Government of South Australia
Adelaide and Mount Lofty Ranges
Natural Resources Management Board

Pastures on small properties

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This fact sheet provides information to help landholders manage their pastures productively and sustainably.

Introduction

Paddocks used for grazing should contain mainly pasture plants with few, or no, weeds (Figure1). While livestock will eat weeds, poor pastures can lead to poor productivity, animal health issues and can lead to soil degradation which can pollute watercourses.

The concept of an ideal pasture will vary between regions. Seasonal variations, soil type and the purpose for which it is being used, will determine what is suitable.

However, pastures should:

- be productive and meet the nutritional needs of livestock
- withstand grazing and persist
- resist disease and weed invasion
- provide good ground cover throughout the year
- not cause livestock health problems.

What pastures to grow?

Most productive pastures are made up of grasses and legumes (e.g. clovers). Grasses produce the bulk of pasture growth during the year, while legumes produce nitrogen which grasses utilise.

Pasture plants can be described as either 'annual' or 'perennial'.

Annual plants survive for only one year and reproduce by setting seed which germinates the following year e.g. Subterranean clover (*Trifolium subterranean*) (Figure 2).

Perennial pastures have deeper root systems, live from year to year, and have the capacity to grow all year if water is available. Phalaris (*Phalaris aquatica)*, Cocksfoot (*Dactylis glomerata*) and Ryegrass (*Lolium perenne*) are common perennial pasture grasses. Rainfall and soil type will play an important part in determining whether perennial or

Figure 1: Highly productive pastures contain few weeds

Figure 2: Subterranean clover (*Trifolium subterranean*)

annual pastures should be sown (or in some cases a mixture of both).

Common pasture plants

Perennial ryegrass (*Lolium perenne*) (Figure 3) is a perennial grass which is native to Europe, Asia and North Africa. It is easy to establish, has good nutritional value and is highly digestible. Unfortunately some cultivars contain an endophyte fungus which can cause 'grass staggers'. Horses and alpacas are particularly susceptible, however it is not usually fatal. Minimum rainfall is approximately 600mm per annum for dryland pasture cultivars (e.g. Avalon and Ellett). Perennial ryegrass is also ideal under irrigation where it can be sown with White clover (*Trifolium repens*).

Figure 3: Perennial ryegrass (*Lolium perenne*)

Phalaris (*Phalaris aquatica*) (Figure 4) is a deep-rooted perennial grass native to the Mediterranean region, which requires at least 450mm rainfall per annum. It is relatively drought tolerant and should persist, provided pastures are not overgrazed. It will persist on a wide range of soil types including heavy waterlogged soils, but it is the most sensitive of the temperate grasses to acid soils, where aluminium toxicity can severely reduce growth. Although the risk is small, livestock may experience staggers when grazing phalaris dominant pastures, which are low in cobalt. Cultivars include Holdfast and Sirosa.

Figure 4: Phalaris (*Phalaris aquatica*)

Cocksfoot (*Dactylis glomerata*) (Figure 5) is a deep-rooted perennial grass which is tolerant of acidic soils. It requires a minimum of 450mm rainfall per annum and will not tolerate waterlogged soils. Cocksfoot does not contain animal toxins and is often recommended as a suitable pasture for alpacas and horses. Cultivars include Currie and Porto.

Figure 5: Cocksfoot (*Dactylis glomerata*)

Other perennial grasses include Tall fescue (*Festuca arundinacea*), Perennial veldt grass

(*Ehrharta calycina*), and salt tolerant grasses such as Puccinellia (*Puccinellia ciliata*) and Tall wheat grass (*Thinopyrum ponticum*).

Native grasses are also worth considering. Kangaroo grass (*Themeda triandra*) (Figure 6) and Wallaby grass (*Danthonia* spp.) can be grazed as long as stocking rates and fertiliser applications are not excessive.

Figure 6: Kangaroo grass (*Themeda triandra*)

Pasture mixes

A mixture of Perennial ryegrass and Subterranean clover (*Trifolium subterranean*) (Figure 7) is traditionally used to produce high quality feed for grazing livestock in areas with at least 600mm of rainfall per annum. In areas with 450mm rainfall per annum Cocksfoot or Phalaris are preferable grasses to use in the Mount Lofty Ranges. The heavier alkaline soils of the Adelaide Plains are often better suited to Annual ryegrasses and Medics (*Medicago* spp.). Always seek professional advice when deciding on a pasture mixture for your property.

Figure 7: Perennial ryegrass and Subterranean clover mix

Assessing pasture quality

It is important to be able to distinguish useful pasture plants from weeds. In some cases there may be insufficient beneficial plants to outcompete weeds. Consequently maintaining adequate ground cover (70% minimum) can become difficult and the risk of soil erosion may increase. If weeds are dominating it may be due to:

- poor grazing management
- low levels of particular soil nutrients
- soil acidity
- poor soil structure.

Before deciding to re-sow a pasture, landholders should determine the density of pasture plants. As a general rule, pastures in high rainfall areas (> 500mm) should have a minimum of 20 perennial grass plants and 60 clover plants per square metre. If this is the case, selectively spraying out weeds, improving soil fertility and adopting a suitable grazing strategy should be undertaken before any thoughts of re-sowing are considered.

Good pastures require healthy soils

Soils are often characterised as being acidic, or alkaline, and measured using the term pH. Pasture production from soils which are highly acidic, or highly alkaline, can decline resulting in severe weed incursions. The pH scale covers a range from zero to 14.0 with 7.0 being neutral. If soils are measured at less than pH 7.0 (in water) they are considered to be acidic. If they are less than pH 5.5 (in water) they are considered to be strongly acidic and can be corrected by the addition of lime (calcium carbonate). The ideal pH range for most plants is from 6.5 to 8.5.

If soil nutrient levels are low it is important to apply fertiliser to counter poor plant growth. A complete soil test will diagnose and monitor the nutrient status of soils and indicate the level of soil acidity (pH). This information will enable a suitable balance of nutrients to be maintained and indicate if lime is needed to correct acidity.

Fertiliser applications

The most common nutrients applied to soils in South Australia are phosphorus (P) and nitrogen (N). Potassium (K) deficiencies are generally rare in South Australian soils, however continual hay production will remove large quantities of this nutrient. Trace elements are required by plants in

only small quantities, but they still have the capacity to severely impact upon the growth of plants. Examples include: copper (Cu), zinc (Zn) and molybdenum (Mo).

Nitrogen Fixation

Poor soil nitrogen is one of the most widespread nutrient problems in South Australia because it is easily leached from the soil. Legumes add nitrogen to soil naturally through a process known as 'nitrogen fixation' which occurs when Rhizobia bacteria in root nodules fix atmospheric nitrogen.

On average, lucerne can add up to 225kg/ha of nitrogen to the soil each year, whilst clover can add approximately 60 to 100kg/ha. To see these nodules, carefully dig up any legume plant such as a clover, bean or pea. Gently wash off the soil to reveal small swellings on the roots (Figure 8).

Figure 8: Legume plant, root nodules

Choosing fertilisers can be confusing, so in order to determine how much of a particular product to add, the 'nutrient analysis' for each fertiliser should be known (see Table 1). This is usually expressed as a ratio. For example, DAP (di-ammonium phosphate) has a ratio of 18:20:0:1.6 where the nutrients are N:P:K:S (nitrogen:phosphorus:potassium:sulphur). This means the product contains 18% nitrogen, 20% phosphorus, 0% potassium and 1.6% sulphur.

It is common to spread fertiliser in Autumn when opening rains occur, however, if cutting pasture for hay, top dressing with a hay boost fertiliser in August will improve productivity.

Table 1: Fertilisers and nutrient analysis

Fertiliser	N:P:K:S*
Conventional	
Super phosphate low analysis	0:8:0:11
Triple superphosphate	0:20:0:0
Urea	46:0:0:0
Sulphate of ammonia	21:0:0:23
Blends	
Super potash 4/1	0:7.3:10:8:5
Blends with trace elements	
Superfect (Cu 1.0%, Zn 1.0%)	1:10:0:10
Organic	
Sheep manure	1.7:0.8:0.6:0.2
Slow release	
Reactive rock phosphate (acid soluble)	0:12.5:0:1.4

* Nitrogen:Phosphorus:Potassium:Sulphur

Improving established pastures

Poor pastures are often the result of landholders ignoring basic management tasks related to soil fertility, weed control and stocking rates. Following a basic management calendar can improve pasture production, carrying capacity and reduce the likelihood of bare ground, which may result in soil erosion (see Table 2).

Establishing a new pasture

In many cases pastures that are weedy and unproductive may not have to be re-seeded. If enough good species are present, careful attention to soil fertility, weed control and appropriate grazing can restore paddock health and productivity without the need to spray out the old pasture and start again.

The first step when deciding if a pasture needs to be re-seeded is to undertake an assessment of good pasture species. (See '*Assessing pasture quality*', Page 3). A professional and experienced consultant can provide help if necessary.

If a pasture is to be re-seeded (Figure 9), landholders require a detailed seasonal action plan covering two years. Inexperienced landholders should consider engaging a professional land management consultant, or agronomist, who will be able to consider local conditions when developing the plan.

Table 2. Pasture management calendar for high rainfall areas (> 500mm)

Month	Activity
January to March	Graze down dry residues to 5cms. Do not overgraze, and maintain 70% cover. Supplementary feed livestock. Soil test paddocks to determine fertiliser and lime application rates. Lime paddocks in March - April, if necessary.
April	Fertilise according to soil test reports. If fertilising close to watercourses, split applications are recommended (half in Autumn and the remainder in late Winter). Control red-legged earth mite, lucerne flea and pasture cockchafer, if present.
May	Inspect for weeds, spray early for broadleaf weeds, if necessary. Control insect pests, if necessary. Graze paddocks using a rotation management system.
June and July	Inspect for weeds, spray for broadleaf weeds, if necessary, and follow instructions for safe applications and livestock withholding periods. Spray for Guildford grass in late July if dense infestations are present. (If spraying for Guildford grass in late July with metsulfuron methyl, pastures may need to be re-sown the following year). Apply 25kg/ha of nitrogen to grass dominant pastures.
August	Apply NPK fertiliser in late august to hay paddocks. Close these paddocks off in early to mid august if cutting hay.
September and October	Watch for insect pests (e.g. lucerne flea and red-legged earthmite) and control if there is a problem. 'Spray top' annual grasses in weedy paddocks (seek professional advice). Hard graze paddocks not cut for hay, especially if weedy.
October and November	Cut pasture for hay or silage. (It is important not to cut hay from the same paddock year after year since this will encourage the build up of annual weeds and reduce the quality of pasture. Hay paddocks should be rotated over a 3 to 4 year cycle). Continue to rotationally graze. Aim to have 10cms of pasture cover by the end of December.
December	Continue to rotationally graze. Always keep 70% cover.

Figure 9: Seeding machine with disc drill suitable for re-seeding pastures

The plan should consider:

- appropriate pasture varieties
- sowing rate
- requirements for inoculation of legume seed
- soil preparation
- time of seeding
- soil testing and fertiliser applications
- correcting soil acidity
- control of pests
- grazing management.

Pest control

Controlling pasture pests, which include insects, mites and weeds, can be a challenge at times. In the past landholders have relied primarily on the use of chemicals, however a much more integrated approach is proving to be environmentally beneficial. A combination of improving soil health, plant competition, biological control and monitoring pest numbers has reduced our reliance on chemicals.

If using chemicals, it is important that landholders have knowledge of the impacts of chemicals on the environment and the user. Registered chemicals will come with detailed technical instructions for crop impacts, application rates, and material safety data sheets which will provide appropriate information for hazard identification, first aid and storage. Always read the label yourself before use. Numerous publications and fact sheets are available to help landholders use chemicals safely (see your local NRM officer to obtain a copy).

The Red-legged earth mite (*Halotydeus destructor*) (Figure 10) is a major pest of pastures, especially Subterranean clover, Annual medics and Lucerne. The use of pesticides such as alpha-cypermethrin (often sold as Fastac Duo) is a common method of control. Typical damage from these mites is seen as 'silvering' or 'whitening' of leaves (Figure 11). It is important to kill adult mites before they are able to lay eggs in Spring which ultimately hatch in Autumn. The optimum dates can be predicted by accessing the TIMERITE website program (www.timerite.com.au). There are a number of biological control agents available, in particular a predatory mite (*Anystis wallacei*), however the dispersal rate for this mite is slow.

Figure 10: Red-legged earth mites (*Halotydeus destructor*)

Figure 11: Red-legged earth mite

Adult lucerne fleas (*Sminthurus viridis*) (Figure 12) are only 3mm long, but can inflict considerable damage to clovers and lucerne. Systemic sprays such as dimethoate can be used when damage is first detected. There are known predators of this pest, but these are unlikely to be an effective control measure on their own.

The larval stage of the Pasture cockchafer (Aphodius tasmaniae) is responsible for damaging pasture. Clovers and ryegrass are particularly susceptible. Larvae can reach 15 to 20mm in length (see Figure 13). Eggs are laid in soil and when larvae emerge during April to August they feed on pasture plants resulting in bare patches

Figure 12: Adult lucerne flea (*Sminthurus viridis*) (Photo courtesy Victorian DPI, Agriculture Note 0415)

Figure 13: Pasture cockchafer (*Aphodius tasmaniae*) grubs can cause severe damage to pastures leaving large bare areas in winter

and exposed soil. In severe cases insecticides can be used since these insects are surface feeders. Avoid spraying after July as larvae will be difficult to eradicate. To confirm that bare patches are the result of the Pasture cockchafer, soil needs to be dug to a depth of 150mm to identify the insect larvae and determine the density of the infestation.

Weed control

Where weed infestations are particularly bad, herbicides may need to be used to control a range of weeds. Spraying annual broadleaf weeds early in the season, when plants are small and lower rates can be applied, encourages more desirable plants to grow without competition from aggressive weeds.

Selective chemicals such as terbutryn, MCPA, diflufenican and bromoxynil are effective against weeds such as Capeweed (*Arctotheca calendula*) (Figure 14), Salvation Jane (*Echium plantagineum*), and Storksbill geranium (*Erodium* spp). MCPA and 2-4D amine can be used on their own, but they are more effective if cattle or sheep are grazed after spraying. This technique is known as 'spray-grazing'. Care must be taken when undertaking this form of weed control since it can lead to livestock poisoning. Seek advice from your local land management consultant, or agronomist, before embarking on this approach.

The process known as 'spray-topping' can help to reduce the amount of annual grasses such as Barley grass (*Hordeum* spp). It relies on spraying the chemical glyphosate onto plants at very low rates in order to kill the young seeds which are forming in Spring. The low rate means good pasture species are not destroyed and far less viable seed is left to germinate in Autumn. This technique is not easy, so inexperienced landholders would be well advised to seek professional help.

Biological control can be used as part of an integrated weed management program. In the case of Salvation Jane effective control can take up to ten years. There are four main insects that are the focus of Salvation Jane biological control. The Crown weevil larvae attack the growing crown of the plant, whilst the Root weevil larvae feed on the taproot, effectively "ring-barking" the root. The flea beetle larvae also attack the primary and secondary roots, and the pollen beetle reduces the amount of seed set.

Grazing strategies

Trying to maintain a good pasture on a property with only one paddock is difficult because the pasture can never be rested. In addition, livestock will graze selectively (eating the most palatable pasture species first) which encourages weeds. Dividing a property into four or six paddocks will increase grazing pressure and enable stock to be moved on when the pasture is low (ie 5cms). During growing seasons pastures should be rested when plants are 3 to 5cms in height, and grazed again when plants have grown to approximately 12cms. This process is known as 'rotational grazing' and can also be adopted by using a single electric wire allowing for strip grazing. Separating small groups of animals into each of the paddocks is not recommended, unless they are different species (ie horses graze the paddock first, followed by a mob of sheep).

Fodder conservation

Excess pasture can be preserved as hay or silage. Once perennial grasses begin flowering in Spring, pastures are generally at their optimum for quality and quantity, and can be preserved as hay (Figure 15

Figure 14: Capeweed (*Arctotheca calendula*)

Figure 15: Small bales are more easily managed on properties with limited farm machinery

CONTACT US

Eastwood

T: 8273 9100

E: reception@adelaide.nrm.sa.gov.au

Gawler

T: 8523 7700

E: gawler.office@adelaide.nrm.sa.gov.au

Lobethal

T: 8389 5900

E: lobethal.office@adelaide.nrm.sa.gov.au

Willunga

T: 8550 3400

E: willunga.office@adelaide.nrm.sa.gov.au

www.amlrnrm.gov.au

Figure 16: Hay making will preserve quality feed for Summer and Autumn

Figure 17: Individual silage bales

Figure 18: Paddocks should never be bared to this extent due to land degradation issues in an extreme event (rainfall and wind)

Figure 19: Grazing off rank dry pasture will allow clovers to establish well in Autumn

and Figure 16). Late October to early November is usually the time for most pastures to be cut for hay in the Mt Lofty Ranges.

Silage is made from green pasture or fodder crops and is cut earlier than normal hay. The plant material is preserved by a process of bacterial fermentation where sugars are converted to lactic acid. This process usually takes about two weeks. Traditionally silage was placed in large heaps on the ground and rolled by a tractor to push out all the air, then covered by a plastic sheet held down by recycled tyres. However, storing silage as individual bales has become more popular (Figure 17). In this case pastures are cut when plant dry matter is around 60 to 70%. The bales are wrapped tightly in plastic wrappers to exclude oxygen, and the material then goes through a limited fermentation.

Managing pastures in drought

Pasture production is heavily reliant on the amount of rain that falls during Autumn, Winter and Spring. In times of drought, pasture feed can be drastically reduced (Figure 18) and livestock will need supplementary feed. Even so, 70% ground cover should be maintained at all times and paddocks should still be rotationally grazed to five centimetres in height. Removing dry, rank pasture will allow good pasture establishment following Autumn rains (Figure 19).

However, in times of drought, paddocks can quickly become bare. If reducing stock numbers is not an option, establishing a small sacrifice paddock as a 'drought lot' should be considered. This paddock should be well fenced and provide animals with adequate room, water, feed, and shelter from wind and sun. In addition, manure management will need to be considered in line with EPA (Environmental Protection Agency) requirements. The site chosen for a sacrificial paddock should have a low erosion risk, be at least 50 metres from any watercourse (wet or dry) and have a slope of no more than 8%. A sacrificial paddock should not be used more than two years in five. Monitoring the condition of all stock is important when supplementary feeding. Feed ration tables are available for all classes of livestock to assist landholders maintain stock in appropriate condition.

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