



Queensland
Government

Pasture Dieback Identification Guide

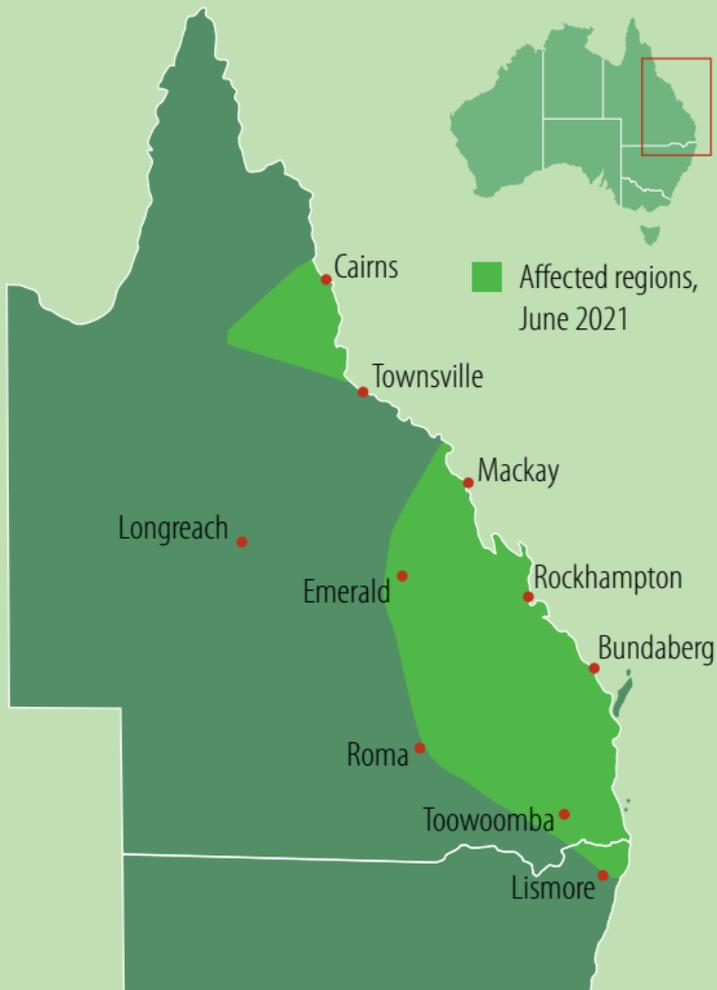
SJ Baker, SR Buck, N Jennings and SP Boschma



INTRODUCTION

Pasture dieback is a condition that kills summer growing grasses. These grasses are also known as C4, sub-tropical or tropical grasses. Pasture dieback begins in small patches which can grow to affect large areas, significantly reducing pasture productivity. Pasture dieback first emerged as an issue in buffel grass in Central Queensland during the 1990s. Since summer 2015, the condition has spread rapidly and now affects many sown and native summer grass species from Far North Queensland to the NSW North Coast.

At the time of writing, the cause of pasture dieback has not been confirmed. Pasture mealybug (*Heliococcus summervillei*) is a key insect under investigation. White ground pearl (*Margarodes australis*) is also being examined for its association with the condition.



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. A management guide for producers and agronomists is available online on the Meat & Livestock Australia Pasture dieback hub.



Patch of pasture dieback, Gatton, Qld. SJB

PASTURE DIEBACK QUICK ASSESSMENT

Are summer growing (sub-tropical/
tropical) perennial grasses affected?

NO

Broadleaf and legume species are not affected. Consider other conditions that may cause the observed symptoms. Continue to monitor pastures for changes

YES

Are grass leaves turning yellow,
red or purple?

NO

YES

Are grasses under-performing in
patches given the seasonal conditions?

NO

YES

Are grasses dying in patches?

NO

Continue to monitor pastures for changes

YES

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.

NO

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

YES

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	YES	NO	COMMENT
Does the pasture contain susceptible grasses?	<input type="checkbox"/>	<input type="checkbox"/>	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?	<input type="checkbox"/>	<input type="checkbox"/>	Symptoms are most evident in actively growing grasses.
Has good rainfall occurred recently?	<input type="checkbox"/>	<input type="checkbox"/>	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?	<input type="checkbox"/>	<input type="checkbox"/>	Pastures with a large amount of bulk due to favourable seasonal conditions and/or conservative grazing management tend to be more susceptible.
Is the annual average rainfall 600 mm or above?	<input type="checkbox"/>	<input type="checkbox"/>	The main dieback affected regions have 600+ mm annual average rainfall.
Has pasture dieback been identified in the local region?	<input type="checkbox"/>	<input type="checkbox"/>	Pasture dieback can affect many properties in a region, however not all properties will be affected.
Has grass hay been brought in from a known pasture dieback affected area?	<input type="checkbox"/>	<input type="checkbox"/>	There have been a few isolated reports of pasture dieback radiating from locations where pasture grass hay was stored or fed in a paddock.

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

SPECIES KNOWN TO BE AFFECTED BY PASTURE DIEBACK

Pasture dieback only affects grass species. To date only summer growing grass species, both sown and native, have been impacted. Some grasses are more susceptible than others. The scale below is based on field observations and grasses are listed in alphabetical order.

Highly susceptible

Mildly susceptible



- Buffel grass (cv. Gayndah and American)
- Creeping bluegrass (cv. Bisset)
- Pangola/digit grass
- Paspalum species
- Sabi grass

- Bambatsi panic
- Kikuyu
- Para grass
- Panic (green and Gatton types)
- Rhodes grass
- Signal grass

- Angleton grass/bluegrass
- Bahia grass
- Black spear grass*
- Buffel grass (cv. Biloela)
- Forest bluegrass* (cv. Swann)
- Golden beard grass*
- Indian couch/Indian bluegrass
- Purple pigeon grass
- Setaria

* *Native grass*

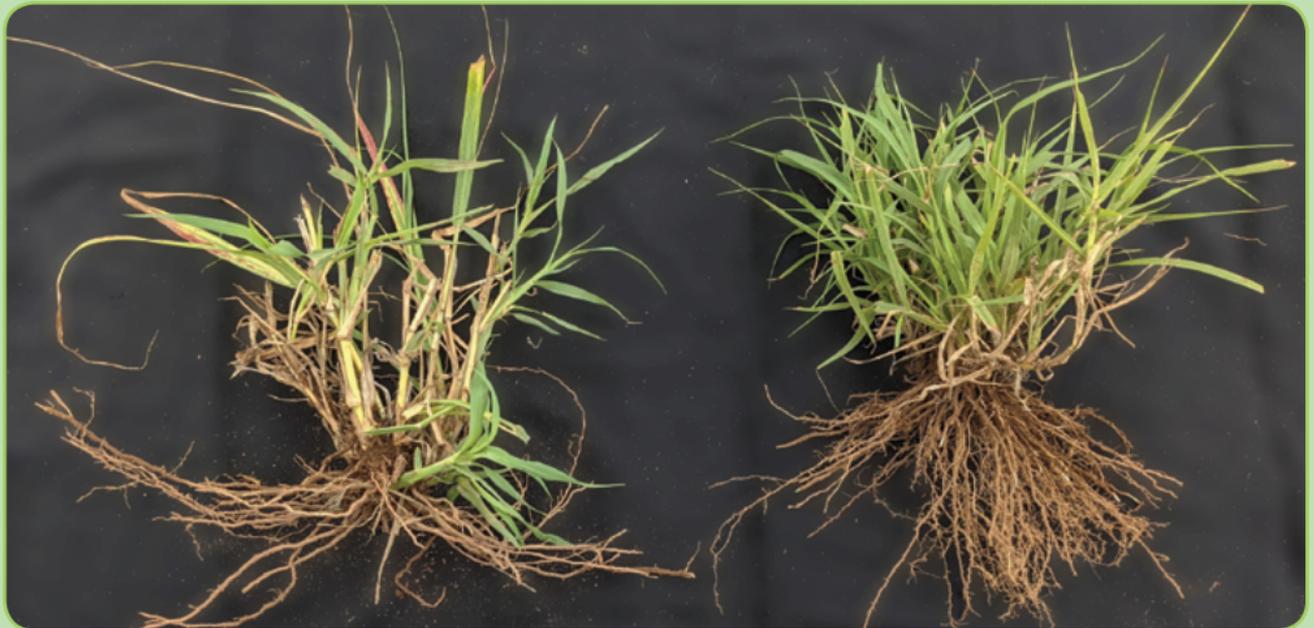
PASTURE DIEBACK SYMPTOM PROGRESSION

It is important to observe the 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.

- 1. Leaf discolouration** can vary between species ranging 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
		
<i>Panic grass. SJB</i>	<i>Buffel grass. SRB</i>	<i>Broadleaf paspalum. NJ</i>
Example grasses: Rhodes grass, Gatton panic, green panic	Example grasses: Buffel grass, creeping bluegrass	Example grasses: Broadleaf paspalum, creeping bluegrass, signal grass, setaria

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

3. Plant death can occur within a growing season.



Buffel grass killed by pasture dieback. JC

4. 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. It often occurs around trees and fence lines. Can stop at fence lines or farm tracks.



Broadleaf paspalum, Rhodes grass and setaria pasture on hill side affected by dieback. NJ

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



Pasture dieback can stop at fence lines. Buffel grass cv. Gaydah was sown in both paddocks. SRB



Dead broadleaf paspalum colonised by cottonbush. NJ



Dead buffel grass colonised by parthenium. SRB

PASTURE DIEBACK RECOVERY

In some cases pasture dieback affected areas have recovered without any intervention. Observations to date indicate the time taken to recovery can vary between 1-6 years depending on grazing and pasture management and rainfall received. The grasses which regenerate will depend on what seed is present in the soil. It may be the original species, other less susceptible species, or a combination that come back.



Early symptoms of dieback in Rhodes grass pasture, March 2018. GP



Same pasture killed by dieback, June 2019. GP



Pasture has recovered with Rhodes grass remaining the dominant grass species, January 2021. GP

PASTURE MEALYBUG AND PASTURE DIEBACK

PASTURE MEALYBUG (*Heliococcus summervillei*)

is associated with pasture dieback symptoms in many areas. Research is ongoing to better understand this insect and its role with the condition.

Description: Scale-like insect with a soft, waxy coat of filaments. Adult females are white or pink, 2-3 mm long and can be seen with the naked eye. Juveniles and egg masses are very small and difficult to see without a hand lens. Found among plants, on the soil surface, in debris and among the plant roots. Damage is caused by mealybugs sucking plant sap. They only affect grasses.

Incidence: Warmer months of the year, especially following rainfall events. During cooler and/or dry periods pasture 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.

Management: Long-term management options are under development. Short term insecticide options are available. Follow label and permit requirements.



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



Adult pasture mealybugs on the roots of buffel 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 ~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



Green lacewing beneficial predatory insect of mealybugs. NSW DPI.



Adult three-banded ladybird (Harmonia octomaculata). MM

WHITE GROUND PEARL AND PASTURE DIEBACK

WHITE GROUND PEARL (*Margarodes australis*)

is under investigation for its role in pasture dieback.

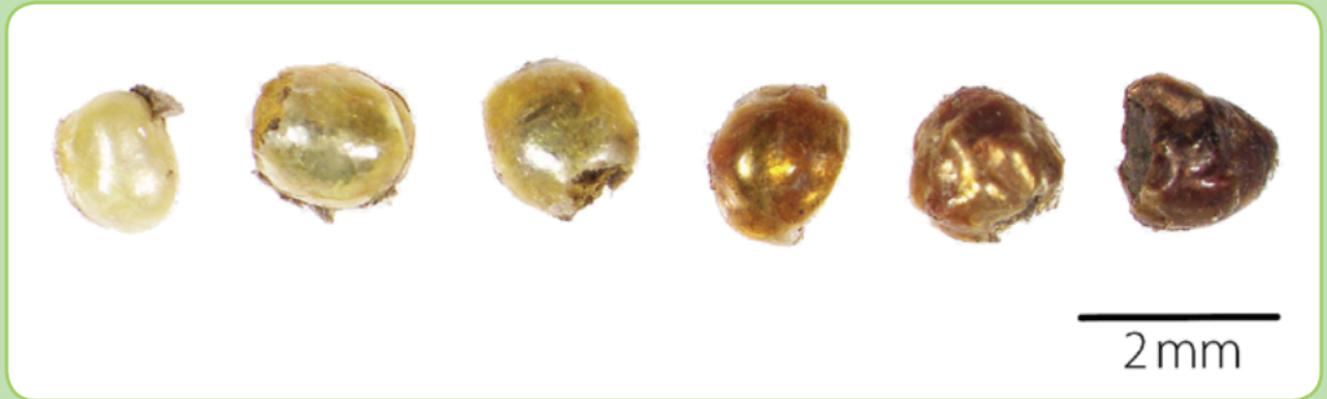
Description: Small (<2 mm) insects that live in the soil and feed on plant roots. Cysts, the second instar nymph stage, are the easiest to identify. Live cysts are around 2 mm in size, shiny, gold/bronze in colour and roughly spherical. Cysts can be found in the soil around active plant roots to a depth of 30 cm. Affected areas are roughly circular and increase in size over time. The change in size of affected areas under favourable conditions is slower than in areas affected by pasture mealybug.

Incidence: Foliage discolouration becomes more prominent and size of affected area increases following rainfall during spring, summer and autumn.



Ground pearls in soil clod. SRB

Management: No control options currently available. Maintaining good soil fertility can reduce productivity losses. Limit spread by restricting activities that move soil.



Colour variation in ground pearl cysts. Live cyst (left), all other cysts are empty and degrading. MT

PASTURE DISORDERS WITH SYMPTOMS SIMILAR TO PASTURE DIEBACK

1. PESTS

ARMYWORM - 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 discoloration. Seedlings may die but mature plants will often show signs of re-growth from the growing point.



Common armyworm (*Leucania convecta*) larva caterpillar. NSW DPI



Common armyworm (*Leucania convecta*) moth. NSW DPI



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

Fall armyworm is a notifiable pest in Australia. For more information visit NSW DPI or DAF websites.

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 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.



Oat aphid (Rhopalosiphum padi). NSW DPI

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 difference between pasture dieback and these pests: 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



Brown leafhopper (Orosius argentatus). NSW DPI



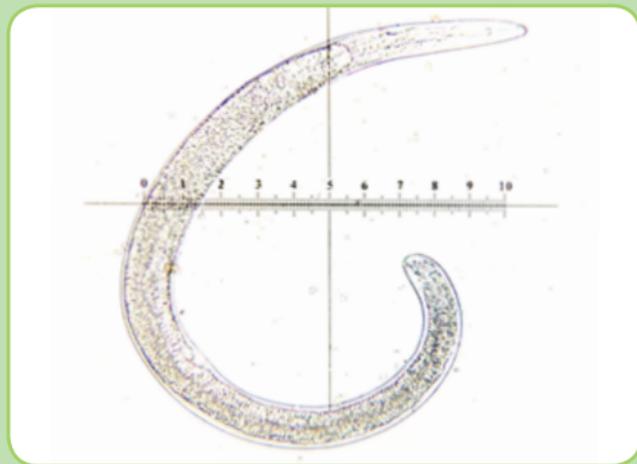
Spider mites produce webbing on grass. SJB

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. It is a biological control agent for giant Parramatta grass (*Sporobolus africanus* and *S. fertilis*). 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.

Buffel blight (*Pyricularia* sp.) causes blotches or blight lesions on the leaves of affected buffel grass 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 discoloration.

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 discoloration, 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 buffel 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 discoloration 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.
Aluminium toxicity	Reddening or purpling of leaves. Reduced plant growth.	Most common in acid soils, with pH_{Ca} 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.

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 A, B, G, J, L and M.

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

- Practice “Come clean, go clean”.
- Ensure vehicles and equipment entering or leaving the property are clean and free of soil and plant material.
- Ensure footwear and clothing are clean and free of dirt and plant material before entering or leaving a property.
- Only use property vehicles to move around the property.
- Ensure all staff and visitors are instructed in and adhere to the property biosecurity plan.
- Monitor grass pastures for signs of pasture dieback, especially following rainfall.
- Monitor both the storage and feed locations of summer grass pasture hay (e.g. Rhodes grass hay).



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 symptoms of pasture dieback:

- Contact the Exotic Plant Pest hotline on **1800 084 881 OR**
- Email **biosecurity@dpi.nsw.gov.au** with a clear photo and your contact details **OR**
- Complete the online reporting form which can be found at **<https://www.dpi.nsw.gov.au/biosecurity/report-a-pest-or-disease> OR**
- Visit your Local Land Services office

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**.

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Front cover image

Pasture dieback affected paddock, central Queensland. Photo: Andrew Lawrie, Grazier

OTHER USEFUL RESOURCES

NSW DPI



www.dpi.nsw.gov.au/pasture-dieback

MLA



www.mla.com.au/research-and-development/Grazing-pasture-management/pasture-dieback/

DAF – FUTUREBEEF



futurebeef.com.au/knowledge-centre/pasture-dieback/



Grassland Society of NSW Inc.

www.grasslandnsw.com.au/news/publications/other-publications