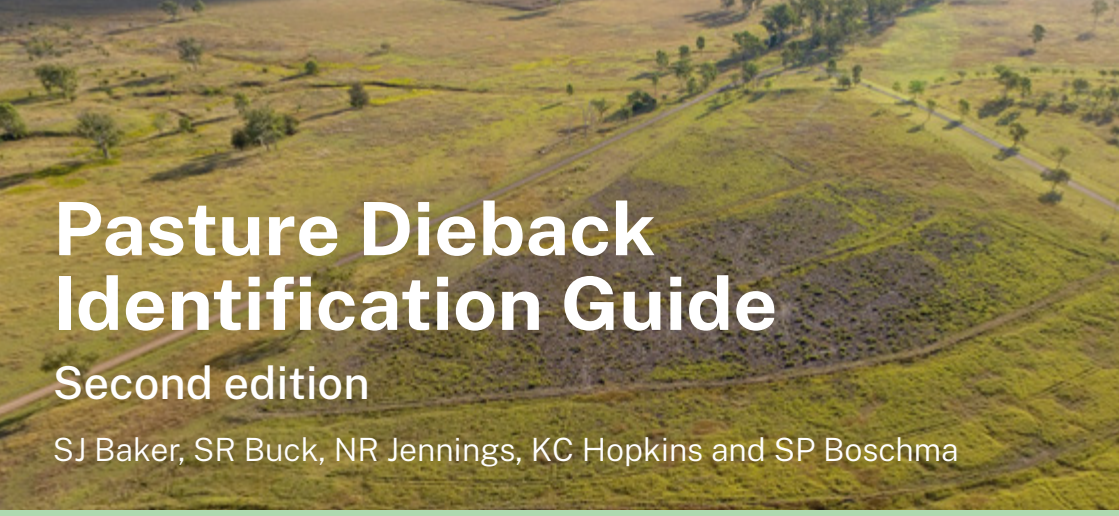


Pasture Dieback Identification Guide

Second edition

SJ Baker, SR Buck, NR Jennings, KC Hopkins and SP Boschma

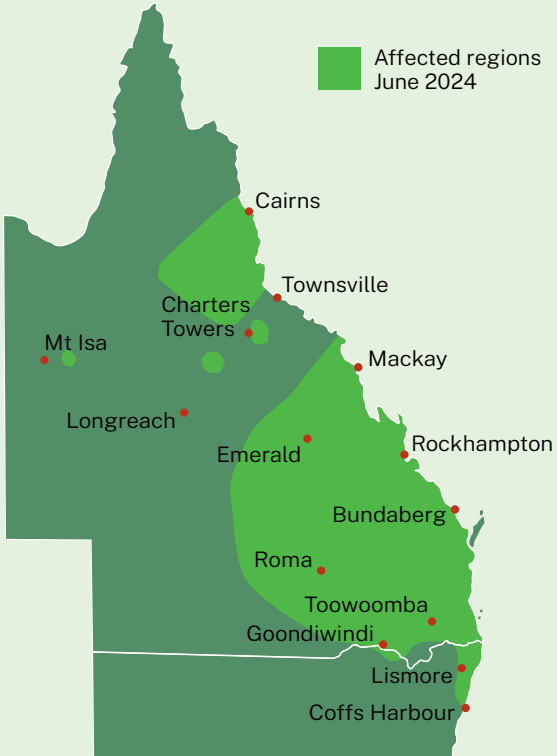
NSW GOVERNMENT

Queensland Government

Introduction

Pasture dieback kills summer growing grasses. These grasses are also known as C4, sub-tropical or tropical grasses. It is a complex condition involving pasture mealybug *(Heliococcus summervillei)*.

Pasture dieback begins in patches which can grow to affect large areas, significantly reducing pasture productivity. Dieback re-emerged as an issue in Central Queensland during the summer of 2014/15. The condition has spread rapidly and now affects many sown and some native summer grass species in Queensland and NSW. It has been detected in districts across eastern Australia from Far North Queensland to the North Coast of NSW.



Some of the symptoms and stages of pasture dieback are similar to other pasture disorders which can make diagnosis difficult and effective management problematic. When assessing a pasture for dieback it is important to consider the symptom progression and the situation in which it is occurring so that other causes can be eliminated.

This guide describes some common pasture disorders and diseases with symptoms similar to pasture dieback. However, not all pasture disorders are discussed. Seek further independent advice from a local adviser before making management decisions based on the information in this guide.

Patch of pasture dieback, Gatton, Qld. SJB

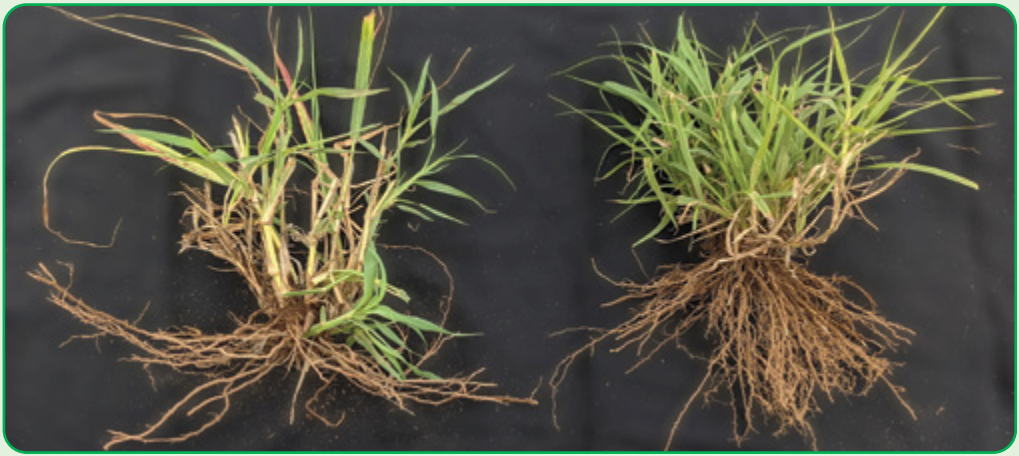
Pasture dieback symptom progression

It is important to observe changes in the pasture over a period of time as this helps to differentiate pasture dieback from other disorders. Dieback symptoms are most obvious and progress quickly when grasses are actively growing, especially after significant rainfall.

Stage 1. Leaf discolouration varies between species from yellowing, reddening and/or purpling. It starts at the tip of the oldest leaf then moves along the leaf blade.

YELLOW/ORANGE DISCOLOURATION	YELLOW AND RED DISCOLOURATION	RED/PURPLE DISCOLOURATION
		
Panic grass. SJB	*Buffel grass. SRB*	*Broadleaf paspalum. NJ*
Example grasses: Rhodes grass, Gatton panic, green panic	**Example grasses:** Buffel grass, creeping bluegrass	**Example grasses:** Broadleaf paspalum, creeping bluegrass, signal grass, setaria

Stage 2. Stunted and unthrifty plants. As the condition progresses most leaves can be discoloured and plant growth slows or stops. Plants have fewer leaves, tillers and smaller seed heads. Root systems are also stunted with fewer feeder roots. Premature senescence can occur.



Dieback affected plant with yellow and red leaf tips and reduced number of roots (Left). Healthy plant (Right). ND

Stage 3. Plant death can occur within a growing season. The size of affected areas can increase rapidly, especially following rainfall during the warmer months of the year. Dieback has been observed moving up, down and across slopes and often occurs around trees. It can stop at fence lines as pasture management or species composition changes.

Broadleaf paspalum, Rhodes grass and setaria pasture on a hillside affected by dieback. NJ

Stage 4. Weeds invade bare areas. Patches where grasses have been killed by dieback are often colonised by broadleaf weeds, legumes and sometimes other more tolerant and less desirable grasses.

Area of dead broadleaf paspalum colonised by broadleaf weeds. NJ

Species known to be affected by pasture dieback

To date only summer grasses have been affected by pasture dieback.
Some grasses are more susceptible than others and are listed in **alphabetical order** below. Other grasses may be impacted as dieback continues to spread.

Highly susceptible → **Mildly susceptible**

- Bambatsi panic
- Buffel grass (cv. Gayndah and American)
- Creeping bluegrass (cv. Bisset)
- Digit/Finger/Pangola grass
- Kikuyu
- Paspalum species
- Sabi grass
- African lovegrass
- Indian couch
- Panic (Green)
- Purple pigeon grass
- Rhodes grass
- Signal grass
- Angleton grass/ bluegrass
- Brizantha (cv. Mekong)
- Buffel grass (cv. Biloela)
- Panic (Gatton types)
- Setaria

Note: Severity of symptoms varies with region, seasonal conditions and other factors (see p. 9).

More information:

What factors are needed for pasture dieback?

Susceptible grass

Creeping bluegrass. DAF Queensland.

+

Pasture mealybug

Adult and juvenile mealybugs. MM

=

Pasture dieback

Dead creeping bluegrass. DAF Queensland.

Factors that can affect the prevalence and severity of dieback in susceptible pastures:

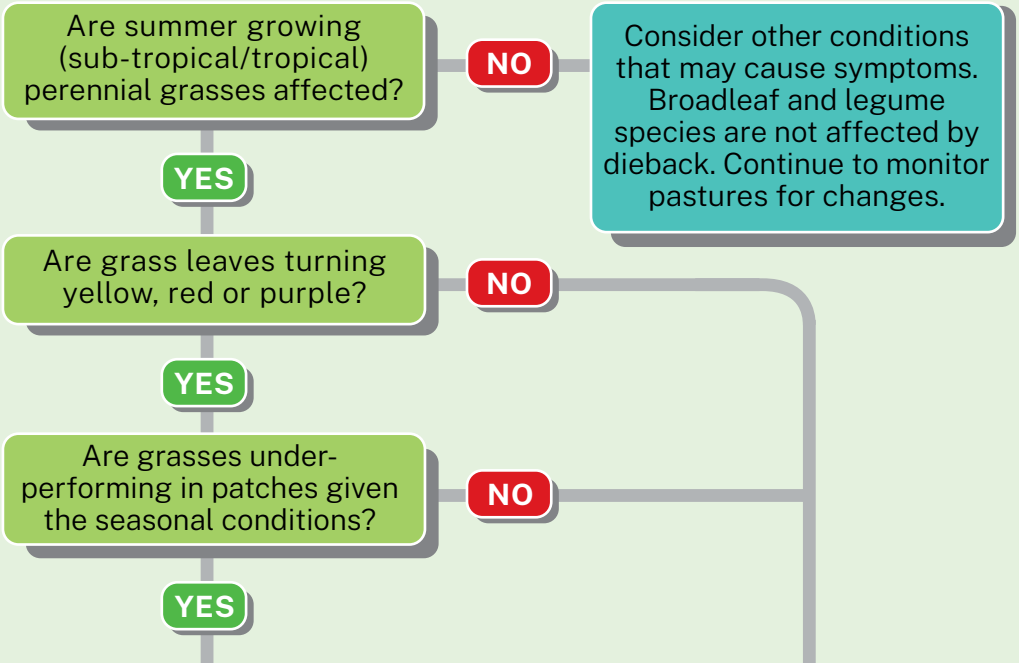
Increases prevalence and severity

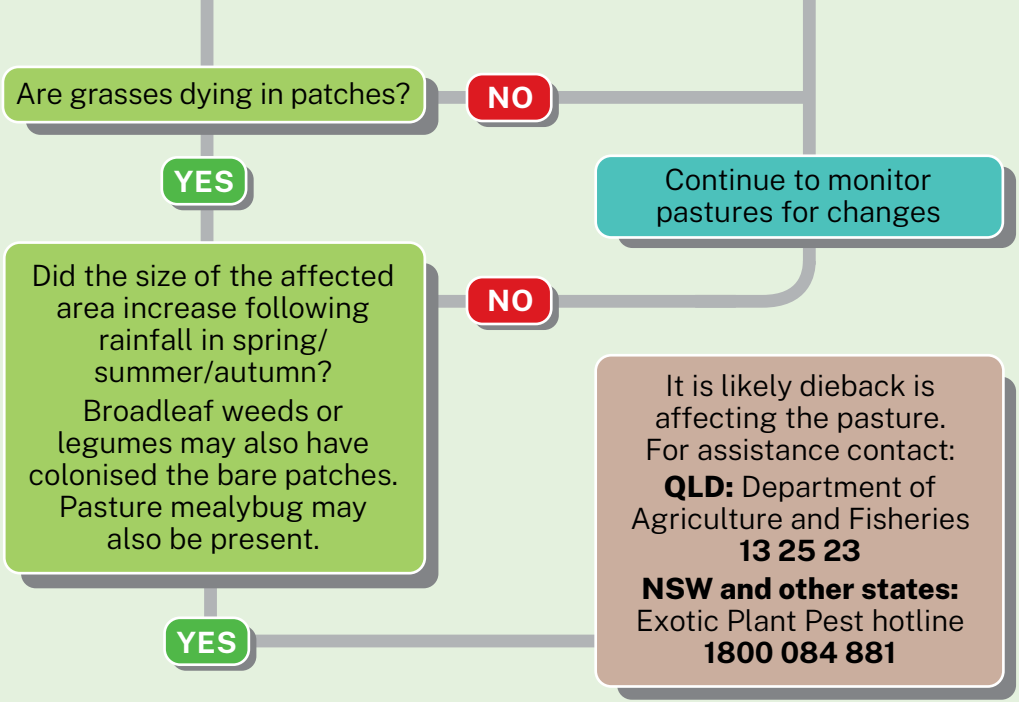
- High grass biomass
- Highly susceptible grass
- Hot and humid conditions
- Grass is actively growing
- Secondary infections?
- Viruses?

Decreases prevalence and severity

- Low grass biomass
- Less susceptible grass
- Cool or dry conditions
- Grass is not actively growing
- Predatory insects present
- Legumes present

Pasture dieback quick assessment




Are grasses dying in patches?
NO
YES
Continue to monitor pastures for changes
Did the size of the affected area increase following rainfall in spring/ summer/autumn?
Broadleaf weeds or legumes may also have colonised the bare patches. Pasture mealybug may also be present.
NO
YES
It is likely dieback is affecting the pasture. For assistance contact:
QLD: Department of Agriculture and Fisheries
13 25 23
NSW and other states:
Exotic Plant Pest hotline
1800 084 881

Situations favourable to pasture dieback

Pasture dieback can be difficult to diagnose from symptoms alone and the situation in which it is occurring should also be considered.

Below are some questions to assess the likelihood of pasture dieback occurring in a pasture.

SITUATION	Y	N	COMMENT
Does the pasture contain susceptible grasses?	☐	☐	Many sown and some native summer growing grasses are susceptible to pasture dieback. Broadleaf and legume species are not affected.
Are summer grasses actively growing?	☐	☐	Symptoms are most evident in actively growing grasses.
Has good rainfall occurred recently?	☐	☐	Symptoms can appear 2-3 weeks after a rainfall event. Symptoms can also become noticeable as grasses run out of soil moisture.
Do pastures have medium to high biomass?	☐	☐	Pastures with a large amount of bulk due to favourable seasonal conditions and/or conservative grazing management tend to be more susceptible.
Has pasture dieback been identified in the local region?	☐	☐	Pasture dieback can affect many properties in a region, however not all properties will be affected.
Can pasture mealybug be found?	☐	☐	Pasture mealybug is often found at dieback sites. They are small and can be difficult to see with the naked eye.

Likelihood of pasture dieback:

YES TO 1-2 QUESTIONS	YES TO 3 QUESTIONS	YES TO 4 OR MORE QUESTIONS
Low Continue to monitor pastures for changes.	**Moderate** Continue to monitor pastures for progression of pasture dieback symptoms.	**High** Report suspected pasture dieback. Contact your local advisor for regionally specific management advice.

Pasture dieback affected hill, Nobbys Creek, NSW. ME

Management strategies for pasture dieback affected country

Practices chosen will depend on the size of the affected area, whether the country is arable allowing machinery access, resources available and the outcome desired. One or a combination of practices may be suitable depending on the circumstances. Seek advice from a local advisor for practices suitable for your enterprise.

Management Strategies	Practice	Small patch		Widespread	
		Arable	Non-arable	Arable	Non-arable
Manage for recovery	Adjust stocking rate (forage budget)	✓	✓	✓	✓
	Monitor and treat weeds in bare patches	✓	?	✓	?
Improve pasture	Sow legumes and tolerant grasses	✓	✓	✓	✓
	Apply fertiliser	?	?	✓	?
	Cultivate	?	✘	✓	✘

Management Strategies	Practice	Small patch		Widespread	
		Arable	Non-arable	Arable	Non-arable
Sow a break crop	Annual forage (graze or hay/silage	✘	✘	✓	✘
	Grain or dual-purpose	✘	✘	✓	✘
Control pasture mealybug	Spray pesticide	?	✘	✘	✘
	Burn	?	?	?	?

✓ *Suitable* ✘ *Unsuitable* ? *Provides inconsistent results or not practical*

More information:

Pasture mealybug and pasture dieback

Pasture mealybug *(Heliococcus summervillei)* can cause pasture dieback but environmental conditions (rainfall, temperature and nutrient stress) and pasture management (species present and grazing strategy) are also contributing factors.

Description: Scale-like insect with a soft, waxy coat of filaments. Adult females are white or pink, up to 5 mm long and can be seen with the naked eye. Juveniles and winged males are very small and difficult to see without a hand lens. Found among plants, on the soil surface, under debris and among the plant roots. Damage is caused by juvenile mealybugs sucking the sap. This species only affects grasses.

Incidence: Warmer months of the year, especially following rainfall events. During cooler and/or dryer periods mealybugs retreat below ground. In warmer, high rainfall environments (e.g. coastal regions) pasture mealybug may be found on or near the soil surface year-round. Mealybugs are mainly spread by wind.

Adult and juvenile pasture mealybugs on creeping bluegrass cv. Bisset. MM

Adult female pasture mealybugs on the roots of grass. MV

Pasture mealybugs at the base of a setaria plant. NJ

Insect predators of mealybugs

Mealybug ladybird or mealybug destroyer *(Cryptolaemus montrouzieri)* is a native ladybird species. Adults are around 4 mm in size with a brownish/orange head and thorax, and black wings covers. Larvae grow up to 13 mm in length and are covered in white, waxy filaments. Larvae are sometimes mistaken for mealybugs. Both adults and larvae feed on scale insects such as mealybugs.

Mealybug ladybird destroyer adult (Cryptolaemus montrouzieri). *MM*

Mealybug ladybird destroyer larva (Cryptolaemus montrouzieri). *MM*

Chalcid wasp ***(Callipteroma sexguttata)*** is a small brown winged insect that parasitises pasture mealybug. Adult females are about 1.7 mm long with antennae and wings about 2.2 mm long. Adult males are smaller about 1.2 mm long with 3.4 mm wingspan.

Other beneficial generalist predatory insects that may feed on pasture mealybug include lacewings, midges and other ladybird species such as the three-banded ladybird.

Chalcid wasp (Callipteroma sexgutta). *MM*

Adult three-banded ladybird (Harmonia octomaculata). *MM*

Green lacewing predatory insect of mealybugs. DPIRD.

Pasture disorders with symptoms similar to pasture dieback

1. Pests

Common armyworm *(Leucania convecta)*

Fall armyworm *(Spodoptera frugiperda)*

Description: Larvae (caterpillars) are light green to brown with a dark head. As larvae mature they become darker with long pale white stripes. Caterpillars can grow to 3-4 cm. Adult moths have a wingspan of 3-4 cm and are brown-cream in colour. Armyworms feed on the leaves, shoots, stems and fruit of many plant species including grasses. Smaller larvae skeletonise leaves, creating 'windows'. Damaged leaf margins are jagged. Larger larvae can cause significant defoliation, cut off seed heads and can result in death of young plants in patches. If stems are not eaten, plants may regrow.

Incidence: Spring, summer and autumn. Varies with armyworm species and food availability.

Key difference from pasture dieback: Affected plants show physical damage. There is no leaf discolouration. Seedlings may die but mature plants will often show signs of re-growth from the growing point.

Common armyworm (Leucania convecta) *caterpillar. DPIRD*

Common armyworm (Leucania convecta) *moth. DPIRD*

Fall armyworm (Spodoptera frugiperda) *larvae can vary in colour. MM*

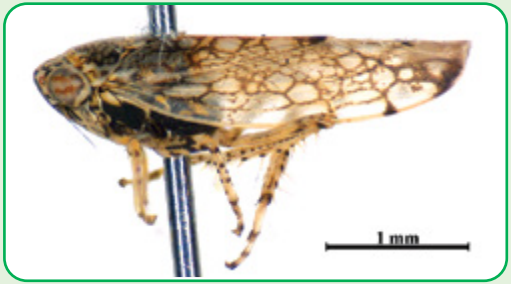
Other pasture plant pests

Aphids: Many species occur in Australia. Typically green in colour but varies with species. Adults are approximately 2 mm in length. Can attack grasses, legumes and other broadleaf plants. Can cause leaf curling and discolouration especially yellowing.

Leafhoppers: Many species can be found in Australia. Adults are wedge shaped with a rounded head and about 2-6 mm in size depending on species. Leafhoppers will jump or fly if disturbed. Colours range from brown to yellow to bright green. Nymphs are smaller than adults and wingless.

Thrips: There are many species in Australia. Adult thrips can be winged or wingless depending on species. Can range from yellow to grey/black in colour and are up to 2 mm in size. Most

Oat aphid (Rhopalosiphum padi). *DPIRD*



Brown leafhopper (Orosius argentatus). *DPIRD*

damage is caused at the seedling stage. Both adults and nymphs suck the sap of leaves. Affected leaves can become distorted and are silvery-white in colour. Typically evident from spring to autumn.

Spider mites: Many species found in Australia. Mites spin fine webs which can be easily seen. The mites are tiny and can be difficult to see with the naked eye. Often found on the underside of leaves.

Key differences from pasture dieback: Most of these pests affect grass and broadleaf species. They can usually be found on infected grasses with close inspection. Plant death rarely occurs.

Thrips on a bean flower. DAF Queensland

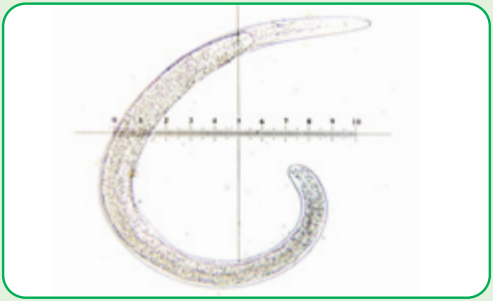
Spider mites produce webbing on grass. SJB

Nematodes

Description: Nematodes are microscopic soil organisms. Most species are beneficial but some are plant-parasitic. Nematodes that affect pastures in northern NSW and Queensland include root-lesion *(Pratylenchus)*, stunt *(Tylenchorhynchus/ Merlinius)*, pin *(Paratylenchus/Gracilacus)* and reniform *(Rotylenchulus)*. Plant-parasitic nematodes feed on roots, limiting root growth or causing lesions that gradually expand until the root is destroyed. Affected plants have stunted root systems and reduced production. Nematode feeding also allows the entry of fungal pathogens that can cause further damage to the plant. Other plant symptoms include poor growth, stunting and wilting. Symptoms are typically seen when the nematode population is high and the pasture becomes stressed due to high temperatures or lack of moisture.

Incidence: Numbers increase when plants are actively growing and moisture and temperature conditions are suitable for reproduction.

Key difference from pasture dieback: The size of the affected area does not increase quickly following rainfall. Symptoms are most noticeable when pasture is moisture or temperature stressed.



Root-lesion nematode (Pratylenchus thornei). *Scale = 0.1 mm. KC*

2. Diseases

Kikuyu yellows
(Verrucalvus flavofaciens)

Description: Disease caused by an oomycete (a fungus like organism) and only affects kikuyu. Affected plants turn yellow and have a stunted root system. Occurs in a roughly circular pattern and weeds often colonise these areas. Most noticeable from spring to autumn. Nitrogen deficient or moisture stressed plants are most susceptible.

Spread: Disease is spread by water borne spores and typically moves down slopes. Can also be spread by the hooves of livestock and on machinery.

Key difference from pasture dieback: Only kikuyu is affected. Other grasses in the pasture remain healthy.

Kikuyu yellows. NJ

Nigrospora crown rot *(Nigrospora* spp.*)*

Description: A naturally occurring fungus that decomposes dead plant matter. Affects leaves of new tillers. Tillers are initially pale orange and within a month turn straw coloured and die. Diseased tillers can be easily removed from the plant crown and have a black-coloured base. Symptoms occur in spring 7-10 days after substantial rainfall.

Spread: Most commonly by transplanting diseased plants.

Key difference from pasture dieback: Only affects giant Parramatta grass.

Giant Parramatta grass affected by Nigrospora crown rot. DO

Leaf spots and blight

Curvularia sp. and *Bipolaris* sp. can cause leaf spots or blotches on a range of species including creeping bluegrass and kikuyu.

Blight *(Pyricularia* sp.*)* causes blotches or blight lesions on the leaves of affected plants and can result in early plant death. Commonly found in buffel grass pastures and sometimes seen on plants also affected with pasture dieback.

Key difference from pasture dieback: Causes spots or lesions on leaves. Plant otherwise appears healthy with no leaf discolouration.

Other fungal species

Other fungal species that can cause damage to pasture grasses include *Fusarium oxysporum, Claviceps* spp., *Rhizoctonia* sp. and *Gaeumannomyces* spp.

Some symptoms can be similar to pasture dieback such as leaf discolouration, poor plant growth, root damage and even plant death. This varies with fungal species.

Key difference from pasture dieback: No rapid increase in size of affected area following favourable environmental conditions.

Leaf blotches caused by blight on buffel grass. SRB

3. Environmental disorders

Pasture rundown/nitrogen deficiency

Description: Tie-up of available nitrogen in soil organic matter leaving less nitrogen accessible to plants. Causes a gradual decline in grass production over multiple years. Grasses appear pale green in colour and lack vigour even after rainfall. Seed production is reduced. Grass near manure and urine patches can appear greener. Pasture productivity and livestock production are reduced compared to when the pasture was first sown or following fertiliser application.

Incidence: Widespread in unfertilised sown pastures. Often occurs relatively evenly over paddocks, properties or regions. Impact varies with soil type.

Key difference from dieback: Does not occur in patches and develops gradually across paddocks over many years or decades. Plants generally do not die. Pasture responds to nitrogen fertiliser.

Rundown affected buffel pasture response to nitrogen application (dark green middle strip). SRB

Cold temperatures and frost

Description: Declining overnight temperatures can cause leaf discolouration of summer growing grasses. Following frost, leaves initially look limp, wilted and dull green then become dry and crumbly to touch. Dead leaves are usually golden in colour but can be dark grey when soil nitrogen levels are high. When temperatures are suitable for growth, new tillers will emerge from the plant base or rhizomes.

Incidence: Leaf discolouration occurs when overnight temperatures decline during autumn. Severity of frost damage can increase with declining soil moisture.

Key difference from pasture dieback: New tillers emerge when temperatures warm and soil moisture is available. Plants remain healthy.

Discolouration of the leaves of digit grass following cold temperatures. SPB

Other nutrient and soil constraints

Many nutrient and soil constraints can look similar to pasture dieback. Some examples are summarised below.

Condition	Similarities to pasture dieback	Differences to pasture dieback
Moisture stress/ drought	Yellowing and reddening of leaves. Wilting. Plants may die.	Symptoms reduced or alleviated following significant rainfall. Affects all pasture species, not just grasses.
Water logging	Yellowing of leaves. Plants may die.	Only occurs where water is lying on the soil surface or at depth (e.g. perched water table). Affects many plant species, not just grasses.
Phosphorus deficiency	Reddening or purpling of leaves. Starts with oldest leaves.	Pastures may thin, but do not die. Not typically associated with small patches which increase following rainfall.
Sulphur deficiency	Yellowing of leaves. Reduced plant growth.	Young leaves are affected first. Not typically associated with small patches.
Acidic soils (low pH)	Reddening or purpling of leaves, yellowing of the leaf margin, mottling and stunted growth. Reduced plant growth.	Grass, legume and broadleaf species can be affected. Pasture responds to liming.

Condition	Similarities to pasture dieback	Differences to pasture dieback
Aluminium toxicity	Reddening or purpling of leaves. Reduced plant growth.	Most common in acid soils, with pH below 5. Grass, legume and broadleaf species can be affected.
Sodicity	Bare patches in pastures.	Only occurs on hard setting soils with poor soil structure resulting in low water infiltration.
Salinity	Bare patches in pastures.	Grass, legume and broadleaf species can be affected. Symptoms include leaf burn and leaf drop. Saline areas are colonisation by salt tolerant species e.g. couch.

Digit grass affected by water logging. PP

Herbicide damage

Description: Symptoms depend on the herbicide group but can include leaf yellowing, reddening, bleach spots, wilting, necrosis and plant death with colonisation by weeds. Some residual and pre-emergent herbicides can also slow grass growth and/or prevent establishment or regeneration of new grass plants. Damage of non-target species can occur by mistake from higher than recommended chemical rates, spray-drift or incomplete washing of equipment between chemicals. Sprayed areas are often colonised by weed species. Some of the main herbicide groups that can cause damage to grasses include Group 1, 2, 9, 14, 15 and 22.

Key differences from pasture dieback: Affected area does not increase following rainfall. Sprayed areas can be colonised by grass and broadleaf species.

Sublethal dose of glyphosate on Bambatsi panic. SPB

Poor land condition

Description: Land condition determines the potential for pasture production after rainfall. Loss of desirable grass species due to over grazing resulting in low productivity areas consisting of less desirable grasses, weeds and bare ground. Particularly common following drought.

Incidence: It can occur over whole paddocks if stock numbers are too high, but commonly occurs in patches where desirable grasses are preferentially grazed over several years without rest periods, fire or slashing.

Key difference from dieback: Poor growing patches often align with soil types or position in the landscape. Preferred grass species can die out but this usually occurs over years rather than one growing season, as seen with pasture dieback. Land condition and pasture growth improves when the pasture is spelled and there is adequate rainfall.

Buffel pasture on poor or 'C' condition land. SRB

Biosecurity

Pasture mealybug is mainly spread by wind.

It is good practice in general to use the biosecurity principle of ***"Come clean, go clean"*** for all machinery and vehicles entering or leaving properties to manage the spread of many common agricultural pests and weeds.

Sign to notify visitors of farm biosecurity. BR

Reporting pasture dieback

Reporting assists state governments track the movement of pasture dieback to gain a better understanding of the condition.

NSW

If you suspect pasture dieback:

- Contact the Exotic Plant Pest hotline on **1800 084 881** *OR*
- Email **biosecurity@dpird.nsw.gov.au** with a clear photo and your contact details *OR*
- Complete the online reporting form which can be found at **https://forms.bfs.dpi.nsw.gov.au/forms/9247** *OR*
- Visit your Local Land Services office or phone **1300 795 299**

Queensland

If you are concerned about pasture dieback:

- Call the Department of Agriculture and Fisheries (DAF) customer information centre on **13 25 23** *OR*
- Visit your local DAF office and speak with a beef extension officer.

All other states

If you suspect symptoms of pasture dieback contact your state department of agriculture or contact the national Exotic Plant Pest hotline on **1800 084 881**

Pasture Dieback Survey App

Other useful resources

DPIRD	MLA	DAF – FUTUREBEEF
www.dpi.nsw.gov.au/agriculture/pastures-and-rangelands/establishment-mgmt/pests-and-diseases/pasture-dieback	www.mla.com.au/research-and-development/Grazing-pasture-management/pasture-dieback/	futurebeef.com.au/knowledge-centre/pasture-dieback/

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Sarah Baker, NSW Department of Primary Industries and Regional Development (NSW DPIRD), Tamworth

Stuart Buck, Department of Agriculture and Fisheries Queensland (DAF Queensland), Rockhampton

Nathan Jennings, North Coast Local Land Services, Lismore

Kylie Hopkins, DAF Queensland, Rockhampton

Suzanne Boschma, NSW DPIRD, Tamworth

Photographers

Brian Rosenberg *(BR)*, NSW DPIRD

David Officer *(DO)*, NSW DPIRD

Ken Cuncliffe *(KC)*, AgEtal

Mark Evans *(ME)*, NSW DPIRD

Marie Vitelli *(MV)*, formerly AgForce Queensland

Melina Miles *(MM)*, DAF Queensland

Naomi Diplock *(ND)*, Applied Horticultural Research

Nathan Jennings *(NJ)*, North Coast Local Land Services

Peter Perfrement *(PP),* NSW DPIRD

Sarah Baker *(SJB)*, NSW DPIRD

Stuart Buck *(SRB)*, DAF Queensland

Suzanne Boschma *(SPB)*, NSW DPIRD

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Front cover image: Pasture dieback affected paddock, southern Queensland. *Photo: DAF Queensland.*

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