for silage or hay production.

Pastures respond best to N:

- Where there is a high proportion of introduced annual or perennial grasses (60% grass content)
- Where the other macro and trace elements are adequate and
- While soil conditions are warm (above 8–10°C) and moist.
- Do not fertilise nitrophilic weeds.

Pasture growth responses to N can range from 15 kg DM/ha for every 1 kg N applied in autumn, down to 5 kg DM/ha for every 1 kg N in winter. Higher responses are possible in spring. During the growing season, N usually works out to be cheaper than filling feed gaps with grain, hay or silage. For example:

- Wheat at $150/t equates to 17c/kg DM or 1.4 c/MJ ME*, whereas
- N at $490/t spread, with a response of 10 kg DM/ha per kg N, equates to 11.0 c/kg DM or 0.9 c/MJ ME.

The economics of N application are dependent on the relative price of grain to N fertiliser as well as the predicted response.

*Megajoules of Metabolisable Energy

Trace elements and plant tissue tests

Molybdenum (Mo) is essential for nodule function in legumes and is commonly deficient in acid soils. Deficient legume plants appear stunted and their roots should be inspected for nodulation and activity of nodules. If there is poor nodulation or nodules are white rather than pink inside, apply Mo.

Alternatively, plant tissue tests can be used to assess the need for trace elements. Samples need to be taken in spring, before the legumes flower. Ensure the lab is ASPAC accredited for the tests you want conducted. Enquire about the correct sampling protocol for the plants you are testing for.

Avoid environmental impacts from nutrient loss

A separate consideration to pasture response is pinpointing areas on your farm where nutrients leak, losing you money and posing a threat to the environment.

Use the Better Fertiliser Decisions CD tool, the 'Farm Nutrient Loss Index', to plan your fertiliser needs and applications across the farm with far greater precision.

From this information, you can choose to either reduce nutrient inputs, or stem nutrient losses by applying one or more of the key decisions, critical actions and benchmarks in this module, and in ***Healthy Soils***.

Get your free copy of the ***Farm Nutrient Loss Index*** tool by:

- Calling MLA on: 1800 675 717
- Emailing MLA on: publications@mla.com.au
- Downloading from: http://www.asris.csiro.au/themes/nutrient.html

Tool 7.5

Grazing management guidelines for individual species

Individual pasture and forage species have specific grazing requirements. You can use these requirements to increase or maintain that species in the pasture or to decrease a species, eg, to increase the relative contribution of other species in the mixture. The table on pages 19-21 contains species specific information and the following are some general rules for grazing management:

Grazing frequency

Plants that can cope with heavy, continuous grazing during their growing season are those with a prostrate (flat) growth habit (sub clover, annual medics and many broadleaf weeds such as capeweed, erodium and thistles), or those with rhizomes or stolons (bent grass, couch grass, kikuyu). These plants are able to maintain some leaf for photosynthesis even when kept grazed very short, and hence are able to survive. Plants that have a more upright or erect growth habit, such as many introduced and native perennial grasses, and most annual grasses, are less resilient to heavy, continuous grazing, because most leaf (and stem) material is easily removed by stock, leaving little capacity for regrowth.

Grazing tactics

If you want to modify your current grazing system or methods, be clear about the benefits you are trying to achieve, for example:

- Use rotational grazing to increase autumn/winter growth rates of desirable perennial and annual grasses. This will improve the size and persistence of perennial grasses and also help suppress broadleaf weeds
- Use crash-grazing or set stocking (with a high stock density) in spring to prevent annual or perennial grass weeds dominating in problem paddocks and also to increase the annual clover content
- Remove stock from paddocks when groundcover falls below the acceptable limit in your district to protect the pasture and the soil (see procedure 6.2 in ***Healthy Soils***). Maintain groundcover and litter at the time of the season break to reduce germination of annual broadleaf weeds such as capeweed. However, leaving more than 1,000 kg DM/ha (litter/dead pasture) in the paddock at time of the autumn break will reduce germination of annual clovers
- Maintain a flexible approach. Varying seasonal conditions from year to year will affect pasture composition so you need to be able to adapt your grazing system accordingly. Because you can't manage all paddocks correctly in all years ensure poor management is not repeated in the same paddock in successive years.
- When applying your grazing strategy or tactic, refer to the seasonal targets you have set for the class of livestock grazing the paddock/s (see tools 10.4 and 10.5 in ***Wean More Lambs***). Pasture and animal production objectives are not always compatible and compromises (economic, environmental and social) have to be made.
- Rest periods (for rotational grazing systems) should be based on allowing the grass you want to be most dominant in the pasture to grow back a target number of leaves. Only when this target number of leaves has regrown on a tiller has the plant fully restored its reserves in readiness for the next grazing and re-growth cycle. This may require lowering your stock numbers or deferment of grazing. The following table lists these targets for species where clear rules are available.

Grazing management tactics to increase, maintain or decrease individual species in a pasture.

Pasture type	Increase or maintain	Decrease/remove
Temperate native grasses	➜ Use strategic, tactical or rotational grazing ➜ Maintain groundcover at 70% (high rainfall) or 40% (semi-arid areas) ➜ Allow flowering and seed set of desirable grasses ➜ Use low rates of phosphorus and sulphur and manage grazing to ensure grasses are not killed	➜ Continuously graze even at low and moderate stocking rates ➜ Overgraze, especially in dry conditions ➜ Regularly burn pastures ➜ Allow shrub and weed invasion [Note – many states/catchments restrict native pasture management interventions– see procedure 5.3 signposts in ***Protect Your Farm's Natural Assets***]
Tropical grasses	➜ Allow flowering and seed set once a year ➜ Rotationally graze and supplement stock when green herbage mass is low ➜ Control growth of temperate species (eg, clover, barley grass, ryegrass) in early spring ➜ Control growth of competitive, summer growing annual grasses ➜ Provide adequate nitrogen ➜ Do not overgraze when dry or N is low ➜ Maintain groundcover	➜ Reduce fertiliser and nitrogen inputs ➜ Graze heavily during flowering ➜ Graze rhodes grass to ground level [Note - Purple pigeon, Rhodes grass and green panic are susceptible to overgrazing particularly when dry and nitrogen is low]
Phalaris	➜ Increase phosphorus applications ➜ In northern environments with more summer rainfall, rest in spring/ summer, remove excess trash late in summer then rest until 3-4 weeks after autumn break ➜ In southern environments, lenient rotational grazing over autumn/winter to allow more tillering of the existing plants ➜ Graze after the plants reach 4-leaves/ tiller	➜ Allow soil fertility to decline ➜ Graze heavily during spring/summer or repeatedly cut so it is not allowed to run to head. ➜ Graze heavily any new green shoots in summer and autumn, but monitor stock for any signs of phalaris poisoning such as phalaris staggers and sudden death syndrome
Cocksfoot	➜ Graze to maintain above 1000-1500 kg DM/ha ➜ Apply high rates of phosphorus fertiliser ➜ Avoid continuous grazing of green shoots during summer and autumn ➜ Graze plants when they reach 4-leaves/tiller to maximise feed quality	➜ To avoid cocksfoot dominance, graze all summer growth including individual tussocks down to 10cm tall at the autumn break ➜ Graze heavily during autumn to physically pull plants from the ground ➜ Graze hard down to 2.5cm or less during late spring or summer ➜ Allow soil fertility to decline
Perennial ryegrass	➜ Rotationally graze during summer, ideally after plants reach 3-leaves/tiller ➜ Apply high rates of phosphorus fertilisers	➜ Allow soil fertility to decline ➜ Do not allow to run to head ➜ Graze continuously and heavily during summer

Pasture type	Increase or maintain	Decrease/remove
Tall fescue	➜ Graze frequently (every 14-21 days) for short periods (2-3 days) during periods of active growth, once the plants reaches 4-leaves/tiller ➜ Do not graze until 3 weeks of good active growth and/or 12-15cm of grass growth ➜ Set stock or rotationally graze from autumn to spring to maintain 1,000-2,500kg green DM/ha (or 5-15cm) of pasture	➜ Continuously graze in hot dry conditions ➜ Graze heavily during dry summers or early autumn
Sub clover	➜ Avoid grazing until seedlings have 3-5 true leaves, usually 3-6 weeks after the autumn break ➜ Keep grass/weed cover below 1,000kg greenDM/ha during summer/ early autumn ➜ Maintain a sward height of 5cm or less until flowering ➜ Increase phosphorus applications	➜ Maintain grass and weed cover above 1,000kg green DM/ha ➜ Do not control earth mites ➜ Cut hay or graze heavily during seedset ➜ Apply herbicides during flowering ➜ Allow soil fertility to decline, including molybdenum and boron
White clover	➜ Keep grass/weed cover low at break and graze continuously to keep the grasses short ➜ Over winter and early spring, graze pasture to 750kg green DM/ha (or 3cm) ➜ Heavily rotationally graze in spring to control grasses, maintaining pasture between 1,000-3,000kg green DM/ha (or 10-25cm) ➜ Increase phosphorus applications	➜ Graze heavily during flowering ➜ Graze to less than 1,200kg green DM/ha while under moisture stress during summer ➜ Allow soil fertility to decline, including molybdenum boron
Lucerne	➜ Allow to achieve well in excess of 10% flowering prior to grazing. This must be achieved at least once per year, preferably in the autumn ➜ Rotationally graze for most areas: - Summer: 2 weeks grazing and 5 weeks rest - Winter: 2 weeks grazing and 7-8 weeks rest	➜ Set stock paddocks at heavy stocking rates ➜ Allow soil fertility to decline, including molybdenum and boron ➜ Potassium can run down when used intensively for hay production, zinc can be a problem on alkaline soils.
Grazing cereals	➜ Delay first grazing until plants are well anchored and starting to tiller (6–8 weeks post emergence) ➜ For winter types, longer deferment can increase growth and winter feed supply ➜ High stock density rotational grazing gives the most even utilisation and allows recovery	➜ Heavy grazing during the first 6–8 weeks ➜ Heavy grazing in spring once the seed heads begin to form ➜ Late grazing of semi-dwarf types can make any grain harvesting difficult

Pasture type	Increase or maintain	Decrease/remove
Chicory	➜ If sown as a specialist finishing pasture, rotational grazing is essential – a four paddock system works well. Aim to maintain height between 5 and 40 cm. ➜ In late summer, allow stands to develop stems and set seed if regeneration is required ➜ If sown as a component of a mixed pasture, rotational grazing is essential for persistence, but it is likely to decline anyway.	➜ Easily removed by set stocking ➜ Plants very susceptible to overgrazing and trampling when dormant (winter) ➜ More erect varieties (eg, Grouse) have higher crowns and are more susceptible to overgrazing
Brassicas	➜ Most brassicas are grown to maturity and grazed only once so strip grazing is needed to minimise trampling losses ➜ Some forage Brassica hybrids are suited to multiple grazing – strip grazing minimises trampling losses and allows more rapid recovery	➜ Not applicable

Tool 7.6

Pasture assessment techniques

Pasture composition

This method can be used to assess the frequency of both individual species (eg, phalaris) and species groupings (eg, perennial grasses).

➜ Cut a 30cm length of 1cm-thick dowel, and drive a nail into one end

➜ Throw the stick ahead at random intervals while walking across the pasture

➜ After each throw, identify and record the pasture species or species group that is touching or immediately below the nail head at the end of the thrown stick

➜ Repeat 20 times (depending on the evenness of the pasture)

➜ Add the number of hits for each species or group and multiply by five (to convert to number of hits out of 100) to give % frequency (or composition)

➜ Normal groups used are perennial grasses, legumes, annual grasses, weeds and bare ground

➜ PROGRAZE® manuals include an example of a recording sheet that simplifies and speeds up the collection and recording process.

Perennial grass establishment and persistence

Counting the number of perennial grasses per square metre is a good way to assess:

➜ How well the grasses established

➜ How well the sown grasses are persisting.

To measure plants/m^2, make up a quadrat (25 x 25 cm metal square). The technique involves throwing the quadrat 20 times across the paddock and recording the number of perennial plants inside the quadrat. Work out the average number of plants recorded inside the quadrat. Multiply results by 16 to convert to plants/m^2.

Pastures will recover with careful grazing management if you have 5-8 perennial plants/m². Tool 7.5 will help you choose the most appropriate grazing management strategy for your pasture.

Groundcover

Groundcover includes existing pasture, weeds and other herbage as well as litter. To estimate groundcover, stand in a representative part of the pasture with your feet 30cm (a foot) apart. Picture a 30 cm square in front of you, and looking vertically into the pasture, estimate the percentage area covered by plant matter and litter. Tool 6.2 in ***Healthy Soils*** has photos of 20%, 40%, 70% and 90% groundcover to help you estimate groundcover in your pastures.

Walk over the paddock and repeat the assessment at about 20 random sites. Record and average the results to accurately determine the percentage of groundcover.

You can make up a 25cm x 25cm square (quadrat) out of fencing wire or metal rod to help with this. The size isn't important but if you stick to 25 x 25 cm, you can use the same square to assess perennial plant densities.

Pasture mass and feed on offer (FOO)

Pasture mass and Feed on Offer are both terms used to describe how much pasture is present in a paddock. Pasture mass typically assumes 300 kg Dry Matter (0.5cm) is unavailable to sheep, while Feed on Offer includes all above-ground plant material. Thus, estimates of pasture mass are lower than the same estimate of FOO.

Pasture mass and Feed on Offer can be assessed by cutting, drying and weighing representative pasture samples as described in various State PROGRAZE® manuals. However, tools of varying levels of sophistication are also available which save much time in collection, and are considered to be the only practical method for use when day-to-day assessments are being made.

There are five types of tools available to measure pasture mass and feed on offer. [Cautionary note: these tools give an approximation only, and some tools (for example, tools 1 and 3 in the list below) can give misleading results when used on annual pastures that are highly variable in composition, in the early establishment phase of growth, or intensively grazed clover-dominant pastures in spring.]

1. Pasture rulers or 'sticks' that measure green pasture height (in cm) are simple, cheap and easy to use. Heights are easily converted to an estimate of kg green dry matter/ha via look-up tables. The MLA pasture ruler is included with hard copies of this manual. See signposts in procedure 7.2 to order another MLA pasture ruler.

Pasture density also needs to be estimated and used as a correction factor when growing or mature pasture is less than 100% of groundcover. See methodology for assessing groundcover and pasture composition (above) which can be used to estimate the percentage density of pasture. Moisture content will also need to be corrected for.

With experience, you can use the height assessment method to gain reasonably accurate estimates of mass, especially when periodically checked against assessments made by cutting and weighing.

2. Rising plate meters measure total pasture mass, green and dry standing feed, and are based on a plate that rises up a probe depending on the amount of compressed pasture material between the plate and ground. Pasture cuts need to be taken to calibrate the meter.

They are available from a number of commercial outlets, and price generally depends on the degree of automation of collection.

Rising plate meters are generally cheaper than electronic probes, and may be preferable when frequent automated assessment of pastures with significant levels of dry pasture is needed.

3. Electronic pasture probes measure dry matter of green material only. They are quick, easy to use and usually fully automated, including the capacity to directly download readings into office based computers. Some also allow collection of user-defined and read assessments such as groundcover and the plant shape, e.g. flat, upright, etc.

Their accuracy declines if there is any free moisture present in the pasture, eg, after rain or heavy dews.

They are normally the most expensive of the three groups.

Numerous commercially available meters and probes can be found on the internet (search for "pasture + meter"). Most rural merchandisers can also help locate commercially available models.

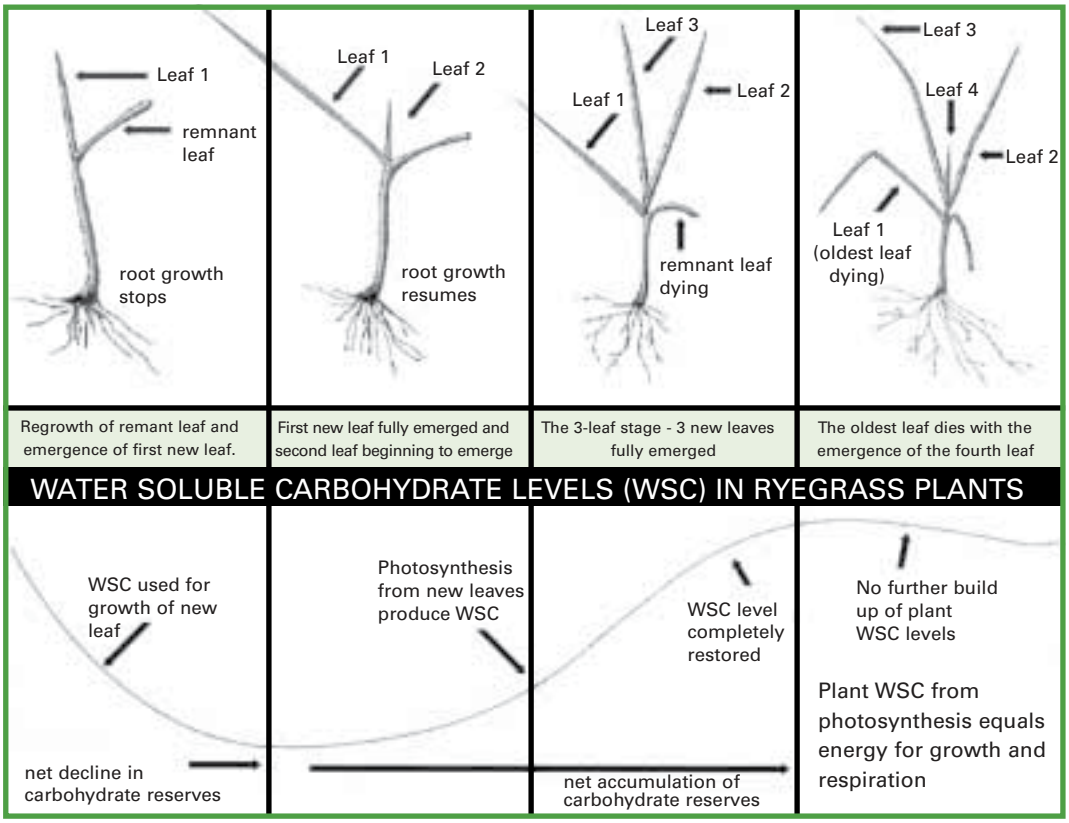
4. Photo standards for pastures are available, and give a good guide to the amount of Feed on Offer in a paddock. Visit www.lifetimewool.com.au/newpastures.aspx

Satellite imaging of weekly pasture growth by annual pastures can be found at: www.pasturesfromspace.csiro.au at either the shire level (free) or paddock scale (by subscription).

Pasture leaf stage

Assessment of leaf stage is made for target species and involves the examination of individual tillers from perennial grass clumps, or annual grasses. To count the number of new leaves on each tiller, inspect at least six plants across the paddock. Don't count the remnant leaf — this is the portion of leaf left from the last grazing, and will be obvious as it will be the one with the tip eaten off. If the paddock has been evenly grazed, the assessment will be fairly straightforward. If the paddock was unevenly grazed, some plants will have more leaf material left behind after grazing.

Regrowth of a perennial ryegrass tiller indicating the correlation between leaf number and levels of water soluble carbohydrates stored in the tiller bases.



Source: MLA More Beef from Pastures

Note: the same principles apply to all grasses, but most perennial pasture species grow four live leaves rather than the three shown here for ryegrass. Many perennial tropical grasses grow six leaves.

Pasture quality

Assessment of pasture quality (energy content) normally requires full laboratory analysis. Field observations provide a useful guide to energy content in MJ ME/kg DM.

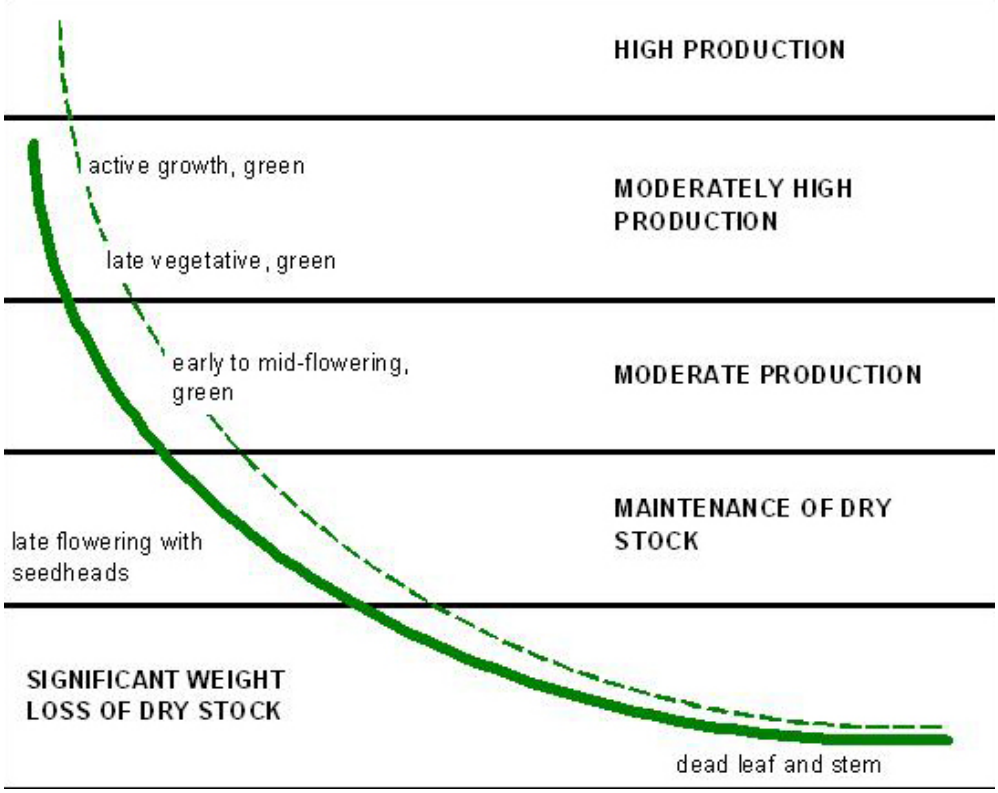
Temperate Pastures.
Actively growing green material is normally in the range of 11.0 to 12.0 MJ ME/kg DM.

Actively growing legumes normally have slightly higher energy content (+ 0.5 MJ ME/kg DM) than perennial grass.

Therefore pasture that is 100% green, has legume and perennial grass composition within the limits of 20 –30% legume and 60–70% grass and the oldest leaf of the dominant grass has not started to senesce can be assumed to have an energy content greater than 11.5 MJ ME/kg DM (M/D). Energy declines as temperate pastures mature.

Tropical Pastures
Tropical grasses mature and digestibility declines more rapidly than in temperate grasses. This means that the 'window' for moderate to high animal production is small without appropriate grazing management and may not be sustained for lengthy periods.

A guide to the decline in digestibility as temperate and tropical pastures mature.



Boschma SP, Lollback M, Rayner AJ (2010) Tropical perennial grasses - pasture quality and livestock production. Primefact No. 1070. (Industry & Investment NSW; Orange). Available at: http://www.dpi.nsw.gov.au/agriculture/field/pastures-and-rangelands/tpg/pasture-quality-livestock-production

Notes

For the most up-to-date Making More from Sheep information, including web signposts, products, publications and events, visit **www.makingmorefromsheep.com.au**

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