How do I ...

optimise perennial grass management in late spring and summer?

A RESOURCE FOR ADVISORS

The issue:	The productivity and persistence of pastures is influenced by the management of perennial grasses in summer and during their reproductive period. The necessary interventions, including grazing periods, differ between species depending on weather patterns and if species are summer active.
The impact:	Incorrect grazing management will lead to plant loss during hot dry summers or, alternatively, loss of productivity for summer-active species. Under-grazing in late spring and summer leads to wasted pasture, while dead plant material restricts new growth and reduces overall herbage quality. Over-grazing during the reproductive growth phase maximises pasture utilisation, but can reduce summer survival.
The opportunity:	Understanding the grazing requirements of different species and their varied growth behaviours allows for better management for persistence and production.

Four introduced temperate perennial grasses are the backbone of pastures in southern Australia: perennial ryegrass *(Lolium perenne)*, phalaris *(Phalaris aquatica)*, cocksfoot *(Dactylis glomerata)* and tall fescue *(Lolium arundinacea)*.

While these species share some commonalities in grazing requirements, there are important differences. This fact sheet covers the main principles of perennial grass survival and the implications for grazing management, from reproduction to the autumn break.

How you manage the grazing of pastures over summer can impact the persistence and productivity in following seasons.

Consideration of the environment and species adaptations

The grazing requirements of perennial grasses during spring differs in summer-moist compared with summer-dry environments. While interventions to fully utilise spring feed, extend vegetative growing conditions and prevent weeds from seeding are the right approaches for summer-active species in moist environments, this strategy can be detrimental to summer-dormant perennial grasses, which employ survival strategies during reproductive growth.

The mismatch between the genetic makeup of a plant (genotype) and the environment in which they are grown is also a common reason for poor persistence. Plant varieties should be selected using considerations such as:

- timing of the season's finish, as plants need to complete flowering before moisture becomes limiting
- rooting depth, which allows access to deeper soil moisture once topsoils become dry
- length of time between rain events, as even dormant plants rely on deep-stored moisture for survival
- likelihood of summer rain which can trigger a premature growth response, depleting stored energy reserves.

Other conditions encountered during the growing season can influence the extent of root development leading into summer, such as:

- low soil pH and associated high aluminium (Al) level
- waterlogging
- low soil fertility
- pest and disease damage.

Fortunately, there are broad differences between the four perennial grasses (Table 1), as well as subtle differences within species, which can be utilised in selecting appropriate species/varieties for the environment.

What are summer-active species and cultivars?

Summer-active species respond to summer rainfall. These include some perennial ryegrass, tall fescue and cocksfoot types (Table 2). Perennial ryegrass will normally respond to summer rainfall, but growth is reduced at high temperatures (30–35°C). If summers are reliably wet and spring feed can be utilised, then choosing perennial ryegrass cultivars with late or very late heading dates allows vegetative growth to extend into summer, taking full advantage of spring conditions.

Both tall fescue and cocksfoot have different growth types based on genetic origin. Summer-active types in tall fescue are referred to as 'continental' types as opposed to 'Mediterranean' types, which show more winter activity. In cocksfoot, subspecies glomerata, or temperate types, show summer growth activity, as opposed to subspecies Hispanica or Mediterranean (warm-season types). Cocksfoot can also have intermediate types which share characteristics of both types.

Summer-active tall fescue.

Table 1. Tolerance of pasture species to environmental stresses.

Species	Perennial ryegrass	Phalaris	Cocksfoot	Tall fescue
Hot, dry (summer)	X	✓✓	✓	✓✓*
Waterlogging (winter)	✓	✓✓	X	✓
Soil acidity (high Al)	✓	X	✓✓	✓
Soil fertility (low)	X	✓	✓	✓
Insect attack	X	✓	✓	✓

** Summer-dormant varieties*

NB. The more ticks the more tolerance. Al (aluminium).

Table 2. Examples of suitable pasture grasses for summer-moist environments.

Perennial ryegrass cultivars with suitable heading dates		Tall fescue continental types with suitable heading dates		Cocksfoot types
Late AberMagic Φ Base AR37 Φ Expo AR37 Φ Halo AR37 Impact 2 NEA2 Φ One50 Φ Platinum Φ Rohan NEA2 Φ Viscount NEA (PBR pending)	**Very late** Bealey NEA2 Φ	**Early maturing** Hummer Φ Max P® Quantum Quantum II Φ MaxP® **Mid maturing** Demeter *(certified seed no longer available)* Pastoral Φ SF Finesse-Q® SF Nouga®	**Late maturing** Martin 2 Tower	Aureus Φ Drover Φ Howlong Megatas Oxen Porto *(certified seed no longer available)* Safin Savvy Φ SF Oasis® SF Lazuly SF Beverly Vision Wana Φ Yarck

Φ *Plant Breeder's Rights (PBR)*

Phalaris is not included in Table 2 due to its tendency for summer dormancy.

Based on Australian Seed Federation database.

Grazing requirements of summer-active species in wet environments

All perennial plants produce reproductive tillers in late spring and possibly early summer with late-flowering varieties. The retention of mature reproductive tillers in summer-active perennials reduces the ability of the plant to grow new leaves, as energy is directed towards seed production.[1]

In summer-moist environments, removal of seed heads at flowering (anthesis) is beneficial.

Continental tall fescue types produce buds on the base of reproductive tillers in spring/early summer which shoot to provide summer production. However, these buds only survive if the reproductive stems are removed before they flower. Hence, if stems are kept, the summer tiller production is reduced.[2]

Tall fescue plant with bud in tiller base.

Implication for grazing management

For environments where summer moisture is common – grazing heavily, delaying reproductive growth or removing reproductive stems before they produce seed heads is recommended, as it encourages new vegetative growth. However, if rain does not occur these vegetative tillers are unlikely to survive. Perennial ryegrass is particularly at risk as it lacks deep roots and drought tolerance, compared to tall fescue and cocksfoot.

What are summer-dormant species and cultivars?

Summer-dormant species show little response to summer rainfall. Not responding to rainfall means fuel reserves to grow a new leaf are not drawn upon. This aids survival. Other summer survival attributes include deep roots, the transfer of water-soluble carbohydrates to the growing points and roots, dehydration tolerance and production of dormant buds.

Perennial grasses which show summer dormancy will grow mainly in winter or early spring and are often referred to as winter-active types. Some winter-active perennial grasses can have complete dormancy or conditional dormancy, which can be broken by large incidental rainfall events. Phalaris, tall fescue and cocksfoot have varieties with partial and complete summer dormancy. Perennial ryegrass has conditional dormancy (Table 3).

The degree of summer dormancy varies between phalaris varieties. Phalaris will have strong summer dormancy in hot, dry environments, but dormancy can be broken by summer storms and cool mild temperatures. Therefore, phalaris can still produce reasonable growth in summer.

Table 3. Examples of perennial grasses for summer-dry environments with different levels of summer dormancy.

Level of summer dormancy	Phalaris		Perennial ryegrass	Tall fescue Mediterranean types	Cocksfoot temperate types
Partial, until rainfall occurs	**Semi winter dormant** Australian Australian II Australis® Grazier Uneta	**Winter active** Advanced AT Ⓟ Amplify Ⓟ Confederate Ⓟ Holdfast Holdfast GT Ⓟ Landmaster Lawson Ⓟ SF Maté Sirolan Sirosa Stockman Ⓟ	All varieties and cultivars		Currie *(certified seed no longer available)* Gobar
Strong dormancy, less rainfall responsive	**Winter active** Atlas PG Horizon Ⓟ			Anywhere Ⓟ Charlem Ⓟ Flecha Ⓟ Fraydo Ⓟ Prosper Ⓟ SF Medallion® Temora Ⓟ	Kasbah Sendace Uplands Ⓟ

Ⓟ *Plant Breeder's Rights*

Based on Australian Seed Federation database.

Grazing requirements of summer-dormant/ winter-active grasses in dry environments

Dormancy is optimised if plants can flower. It is critical for regrowth the next autumn. Tiller and bud formation during spring is described in the fact sheet How do I get perennial grasses to thrive and survive?

In phalaris, the degree of stem elongation is related to the formation of dormant buds. In hotter, dry environments north of the divide, it is recommended phalaris is spelled to allow seed head development. However, south of the divide in milder environments, no special grazing strategies are required, as in most seasons, feed supply outstrips demand and reproductive seed head development occurs.

Implication for grazing management

Allow winter-active grasses to flower in summer-dry environments. It is beneficial for dormant bud development and can help species like perennial ryegrass and cocksfoot to seed and recruit seedlings in the following autumn, thereby increasing pasture density.

Commonalities in grazing requirements

Regardless of the winter or summer activity of perennial grasses, there are some common growth principles and subsequent grazing rules which apply.

PRINCIPLE
Reproductive structures retard the emergence of new vegetative tillers.

The removal of dead seed heads over summer is important to maximise plant regrowth. Plants perceive light quality within their growing points and shading by excessive dead plant material and old seed heads will limit tiller emergence in autumn. See MLA fact sheet: How do I remove excess mature reproductive pasture?

An example of dead seed heads (along fence behind grazed phalaris) which can limit the emergence of new tillers, such as those seen in the grazed area.

Implication for grazing management

Ensure excessive reproductive tillers are removed by the end of summer to maximise new tiller regrowth after the autumn break.

PRINCIPLE
When a plant is grazed, it uses its 'fuel reserves' (water-soluble carbohydrates in tiller bases) to try to regrow a new leaf.

Conditions which create stress on vegetative tillers over summer (very hot temperatures, limited soil moisture and repeated grazing), can result in tiller death, especially if they occur concurrently. Unseasonal rain sufficient to trigger some leaf emergence in summer-responsive varieties and cultivars, but not enough to enable replenishment of reserves, followed by grazing of the green pick, can also lead to losses.

Implication for grazing management

Avoid high grazing pressure (herbage mass below 1,000kg DM/ha) in summer as this will reduce vegetative tiller survival. Pasture species which have 'greened up' in response to summer rainfall (broken dormancy) are vulnerable to overgrazing. Closely monitor and avoid grazing until the full complement of leaves (three to four leaves depending on species) has been grown to replenish reserves. If this is not possible, then a rapid grazing followed by a long period of spelling is required. Do not continuously graze. Short grazing periods are important to maintain plant persistence.

Ensure phalaris, which has greened up following rainfall, has restored fuel reserves by growing back its full complement of active-growing leaves (four) following grazing.

Individual species' grazing requirements

There are additional important differences in growth of individual species during flowering and summer which influence their management.

Perennial ryegrass

Perennial ryegrass is only medium to shallow-rooted (about 0.7–1.2m) in comparison to tall fescue and phalaris (1.4–1.5m). This means access to deep soil water is reduced.

The survival of vegetative daughter tillers produced in spring/early summer is highly dependent on summer moisture. They will die quickly if under moisture stress. If they survive until autumn, they can produce further daughter tillers when there is adequate moisture.

Reproductive tillers with associated vegetative buds have a conditional dormancy. While this makes them more robust than vegetative daughter tillers, they only remain dormant in the absence of rainfall. Summer rain will trigger their growth, meaning tillers formed from these buds are most likely to survive if they shoot after the hottest, driest period in late summer.[3]

Perennial ryegrass endophyte is a tiny fungus which lives inside the plant but cannot be seen by the naked eye. Ryegrass infected with endophytes shows improved seedling establishment, increased herbage yields and increased persistence. This is due to endophytes producing chemicals which deter many insect pests (weevils, root aphids, nematodes, cockchafers, black field crickets and caterpillar-type pests). Some of the alkaloids produced by naturally occurring endophytes (wild types) under certain seasonal and grazing conditions can also be toxic to stock and can cause the condition known as ryegrass staggers.[3] Livestock grazing perennial ryegrass in late summer or early autumn can occasionally develop it, but the occurrence is highly variable. Low-toxicity, endophyte-infected seed is available to reduce the impact of ryegrass staggers.

Implication for grazing management

Reduce grazing of perennial ryegrass where possible over summer. If grazing is required, aim to apply short periods of intensive grazing followed by an extended period of rest, particularly when there is some plant growth.

Employ seedling recruitment strategies on an occasional basis to increase ryegrass density.

If ryegrass staggers occur, stock should be quietly moved (avoiding stress) to safe (non-ryegrass) pastures until toxicity subsides.

Phalaris

Phalaris has high drought tolerance through its formation of dormant buds. The plant also has a deep root system which provides the dormant buds with moisture. High levels of bud dormancy and deep roots allow phalaris to survive drought.

Subsoil acidity with associated aluminium toxicity (exchangeable Al greater than 5–10%) causes root pruning, cutting off access to deep soil water. This inadvertently results in the death of dormant buds.

Where natural subsoil acidity exists, consider using plants tolerant to high aluminium levels. Good liming practices (regular liming to maintain pH ($CaCl_2$) above 5.5), can help address acidity within the topsoil and over time, gradually treat deeper soil acidity.

Dormant buds on phalaris.

Implication for grazing management

Allow stem elongation of phalaris during reproductive development to encourage dormant bud formation. In southern, cooler summer areas, pastures tend to run to head under most spring stocking rates, however in northern, drier areas, phalaris may need to be spelled to encourage formation of reproductive stems.

Rotational grazing over summer is possible, given a suitable period of spelling is provided.

Tall fescue

Mediterranean-type cultivars are more drought tolerant than continental types and use the following strategies to greater degrees:

- dehydration strategies during water deficits in summer
- summer dormancy
- reduced above ground herbage
- increased root:shoot ratio
- reduced growth rate to survive over summer.

Tall fescue produces rhizomes at flowering which helps with plant expansion. See fact sheet How do I get perennial grasses to thrive and survive? A resource for advisors.

Implication for grazing management

Where continental types are grown and if dry conditions occur over summer, spell the pasture to assist survival.

Relaxed grazing pressure during flowering can increase production of rhizomes, which help increase tall fescue density if desired.

Cocksfoot

Cocksfoot has deep roots which help it survive, however it has a lower proportion of live roots than phalaris prior to the autumn rains and a substantial new root system is not regenerated until it develops daughter tillers – about one month after initial rains. This puts plants at risk of being pulled out by grazing stock.[4]

There is evidence that summer closure of cocksfoot-based pastures to grazing, can increase cocksfoot frequency due to greater root development and recruitment of new plants.[5] High grazing pressure resulting in less than 1,000kg DM/ha in summer was found to be a critical factor in poor cocksfoot persistence in trials across five locations in Australia.[6]

Implication for grazing management

Avoid grazing cocksfoot in summer and early autumn, unless plants are well anchored. Summer spelling of cocksfoot pastures has been found to increase plant density.

Mediterranean tall fescue pasture (winter active) becomes dormant, helping it survive during summer.

Ensure cocksfoot and perennial ryegrass (pictured) are well anchored before grazing in autumn to avoid being pulled out by grazing stock.

Acknowledgments and more information

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