

Coolatai Grass

Invasive Species Unit

Coolatai grass (*Hyparrhenia hirta*) is an invasive drought, fire and herbicide tolerant tussock forming perennial grass. It has become a major invasive species in northern New South Wales (NSW) and southern Queensland, dominating pastures over a range of soil types and conditions. It is also one of the few perennial grasses capable of invading undisturbed natural ecosystems and is a major threat to natural biodiversity in stock routes, nature reserves and National Parks. Pasture dominated by Coolatai grass can be productive, although the management requirements are higher than that commonly employed.

Coolatai grass continues to expand its range across southern Australia, which will be enhanced by the predicted increases in summer rainfall and milder winters due to global warming.

Distribution

Coolatai grass is a native of tropical and temperate Africa, the Mediterranean region, Oman, Saudi Arabia, Yemen, Turkey, Iraq, Iran, Afghanistan, Pakistan and India.

It is naturalised in Australia, Mexico, the Caribbean and parts of South America.

The plant was thought to have been first introduced from southern Africa to Queensland and northern NSW in the late 1800's. The CSIRO and some State Government departments also introduced a range a material in the 1950's and 1960's in an effort to find a hardy perennial grass that would survive heavy grazing and grow in a winter dominant rainfall zone.

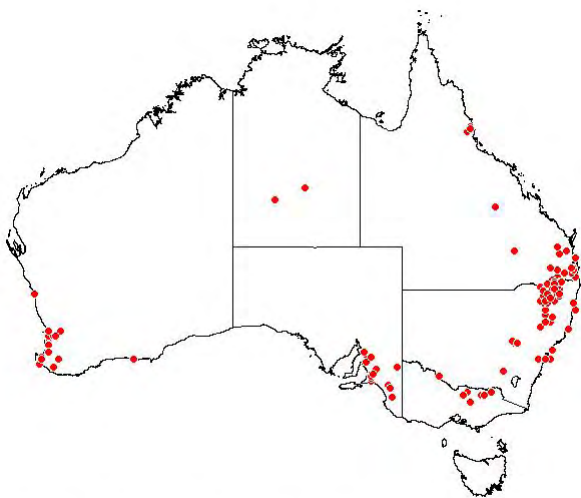
It is found in all Australian states and territories.

Figure 1. Coolatai grass dominated pasture Inverell district of NSW



Main infestations are found in south-eastern Queensland, north eastern NSW, north eastern Victoria, the Adelaide basin and the upper Yorke Peninsula in South Australia. In Western Australia it is found around Geraldton, Perth to Augusta and Esperance.

Coolatai grass continues to expand its range in southern NSW where isolated infestations are often identified.



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Figure 2. Distribution of verified infestations of Coolatai grass in Australia

Habitat

Coolatai grass will grow on a range of soils but is most active on light to medium textured soils and will grow and increase on heavy clay soils if not waterlogged. Studies in South Africa and the Middle East show that Coolatai grass prefers growing on slopes that face the sun.

It is cold tolerant and is found from sea level to 1500 m altitude. In South Africa Coolatai grass is found up to 2400 m above sea level.

It thrives in both sub-tropical and temperate conditions however the seedlings are sensitive to heavy frosts. Currently in Australia, it is found in areas receiving 400 to 800 mm annual rainfall, with a distribution pattern ranging from winter dominant to summer dominant.

Tussocks can easily survive hot fires and regular burning has been shown to have no negative impact on plant numbers.

Coolatai grass will readily invade disturbed areas such as roadsides and pastures, forming monocultures and out-competing most other species. It also has the ability to invade relatively pristine remnant native vegetation, making it a

significant threat to the conservation of these areas.

Coolatai grass is also expanding its range in southern Africa, outcompeting taller *Hyparrhenia* species, which are preferred thatching grasses. The likely cause is an increase in frequency of pasture burning followed by heavy grazing with cattle.

Impact

In 2004 it was estimated that Coolatai grass already infested 1 million hectares in NSW. It has continued to expand its range across Australia.

Coolatai grass presents a dilemma in that it is able to invade relatively undisturbed natural ecosystems, yet can be a resilient productive pasture species if managed correctly.

Coolatai grass is also highly tolerant of most herbicides making control on a large scale difficult, particularly where the treatment cost will exceed the productive value of the land.

The agricultural landscape

Coolatai grass readily invades pastures and dominates them, particularly where ground cover is low (less than 70%) due to the grazing regime (set stocking) and low soil fertility. Failure to appropriately manage a Coolatai grass dominated pasture will see a monoculture of tall rank growth of low digestibility (<40%) and protein (<7%). Sheep production will be poor and cattle will need supplementary nitrogen or protein to be able to utilise the feed.

Most graziers feel that if you don't already have Coolatai grass you don't want it as there are more easily managed perennial and annual pasture options available.



Figure 3. Coolatai grass spreads readily along roadsides, this adjacent native pasture is being infested from the roadside.

On the other hand, studies have shown that with significant management inputs where Coolatai grass is kept short, it can be a highly productive pasture and meet the feed requirement of dry stock. Coolatai grass also has the benefit of not having damaging seeds like wiregrasses (*Aristida* spp.) and corkscrew grass (*Austrostipa* spp.), however there are other more easily managed tropical perennial pasture species available that also have benign seed.

If large areas have been dominated by Coolatai grass, management strategies of rotational grazing, spring burning and/or slashing will be essential. The maintenance of a legume component in a Coolatai grass dominated pasture is difficult.

Natural ecosystems – remnant vegetation

Coolatai grass poses a huge risk to the biodiversity of the fragmented areas of native ecosystems remaining across NSW as it easily invades relatively undisturbed ecosystems. The mechanisms of how this occurs are still not fully understood but Coolatai grass has a number of characteristics that allow it to invade a range of ecosystems:

- plants are long lived
- able to produce fertile seed from a single plant
- seed is mobile – wind, water, animals, vehicles
- seed will germinate over a wide range of temperatures
- seeds are able to germinate and establish at the soil surface in the presence of leaf litter
- established plants are tolerant of drought, fire and herbicides

Studies in northern NSW have shown that Coolatai

grass infestations have reduced the number of plant, invertebrate and frog species in threatened white box, yellow box and Blakeley’s red gum communities.

Description

Coolatai grass is a long lived summer active perennial grass that forms a dense tussock and grows to 1.5 m. It has greyish-green leaves that turn orangey-red in winter, particularly after frost. The leaves are harsh to touch. Leaf sheaths are usually hairless and keeled. The leaf blade is flat and 2-3 mm wide with the ligule 2-3 mm long and minutely toothed.



Figure 4. Coolatai grass tussock

The seedhead is a ‘false panicle’ consisting of paired racemes with 5-8 awns per raceme. The paired racemes are up to 35 mm long and arise from 3-8 cm long flower bracts. Half the flowers are male and therefore sterile.

Table 1 Characteristics of *Hyparrhenia* species found in Australia

Name	Coolatai Grass (<i>H. hirta</i>)	Tambookie grass (<i>H. filipendula</i>)	Thatch grass <i>H. rufa</i>
Origin	Introduced	Native	Introduced
Habit	dense tussock to 1.5 m	tussock to 1.5 m	tussock to 2.5 m
Seedheads	Paired racemes 15-50 mm long, whitish or greyish	Paired racemes 15-25 mm long	Paired racemes 20-50 mm long, bases hairy
Awns per raceme	5-8	1-3	9-10
Distribution in Australia	All mainland states and territories.	Coastal northern NSW & Queensland.	Newcastle, Upper Hunter and Werris Creek in NSW; north coast of Queensland.

Related species in Australia

In addition to Coolatai grass there are two other species of the *Hyparrhenia* genus in Australia, *H. filipendula* and *H. rufa*. *Hyparrhenia filipendula* is a native of Australia and has a coastal distribution. *Hyparrhenia rufa* is introduced and is currently found in small infestations around Quirindi and along the coast from Newcastle to northern Queensland (see Table 1).

Native species that might be confused with Coolatai grass

Grasses not in flower can be very difficult to identify, particularly when seedlings. The best method to identify a grass is to collect specimens when flowering, press till dry and send to the National Herbarium of NSW. See Primefact 919 "Collecting and preparing plant specimens for identification" (see below under Publications available).

The most obvious distinguishing characteristic of Coolatai grass is the paired racemes with 5-8 brown awns per raceme. The racemes are soft to touch compared with barb wire grass and kangaroo grass.



Figure 5. Paired racemes of Coolatai grass are a key distinguishing feature.



Figure 6. Redgrass seedheads do not have paired racemes but have 3-6 racemes arising from a single point

Table 2. Characteristics of summer growing native grasses that could be confused with Coolatai Grass

Name	Coolatai grass <i>Hyparrhenia hirta</i>	barbed wire grass <i>Cymbopogon refractus</i>	kangaroo grass <i>Themeda australis</i>	redgrass <i>Bothriochloa macra</i>
Habit	Dense tussock to 1.5 m.	Aromatic perennial to 1 m.	Dense tussocky perennial to 1.5 m, blue to pale green growth turning reddish-brown at maturity.	Straggly perennial to 1 m.
Seedheads	Paired racemes 15-50 mm long, whitish or greyish.	Paired racemes with sparse hairs, bending downward as they mature. Firm to touch.	Loose interrupted panicle to 25 cm long, spikelets single or in pairs. Papery to touch.	3-6 racemes arising from a single point, upright and close packed. Soft to touch.
Distribution and Habitat	Common in Northern NSW and increasing infestations in southern NSW especially on roadsides.	Common in the eastern half of NSW, widespread on low fertility soils.	Widespread across NSW Heavily grazed when young. Can form dense stands of coarse material not readily grazed.	Common in the eastern half of NSW. Common in heavily grazed pastures.



Figure 7. Kangaroo grass seedhead



Figure 8. Barbed wire grass seedhead

Life cycle

Coolatai grass is a long lived perennial that produces short rhizomes that form dense tussocks. Being drought tolerant, it has the ability to rapidly respond to rain, producing new culms from the tussock base and flowering in a matter of weeks. It is well adapted to fire, with tussocks surviving hot burns.

Both these characteristics give the species the ability to quickly flower and set seed when environmental conditions are favourable.

Its sole means of reproduction is by seed. Seed yields are low compared to many grass species with 4 to 10% of the florets producing viable seed. Seed is produced both sexually (with pollen) and asexually (without pollen - apomixis). Asexual seed formation allows Coolatai grass to produce viable seed in the absence of pollen.

Although Coolatai grass seed will germinate at temperatures between 5° and 40° C, its optimum temperature range for germination is from 20-30°C. Seedlings are small, weak and killed by heavy frost and temperatures below 10° C. This pattern is common in tropical grasses.

The main recruitment period for seedlings is therefore in spring for much of southern Australia.

Coolatai grass will flower and set seed from spring to autumn, however it will flower all year if conditions are suitable. This demonstrates that the plants in Australia have no photoperiod requirement (i.e. day neutral) or cold requirement (vernalisation) to promote flowering.

The period from germination to flowering is approximately 90 days.

Seedheads mature unevenly and the seed is shed quickly on maturity.

There is no data on the presence or absence of post ripening dormancy of the seed or persistence and size of the seedbank.

Spread

The predicted increase in summer rainfall and milder winter temperatures in southern NSW with the onset of global warming will favour the spread and establishment of Coolatai grass in these areas. Coolatai grass has the characteristics that allow it to benefit from the increased spring/summer rainfall events and milder winter temperatures.

Seed sheds quickly on maturity. The hairy, awned seeds readily adhere to the hair and wool of animals, clothing and is easily caught on and in vehicles.

Along roadsides the seed is spread by the common practice of slashing for 'road safety'. The light weight of the seed also facilitates the spread by air movement by passing vehicles, particularly trucks.

Cattle are known to graze the heads of Coolatai grass. Research on the viability of annual ryegrass (*Lolium rigidum*) passing through cattle shows that around 12% of seed consumed remains viable. Therefore it would be reasonable to assume that some Coolatai grass seed will survive the digestive track of cattle.

Control and management

The greatest problem with invasive species is the lack of early detection and management. Grasses are particularly difficult because they look innocuous and rarely raise land managers'

attention until the species is well established. This is because most grasses look much the same to the untrained eye and unless they have a particularly acute affect, such as stock poisoning or produce damaging seed, they do not pose an immediate threat. Coolatai grass is a prime example of this.

The general public and land managers need to know that Coolatai grass is an invasive undesirable species and new occurrences must be correctly identified and controlled.

In any management program, infestations should be mapped and early efforts directed at lightly infested areas, working back toward more heavily infested areas.

Prevention – quarantine

Coolatai grass is easily spread by stock, machinery, fodder and seed. Land managers must ensure stock, fodder, grain and machinery coming onto their land has not come from a Coolatai grass infested area.

New or stock returning from agistment must be quarantined in a small paddock for at least a week. This quarantine paddock needs to be monitored for Coolatai grass establishment for the next 2 summers. Also stock grazed on Coolatai grass during flowering and seed set should not be moved to 'clean' paddocks without some quarantine period.

Early detection and control

Coolatai grass will usually start from one or two plants near the front gate, driveway, track or farm buildings. These plants must be identified and removed before viable seed has been set.



Figure 9. Individual plants should be dug up and disposed of taking care not to disperse seed

Remove plants, bag and burn, try to stop seed being dropped in the process. It may be useful to sow some replacement competitive pasture

species in disturbed areas to compete with new germination of Coolatai grass.

Spot spraying with knockdown herbicides will require 2-3 applications for complete control.

Roadside management

The lighter textured soil used in road construction and regular applications of glyphosate to control vegetation combined with the water-harvesting of the road surface creates an ideal environment for establishment and growth of Coolatai grass. Road maintenance and construction along with slashing grass with mature seed, stock, water and wind all move the seed to new areas.

Roadside vegetation should be mapped and areas with Coolatai grass 'flagged' and treated. These areas must not be slashed, or should be slashed last and then the machines thoroughly cleaned before moving to a new area.

Construction and maintenance crews must be made aware of infestations and no unnecessary machinery movement or "cleaning up" of the roadside should be conducted.



Figure 10. Roadsides are an ideal environment for establishment and growth of Coolatai grass

Herbicides

Coolatai grass is tolerant of most commonly used herbicides and suppression of growth is the most likely outcome.

There is an Australian Pesticides & Veterinary Medicines Authority (APVMA) permit 'Control of tussock grasses' (PER9792 which expires on 30th November 2015) which outlines the allowed use of glyphosate and flupropanate for the suppression of Coolatai grass (Page 8, Table 5). Copies of the permit can be downloaded from the APVMA website www.apvma.gov.au.

Research has shown that pre-treatments of burning and slashing can reduce control as it suppresses the active growth of Coolatai grass

which should have sufficient green leaf and be actively growing for the highest levels of control.

Regardless of application method, up to three applications of glyphosate in the same growing season will be required. The repeat application timed for when there is sufficient regrowth of fresh leaves.

Cropping

In areas suitable for cropping, 2 - 3 years of crop will control Coolatai grass. A competitive pasture should then be re-established.

Competitive pastures and grazing management

Coolatai grass seedlings are small and weak, and plants produce relatively smaller quantities of seed compared to many other invasive perennial grasses. These characteristics highlight that competitive pastures (where ground cover is maintained at >70%) will resist Coolatai grass invasion.

Rotational grazing is also important. Research conducted in northern NSW has shown that pastures that are rotationally grazed have higher ground cover and litter, more soil organisms, more pasture growth, reduced runoff and evaporation all with less supplementary feeding compared with 'year-long' grazed pastures. Where 90% groundcover was maintained there was little runoff, summer soil temperatures and evaporation were lower, all leading to higher pasture growth.

Growing tropical perennial grasses in northern NSW will effectively compete with Coolatai grass for resources. In southern NSW competitive pastures in spring, maintaining high levels of ground cover over summer will resist Coolatai grass invasion. Small numbers of surviving plants in autumn will be obvious and can be hand pulled and burnt.

Maintaining adequate levels of soil nutrients for your level of stocking will be essential to maintain competitive pastures.

Legislation

In various areas of NSW (see Figure 11) Coolatai grass is declared a Class 3 noxious weed under the *NSW Noxious Weeds Act 1993*. Class 3 control requirements are 'that the plant must be continuously suppressed and destroyed'. For further information contact your local council weeds officer or refer to the Industry and Investment NSW website www.dpi.nsw.gov.au/weeds.

The responsibility for control of noxious plants and appropriate disposal of weed plant material on private land rests with the owner or occupier of the land.



Figure 11. Declaration of Coolatai grass in NSW

Acknowledgements

Author: Andrew Storrie

Technical Reviewers: Lester McCormick, Paula Bosse

Edited and prepared by: Birgitte Verbeek, Alan Maguire

Images

Figures 1, 3, 5, 9 – Birgitte Verbeek

Figure 2 – Australia's Virtual Herbarium

Figure 6 – Harry Rose

Figures 4, 7, 10 – Andrew Storrie

Figure 8 – Lachlan Rowling

Figure 11 – Alan Maguire

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ISSN 1832-6668

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Job number 10324 Trim Reference PUB10/172