Chapter 7
Native perennial pastures

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Roy Butler (DAFWA): page 177; Peter Maloney (DAFWA Image Resource Centre): page 182; Geoff Moore (DAFWA): page 183; John Schneider (DPI Victoria): All photos in sections 7.1, 7.2, 7.4, 7.5, 7.6 and 7.7.
Native perennial pastures
Richard Bennett and Meredith Mitchell

The use of native perennial plants in pastures is gaining popularity in the eastern States of Australia. Their use in WA has so far been limited, however they could offer similar advantages to WA farmers as to their eastern States counterparts.

In this section we describe some native perennial species that are persistent, productive, drought-tolerant and can be sown or encouraged in low input pastures to improve productivity if managed appropriately.

The major advantage of native plants is their adaptation to local environmental conditions such as low rainfall, infertile soils and acid soils. Native-based pastures are generally considered to be less productive than introduced pastures but their adaptation can enable them to be more productive and persistent than introduced species in marginal areas or in difficult situations. Even in areas where introduced pastures are productive, native pastures can offer the advantages of lower input (fertiliser) requirements and more sustainable, resilient pastures.

In addition to their hardiness, native grasses can offer an alternative source of income from the collection and sale of seed, which can be relatively expensive. Licences to collect and sell seed from native plants on private property can be obtained from the Department of Environment and Conservation (www.naturebase.net/plants_animals/watscu_licensing.html) and seed can be sold to commercial suppliers or local parties. No licence is required to collect seed of non-registered cultivars on private property for non-commercial uses, provided the permission of the landholder is obtained.

An impediment to the productive use of native pastures is a lack of knowledge about their characteristics, establishment, management and harvesting. Farmers considering investment in native pastures need to be innovative, prepared to take some risks and observant.

There are many perennial species native to Australia that can be used as fodder plants. Some of these species are naturally abundant in protected areas of the WA wheatbelt and require simple changes to pasture management to become established and persist. Cultivars of some native grasses have been developed for specific traits and purposes, however seed can be expensive for broadacre use.

Species from the wheatbelt of WA that show some promise in pastures are: wallaby grasses (Austrodanthonia spp.); windmill grass (Chloris truncata); common wheat grass (Elymus scaber); curly windmill grass (Enteropogon ramosus); weeping grass (Microlaena stipoides); mulla mulla (Ptilotus polystachyus); and kangaroo grass (Themeda triandra). Suitable species that are available as cultivars are common wheat grass, wallaby grasses, kangaroo grass and weeping grass.

Establishment
Difficulties in establishing native pastures mean that it is most profitable when they are used in permanent pastures or long pasture rotations. There are two approaches to establishing native pastures. Where available, seed can be used to sow a pasture. Good weed control before sowing is essential since most native plants have limited or nil herbicide tolerance. Notable exceptions are windmill grass and weeping grass, which have moderate herbicide tolerance. Specialised machinery is usually required for sowing native grasses since the seeds can possess hairs, bristles or awns that cause seeds to clump and prevents accurate metering. Broadcasting by hand can be effective for establishing small areas.

Where native pasture species occur in the immediate area, the best form of establishment is natural regeneration. This process, although slower than sowing seed, is a low cost way of developing native pastures and can lead to a more resilient pasture in the long-term. Look out for the occurrence of useful native species in undisturbed or neglected corners of paddocks or in protected remnants such as tree lines or rock outcrops. It is likely that native grasses are already common on many farms and simple management changes can enable them to spread into new areas of the farm. Developing pastures should be allowed to set seed and grazing should be relatively light for the first few years. Windmill grass, curly windmill grass and wallaby grass are the most widely and commonly distributed in the WA wheatbelt.
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Native pastures are best suited as a component of a pasture mix, rather than as a monoculture. Consider a system where annual legumes are grazed hard in early spring, enabling native C4 grasses to grow over spring and summer. Mixtures of C3 and C4 native grasses can also be effective.

Grazing management

Grazing management differs between native species. Some species respond well to grazing, increasing in density while other species can be grazed out in poorly managed pastures. As with most perennial grasses, older foliage may have a low palatability to stock and slashing or burning may be required to generate desirable new growth. For this reason, heavy stocking for short durations is recommended for most species (see species descriptions). Grazing may need to be more frequent at certain times of the year and should be avoided when the pasture is seeding heavily.

Case studies

Mike and Jeanette Buegge noticed considerable windmill grass growing in a 40 ha paddock that had been continuously cropped for three years. When they realised that pure seed could be worth harvesting and selling, they developed a system to generate three sources of income.

First, Mike finds the windmill grass reasonably easy to harvest with a conventional header. Harvest from about 20 ha in February 2000 produced about 1 tonne of reasonably pure seed. Mike estimated that about 25% of the seed is recovered using the conventional header.

Second, they are able to over-sow crops in the windmill grass paddock using no till points and a conventional herbicide regime. There has been no indication of crop yield penalties compared with the rest of the farm. This is attributed to the winter dormancy of windmill grass. In addition, the early growth of the windmill grass before the crop is harvested suppresses the growth of summer weeds like caltrop and paddy melons.

A third source of income is generated from the use of the paddock as a summer pasture to fatten wether lambs. Usually the paddock is stocked at 7.5 lambs/ha straight after harvest. During 2000 the sheep gained 2-3 kg/week over the three months they were grazing the windmill grass paddock. Before the windmill grass pasture, the area would have been grazed for only one month.
7.1 Common wheat grass \textit{(Elymus scaber)}

**Features**
- tussocky perennial
- good palatability and feed quality
- suited to a wide range of soil types and acidity conditions
- frequent recruitment.

Common wheat grass is a tussocky cool-season perennial found in all Australian States, but is more common in districts with cool winters. Within WA, it is sparsely distributed throughout the wheatbelt, from as far north as Geraldton and east to Kalgoorlie. Common wheat grass is found on various soil types from sands to clay-loams. It will tolerate mildly acidic to alkaline soils. It is one of the first native grasses to start growing in spring, providing early green feed. There is considerable variation within this species. Common wheat grass is usually a minor component of native regenerated pastures and therefore only makes a small contribution to total pasture production.

**Seasonal growth pattern**
Temperate (C3) perennial grass – winter productivity depends on temperature. It flowers from late winter into summer.

**Establishment**
Wheat grass is easier to establish than most other native grass species. The seed heads should be clipped into individual florets, each containing one seed. Preferred depth for sowing is around 10 mm in autumn to early winter. With moist conditions, the seed takes 7-10 days to germinate. The seedlings are hairy and bluish in colour. They progress rapidly through to the 5-7 leaf stage. Seed should be sown at a rate of between 8-10 kg/ha.

**Livestock disorders**
None reported.

**Description**
- tufted perennial, 30-60 cm high
- green flowers, bronze when mature
- leaf blades are narrow with rough edges
- seed heads are 15-25 cm long, narrow and rough to touch.
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Management
Dry matter yields of 3-7 t/ha have been recorded. Common wheat grass is a palatable species and can be grazed preferentially and lost from a pasture. Rotational grazing is the best method to maintain this grass in pastures.

Companion species
Unknown.

Cultivars
Currently there are two cultivars of common wheat grass commercially available, both developed from the LIGULE program.

‘LIG 363’ (public variety) was selected from wheat grasses found on the higher tablelands of NSW. It is adapted to cooler conditions with slightly higher rainfall.

‘LIG 473’ (public variety) was selected from wheat grasses occurring in the wheat-sheep zone and is better adapted to warmer and drier conditions.

Soil–climate adaptation
Rainfall: >350 mm
Drought tolerance: Moderate
Frost tolerance: High
Soil type: Wide range
Soil fertility requirements: Medium
Soil pH_{Ca^2+}: >4
Aluminium tolerance: Sensitive
Waterlogging tolerance: Unknown
Salt tolerance: Nil
Nutritive value
DMD: 53-90% 214, 419
Crude protein: 10-36% 214, 224
7.2 Curly windmill grass (*Enteropogon ramosus*)

**Features**
- densely tufted perennial
- moderate palatability and feed quality
- old leaves are curly
- seed head with radiating spikes in several planes.

Curly windmill grass or spider grass (formerly *E. acicularis*) was once the dominant species of the drier parts of many types of grassland but is now confined to protected remnant areas. Within WA, curly windmill grass is distributed widely from north to south and into the interior. It is generally found in undisturbed, protected areas such as tree lines or roadsides in the wheatbelt. Characteristic features are the seed head with spikes radiating from the top of the stem in several planes and the tightly curled old leaves. Although slower to respond to summer rainfall events than windmill grass, curly windmill grass is much more persistent, deep-rooted and drought-tolerant. This species is generally considered to have low to moderate forage quality.

**Seasonal growth pattern**
A warm season (C4) grass that grows actively during spring and summer when moisture is available. It flowers from summer through to autumn and is a valuable fodder in early summer.

**Establishment**
Curly windmill grass seed should be sown on or just below the surface, no deeper than 5 mm. It is best to sow in late winter to early spring, when soil moisture is available. Good weed control or heavy grazing is recommended prior to sowing.

**Livestock disorders**
None reported.

**Description**
- tussocky, perennial grass with a sprawling habit, 25-60 cm tall
- leaf blades folded in the bud
- leaves flat, old leaves curled or spiralled
- purple inflorescence of 2-14 spikes stiffly radiating from central stem in several planes
- leaves are often bluish-green in colour.
Native perennial pastures

Management
Annual dry matter production ranges from 0.7-1.5 t/ha. Curly windmill grass is of most value over the summer months, particularly before the seed heads form. Young plants are moderately palatable, but plants that have been left ungrazed can become harsh and may be ignored. Heavy stocking rates may eliminate this grass from a pasture but light stocking will stimulate growth and dispersal. It responds well to increased soil fertility.

Companion species
Windmill grass is a good companion for curly windmill grass, as windmill grass responds much more rapidly to rainfall, but it is less persistent. Curly windmill grass would also complement annual legume-based pastures.

Cultivars
Currently there are no cultivars of curly windmill grass commercially available.

Soil–climate adaptation
Rainfall: >300 mm (will persist in lower rainfall areas)
Drought tolerance: Very high
Frost tolerance: Moderate
Soil type: Sandy loams to fine-textured soils
Soil fertility requirements: Low
Soil pH<sub>Ca</sub>: >4.5
Aluminium tolerance: Unknown
Waterlogging tolerance: Moderate to high
Salt tolerance: Nil
Nutritive value
DMD: 46-66%<sup>56, 214, 419</sup>
ME: 8.4-9.6 MJ<sup>214</sup>
Crude protein: 5-13%<sup>214, 322</sup>
7.3 Green mulla mulla (*Ptilotus polystachyus*)

**Features**
- deep-rooted ephemeral or short-lived perennial
- tolerant of low nutrition and acid soils
- productive, with prolific seed production
- can contain moderate to high nitrates.

Green mulla mulla is a short-lived or opportunistic perennial herb. Its natural distribution extends over the majority of Australia except for northern Queensland and the high rainfall zones of New South Wales, southern Western Australia and Victoria. Green mulla mulla is very palatable to cattle and sheep, particularly when green. It is very productive, seeds freely and is naturally abundant in wheatbelt areas with low rainfall and deep, nutrient-poor acid sands. Its upright flowering stems may make harvesting with a conventional header possible. Research on the agronomic traits of green mulla mulla and its potential for wide scale use in southern Australian agriculture is underway.

**Seasonal growth pattern**
Green mulla mulla grows mainly during spring and summer and is dormant in winter. Flowers are produced year-round but are prolific in mid-summer.

**Establishment**
Seed can be threshed to remove woolly flower parts and improve germination. Naked seed should be sown no deeper than 10 mm and un-threshed seed can be sown on the surface. Sowing rates have not been determined, but about 3 kg/ha of naked seed should be sufficient. The best time to sow is in late autumn with stock excluded until the plants are well anchored.

**Livestock disorders**
Green mulla mulla accumulates large amounts of nitrates and can pose a danger to livestock at times of year when nitrate accumulation is at a peak. Key factors increasing the chance of excessive nitrate accumulation are weather conditions that limit plant growth (drought or cool, cloudy weather) and high levels of available nitrogen in the soil. Nitrate concentrations are usually higher in the lower third of the plant stems. Management practices that reduce the risk of nitrate poisoning of livestock include: allowing

**Description**
- upright, spreading herb to 140 cm
- many green to brown flowers in terminal spikes to 20 cm long
- variable species with regard to growth form, leafiness and seeding characteristics.
at least 14 days after drought breaking rains before grazing; avoiding heavy applications of fertiliser before grazing and lighter stocking rates or shorter grazing periods of green mulla mulla pastures to allow animals to select plant matter lower in nitrate content. Recent tests on field harvested material have shown levels of nitrate of 600-4,800 mg/kg. High values were found in large plants at advanced seeding stage. At the highest reported level, green mulla mulla intake should be limited to less than one fifth of overall dry matter intake.

Management
Young plants are very palatable and will be killed by over-grazing. Older plants seem to be more resistant but can still be killed. Heavy grazing for short periods is expected to produce the best results. Grazing should be monitored carefully and old plants grazed before new recruits germinate in autumn or slashed to promote fresh, palatable growth.

Companion species
Green mulla mulla should be suited to a companion pasture of annual legumes or perennial grasses with similar management requirements like kangaroo grass, although this has not been tested.

Cultivars
Currently there are no cultivars available.
**7.4 Kangaroo grass (Themeda triandra)**

**Features**
- tall, tufted perennial
- moderate palatability and feed quality
- tolerant to soil acidity.

Kangaroo grass is one of Australia’s most widespread species, extending from the arid interior to alpine regions. Although once common throughout Australia, its persistence has been heavily affected by grazing animals, indicating a lack of tolerance to heavy grazing. It is a drought-resistant, deep-rooted, warm-season perennial grass with a tussocky habit. The leaves are long and thin and turn from green to red/brown/purple as they mature. Kangaroo grass flowers throughout summer and has attractive rusty-red seed heads on 30–50 cm long inflorescences with dark nodes. The seed heads have a distinctive shape. Kangaroo grass becomes dormant during winter. The grass is more common in areas that are not heavily grazed, like roadsides.

**Seasonal growth pattern**
Warm season (C4) grass growing actively from mid-spring. Summer-autumn growing, with winter dormancy. It flowers from summer to autumn.

**Establishment**
Kangaroo grass seed requires shallow sowing, 5-10 mm deep. The seed needs to stay moist for about a week for it to germinate. No fertiliser is needed at sowing, but the seedbed should be free of weeds and not too finely tilled. Seed germinates readily in spring and summer when the air temperature is >25°C and soil temperature is >20°C. A sowing rate of 5 kg/ha for pasture is recommended.

When collected or harvested on-farm, seed stored for 12 months will have higher germination than fresh seed.

**Livestock disorders**
None reported.

**Description**
- densely tufted, tussocky habit to 120 cm
- long (to 50 cm) inflorescence with distinctive seed heads
- seeds large (to 10 mm) and shiny black
- older leaves have red/brown tinge.
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Management
The annual dry matter production for kangaroo grass can range from 1.6 to 8.3 t/ha depending on the climate and age of the plants.\textsuperscript{214, 323} The plant density increases under regular burning (autumn) and light stocking.\textsuperscript{225, 276} Kangaroo grass requires rotational grazing and does not persist under set-stocking. Kangaroo grass is best grazed over summer when the grass is actively growing. It responds well to being rested over winter.

Companion species
Unknown.

Cultivars
Currently there is only one cultivar of kangaroo grass that has been selected for pastoral use. ‘LIG 520 Kangaroo grass’ (public variety) was selected by LIGULE for long-term persistence and high productivity.\textsuperscript{214} It is suited to grazing by sheep and cattle.

Soil–climate adaptation

Rainfall: >350 mm
Drought tolerance: Very high
Frost tolerance: Low to moderate
Soil type: Sandy loams to fine-textured soils
Soil fertility requirements: Low
Soil pH\textsubscript{Ca}: >4.5
Aluminium tolerance: Very highly tolerant
Waterlogging tolerance: Nil
Salt tolerance: Nil

Nutritive value
DMD: 55-75\%\textsuperscript{12, 214}
Crude protein: 5\% (winter) to 17\% (summer)\textsuperscript{214}
7.5 Wallaby grass (*Austrodanthonia* spp.)

**Features**
- tufted perennial
- good palatability and feed quality
- tolerant to soil acidity
- attractive, white fluffy seed heads.

Wallaby grasses are among the most valuable native grasses in pastoral areas of Australia, due to their persistence and productivity. They are tufted perennial grasses with fine leaves that remain green all year. There are five wallaby grasses that are native to Western Australia – *Austrodanthonia acerosa*, *A. caespitosa*, *A. occidentalis*, *A. pilosa* and *A. setacea*. Of these, *A. acerosa*, *A. caespitosa* and *A. setacea* are the most common in the WA wheatbelt.

**Seasonal growth pattern**
Temperate (C3) grass with typical winter growth, which flowers in spring and sometimes in autumn, depending on the seasonal conditions.

**Establishment**
Wallaby grasses prefer well drained soils. It is essential to have a weed-free seed bed before sowing. Sowing in autumn allows for the best establishment, however seed can be sown at all times of the year as long as soil moisture is available. Germination can be expected within 14-21 days in autumn and spring, but it may take up to 60 days in winter. The cleaned seeds are very small and need to be sown just below the surface (5-8 mm). If sowing in a dryland situation, use fluffy (uncleaned) seed. The seeds of wallaby grass are fairly small with 1-1.5 million per kilogram. A sowing rate of 1–2 kg/ha for cleaned seed and 5–10 kg/ha for fluffy seed is recommended.

**Livestock disorders**
None reported.

**Description**
- white fluffy seed heads 30-100 cm high when mature
- ligule has long hairs at base of leaf blade
- leaf blade folded in the bud with parallel lines of thickening
- individual species are identified primarily by hair arrangement, shape and length on back of the lemma and by shape and size of palea.
Native perennial pastures

Perennial pastures for Western Australia

Native perennial pastures

Companion species
Annual legumes and other warm season (C4) grasses.

Cultivars
There are currently three pasture cultivars of wallaby grass commercially available. They were all selected in eastern Australia.

'Bunderra' (*A. bipartita*) was selected by the NSW Department of Agriculture as a forage grass for low fertility, fine-textured soils. It produces significant amounts of foliage and has been shown in grazing trials in eastern Australia to be palatable and of high feed value.

'Taranna' (*A. richardsonii*) was selected by the NSW Department of Agriculture as a forage grass for low fertility, medium- to fine-textured soils. It produces significant amounts of foliage and has been shown in grazing trials in eastern Australia to be palatable and of high feed value. Taranna can establish on sandy soils but may perform poorly.

'LIG 179' (*A. fulva*) (public variety) was selected by LIGULE for revegetation and pasture uses on shallow and infertile soils.

Soil–climate adaptation
Rainfall: >300 mm, most productive >400 mm

Drought tolerance: Very high

Frost tolerance: High

Soil type: Light sandy loam to medium clays

Soil fertility requirements: Low

Soil pH<sub>ca</sub>: >4 (depends on species)

Aluminium tolerance: Tolerant (but dependent on species)

Waterlogging tolerance: Low

Salt tolerance: Nil

Nutritive value

DMD: 45-82%<sup>12, 214</sup>

Crude protein: 10-25%<sup>214, 224, 276</sup>

Management
Annual dry matter production can be 1.8-7.8 t/ha depending on the species and the location.<sup>12, 214</sup>

A pasture that contains both wallaby grass and clover needs to be managed to ensure that the clover does not dominate. This is best achieved with a short period of heavy grazing in the spring. Wallaby grass is very sensitive to glyphosate, so spray topping cannot be used to remove annual grasses from native grass pastures dominated by wallaby grass.<sup>358</sup> Wallaby grasses respond well to fertiliser and grazing, increasing growth even at fairly high stocking rates.
7.6 Weeping grass (*Microlaena stipoides*)

**Features**
- rhizomatous perennial
- good palatability and feed quality
- tolerant to soil acidity
- tolerant to glyphosate herbicide.

Weeping grass is a tufted perennial grass with a short rhizome and remains green throughout the year in higher rainfall areas, producing high-quality feed. Weeping grass is a highly competitive species that responds well to increased fertility and moderate-to-heavy grazing while it is actively growing. Within WA, weeping grass rarely extends further east than a line between York and Albany. However, cultivars have been selected in the eastern States for persistence and drought tolerance and these may expand its adaptation.

**Seasonal growth pattern**
Temperate (C3) grass, but stays green all year in suitable environments. Flowers are produced from summer through to autumn.

**Establishment**
The seeds of weeping grass are fairly large and each dispersal unit weighs about 0.005 g. Autumn sowing is preferred. Begin with a weed-free seedbed. Sow seed 10-15 mm below the soil surface. Germination may take 10-14 days. Weeping grass should be sown at 5-10 kg/ha.

**Livestock disorders**
None reported.

**Management**
Annual dry matter production 1.7-7.4 t/ha, and to 25 t/ha under ideal conditions. Weeping grass can withstand moderate-to-heavy grazing while actively growing. This grass needs to be kept short, especially over summer, as rank growth becomes unpalatable to stock and should be grazed short to ensure that clover germination is not suppressed in the autumn. Heavy grazing in the early spring may minimise seed contamination problems. Weeping grass is tolerant of glyphosate herbicides. Spray topping therefore can be used to control annual grasses in weeping grass pastures.

**Companion species**
Annual pasture legumes.

**Description**
- erect to prostrate form to 50 cm high with short rhizomes
- leaves soft, slightly rough to touch, distinctive crimp at leaf tip
- slender seed bearing stems to 70 cm with the inflorescence portion weeping
- seeds quite large, up to 15 mm.
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Cultivars
There are currently four pasture cultivars of weeping grass commercially available which were all selected in eastern Australia.

‘Shannon’ was selected by the University of New England for revegetation and pasture applications. It has performed well on very shallow soils under exposed conditions. It grows well in higher altitude environments, having performed well in the higher test sites in north-eastern Victoria, but also persists well at lower altitudes.

‘Wakefield’ was selected by the University of New England for pasture applications. It can persist in soils of low fertility but has the capacity to respond to increased nutrient levels. The annual dry matter production for a well established Wakefield weeping grass pasture can exceed that of introduced pasture grasses.

‘LIG 183’ (public variety) was selected by LIGULE program from a grass population that originated in the wheat-sheep zone near the NSW-Victorian border and has considerable heat and drought tolerance. It is a larger plant, which produces considerable dry matter of high grazing quality.

‘LIG 704’ (public variety) was developed in the LIGULE program from a grass population that originated in the medium rainfall zone where grazing is the principal activity. It is an upright plant with medium textured leaves and is highly tolerant of acid soil conditions.

7.7 Windmill grass (*Chloris truncata*)

**Features**
- tufted or prostrate, short-lived perennial
- moderate palatability and feed quality
- seed head with 5-13 spikes radiating like blades of a windmill from the stem.

**Description**
- tufted or prostrate, 10-50 cm high
- may be stoloniferous
- short, narrow, pale green leaves
- inflorescence with 5-13 spikes radiating from stem like the blades of a windmill
- seeds are black when mature, with a broad obtuse apex on the upper (infertile) lemma.
Windmill grass is a short-lived (two to three years) perennial and makes rapid growth in early spring. In some drier situations it can act as an annual grass but its very rapid germination and growth after summer rainfall allow it to use excess water from out-of-season rainfall. It is distributed widely throughout Australia and is found in the WA wheatbelt on a range of soil types. It commonly occurs in disturbed areas such as firebreaks or paddocks under crop and this has led to it often being considered a weed, although growth over spring and after summer rain can provide valuable out-of-season forage. The plants are tufted or prostrate with small fibrous leaves that have moderate palatability.

**Seasonal growth pattern**
Warm season (C4) grass, which grows rapidly during spring and summer when moisture is available. It is dormant in winter and begins flowering four to six weeks after growth starts or germination. Flowers can appear from late winter through to autumn.

**Establishment**
Windmill grass seed should be sown on or just below the surface, no deeper than 3-5 mm. It is best to sow in the early spring, when soil moisture is available. Recommended sowing rate varies between 5-15 kg/ha. Windmill grass is moderately tolerant of most herbicides so weed control can be conducted on mature stands.³

**Livestock disorders**
Can cause hepatopathy and secondary photosensitisation in sheep and cattle.³