final report

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Pasture Dieback: Evaluation and delivery of diagnostic tools and information products for graziers

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Abstract

This project provided a two-way communication conduit between eastern Queensland producers and researchers engaged in identifying pasture dieback and finding management solutions. The best methods for information sharing are through paddock walks, video interviews shared on social media and localised discussion amongst producers and researchers.

During 2021 to 2023, 695 producers and agribusinesses attended 19 producer events coordinated by AgForce. Ten producer interviews were uploaded onto Facebook social media and one video was used by regional television. Producers mapped 65,048 ha of dieback across 41 affected areas on the crowdsource web map.

Learnings gathered from the two case studies and demonstration trial show diverse management responses, the role of cool fire in some situations and follow up weather conditions are critical for success of pasture renovation. The incidence of pasture mealybugs and associated insect predators such as lacewings and Cryptolaemus ladybirds are infrequent and sporadic. Producer observations from some sites indicate other possible factors contributing to dieback symptoms such as pathogenic leaf rusts and diseases.

AgForce recommends future extension networks should focus on maintaining the Pasture Dieback Industry Network coordinated through the Queensland Department of Agriculture and Fisheries and increased engagement with grazing consultants and produce agencies.

Executive summary

Executive summary

The epidemic of pasture dieback across eastern Queensland in improved pastures since 2018 has caused a 50 per cent reduction in pasture production and 40 per cent loss in carrying capacity. A wide range of improved pasture grasses are affected, including Gayndah and American buffel, creeping Bisset bluegrass, pangola, paspalum, panics, kikuyu, signal grass and Callide Rhodes.

Pasture dieback is a complex condition. Symptoms can vary across different locations and different pasture grass species. In 2020, Meat & Livestock Australia and the Australian Government co-invested in research to investigate dieback symptoms associated with one of the confirmed causes, the pasture mealybug *Heliococcus summervillei.*

The role of this AgForce project was producer communication by sharing emerging research through a series of paddock walks and events; collating a photo library of dieback symptoms; documenting three case studies and demonstration sites; developing a web map for recording dieback affected areas; and surveying for changes in producer skills. During 2021 to 2023, 695 producers and agribusinesses attended 19 producer events coordinated by AgForce. Ten producer interviews were uploaded onto Facebook social media and one video was used by regional television. Producers mapped 65,048 ha of dieback across 41 affected areas on the crowdsource web map.

Survey results indicated 90 per cent of producers know pasture dieback is most prevalent in high biomass, conservatively grazed pastures, particularly after rainfall and when temperature and relative humidity were high. Forty-five per cent of producers were implementing short-term heavy grazing to open up pasture and reduce risk. The key message was “use it or lose it” during dieback risk periods.

Another 45 per cent of graziers were seeking more information on best management and prevention of pasture dieback. Main sources of information were from other producers, producer information sessions, Future Beef extension, Meat & Livestock Australia and social media. By 2023, 40 per cent of producers were seeking dieback management advice from grazing consultants and producer agencies.

This communication project has confirmed the best method for information delivery is through paddock walks, video interviews shared on social media and robust, localised discussion amongst producers and researchers.

The Pasture Dieback Industry Network developed by the Department of Agriculture and Fisheries Future Beef team in conjunction with Meat & Livestock Australia is recommended as the main channel for future extension about pasture mealybug-induced dieback.

AgForce recommends seeking future advice from dryland crop pathologists to assist with isolation and identification of other causative factors contributing to pasture dieback such as pathogenic pasture diseases and ill thrift due to lack of available soil macro and micro-nutrients.

Over 80 per cent of producers are not sure of spread pathways for pasture dieback. Therefore, it is difficult to implement farm practices and farm hygiene methods to reduce risk of spread off-farm and onto farm. Another management area recommended for further investigation.

Table of contents

1 Background 6
1.1 Pasture Dieback 6
1.1.1 The problem for the grazing industry 6
1.1.2 Impact on livestock producers 6
1.1.3 Helping producers to identify and manage pasture dieback 6
2 Project objectives 7
3 Methodology 8
3.1 GIS crowdsource web map 8
3.2 Producer survey 8
3.3 Producer events and property visits 8
3.4 Producer demonstration sites and case studies 8
3.5 Photo library of pasture dieback symptoms 8
4 Results 9
4.1 GIS crowdsource web map 9
4.2 Producer survey results from 2022 and compared to 2023. 14
4.3 Producer events and property visits 20
4.4 Producer demonstration sites and case studies 22
4.4.1 Producer videos discussing pasture dieback experiences and impacts 22
4.5 Photo library of pasture dieback symptoms 23
4.5.1 Pasture dieback symptoms on pasture species 23
4.5.2 Pasture mealybug – *Heliococcus summervillei* 27
4.5.3 Pasture dieback situations 28
4.5.4 Management methods used by producers 29
4.5.5 Photos from pasture dieback events and research trial sites 29
5 Discussion 30
6 Conclusions/recommendations 31
6.1 Future communication 31
7 Bibliography 33
8 Appendix 1 34

8.1 Producer Case Studies..... 34

8.1.1 Paul and Majella Erbacher, Dorset Station, Guluguba, Southern Inland Queensland 34

8.1.2 Rob Lethbridge, YoYo Station, Taroom, Southern Inland Queensland 37

8.2 Producer Demonstration Sites 39

8.2.1 John and Marian Cowen, Bilburrie Station, Mundubbera, Southeast Queensland. 39

1 Background

1.1 Pasture Dieback

1.1.1 The problem for the grazing industry

Pasture dieback caused total collapse and death of vast areas of improved pastures and some native pastures across eastern Queensland and northern New South Wales. The current outbreak since 2017 is the most widespread and most devastating of all occurrences of pasture dieback since the 1920's. Causes and management strategies were poorly understood. The potential impact to the beef cattle industry in lost carrying capacity was the trigger to commence research in 2020, which was funded through Meat & Livestock Australia MLA and the Australian Government National Landcare Program.

1.1.2 Impact on livestock producers

This is potentially a $2Billion problem to the northern beef industry. Affected producers recorded a 50 per cent reduction in pasture production and up to 40 per cent loss in carrying capacity. In 2018, an AgForce survey indicated 85 per cent of coastal and central Queensland graziers across 18 local government shires were affected by pasture dieback. In 2018, the most severely affected shires included Central Highlands, Banana, North Burnett and Isaac. Average area of pasture dieback per property was 680ha, with some properties reporting 8000ha or more. In 2018, survey respondents had lost a total of 57,900 ha to pasture dieback. This equates to lost feedbase opportunity for 14,475 AE livestock at a stocking rate of 4ha per adult on improved pasture. Since 2018, millions of hectares and many more producers were affected by pasture dieback. A wide range of improved pasture grasses were affected, including Gayndah and American buffel, creeping Bisset bluegrass, pangola, paspalum, panics, kikuyu, signal grass and Callide Rhodes. Native grasses such as forest blue grass, golden beard grass and black spear grass were occasionally affected. Legumes and broadleaf weeds were not affected. It can take two years or more for some improved pasture grass species to recolonise dieback-affected areas.

1.1.3 Helping producers to identify and manage pasture dieback.

Pasture dieback is a complex condition. Symptoms can vary across different locations and different pasture grass species. Until 2021, there was limited information and no comprehensive visual guides or tools for producers to accurately diagnose dieback from other chronic conditions in their own pastures. In central Queensland buffel pastures, the symptoms for mealybug-infested pasture dieback (MIPD) can differ from symptoms seen in south-east Queensland on kikuyu, broadleaf paspalum and Rhodes grass.

In 2020, MLA and the Australian Government co-invested in research to investigate dieback symptoms associated with the pasture mealybug *Heliococcus summervillei*. Ongoing research over the next two years identified and investigated multiple causal factors including biotic and abiotic factors and potential pathogenic organisms (Buck *et al*, 2022). The first diagnostic guides were published in 2021 by MLA (MLA, 2021) and jointly by New South Wales Department of Primary Industries and Queensland Government (Baker *et al*, 2021).

The role of AgForce was to assist producers by sharing emerging research information about the causes, vectors and spread pathways of pasture dieback. The movement of contaminated hay,

fodder and vehicles may spread pasture dieback. Producers and land managers need help to identify early signs and be aware of pasture dieback affected areas. Some producers conducted their own paddock trials to rejuvenate pastures and restore productivity. While awaiting research outcomes, there are rich learnings from the observations, successes and failures shared amongst other producers through facilitating farm visits and collating case studies.

2 Project objectives

Objectives of this two-year project were to:

1. *Utilise survey techniques to demonstrate improved producer skills in identification of pasture dieback signs and use of diagnostic tools and information products generated by the Pasture Dieback Research Program.*

   ACHIEVED: Survey results indicated 90 per cent of producers know pasture dieback is most prevalent in high biomass, conservatively grazed pastures, particularly after rainfall and when temperature and relative humidity were high. Forty-five per cent of producers were implementing short-term heavy grazing to open up pasture and reduce risk. The key message was “use it or lose it” during dieback risk periods

2. *Develop and implement an ArcGIS crowdsource web map to enable producers to map dieback incidence and affected area.*

   ACHIEVED: Producers mapped 65,048 ha of dieback across 41 affected areas on the crowdsource web map.

3. *Facilitate improved awareness of management strategies through a series of field walks, producer information events and social media interviews*.

   ACHIEVED: During 2021 to 2023, 695 producers and agribusinesses attended 19 producer events coordinated by AgForce. Ten producer interviews were uploaded onto Facebook social media and one video was used by regional television.

4. *Establish and collate three producer trials and case studies*.

   ACHIEVED: Two producer case studies from Dorset Station, Guluguba and Yo-Yo Station Taroom and one producer demonstration site at Bilburrie Station Mundubbera Queensland were established to share producer experiences in combating pasture dieback and investigating possible causes. Two sites were severely affected by pasture dieback since 2018 and one site since 2020. Sites varied between buffel-dominant blade ploughed country to diverse improved pastures over previously flooded country.

The project period was from April 2021 to April 2023.

3 Methodology

3.1 GIS crowdsource web map

Develop and implement an ArcGIS Crowdsource web map and web database, where producers can zoom into their property to monitor the incidence and spread of dieback by drawing polygons of affected areas, upload photos and provide responses to relevant information.

3.2 Producer survey

During 2022, develop and conduct base-line survey of producers engaged in the project to ascertain industry skill level in identifying symptoms of pasture dieback. Producers to also provide information on the preferred format and sources of information delivery.

Towards completion of the project in 2023, conduct a follow-up dieback survey to assess for increased awareness and improved skills in identification of pasture dieback. The eight survey questions were:

(1) How confident are you in identifying pasture dieback symptoms?
(2) Have you seen areas of pasture dieback?
(3) At what stage of incursion can you identify pasture dieback?
(4) What conditions does pasture dieback prefer?
(5) How does pasture dieback spread to new areas?
(6) What are your sources of information about pasture dieback?
(7) Although causes and management of pasture dieback are not fully known yet, what do you think are some of the best management options?
(8) What are your preferred methods to receive future useful information about pasture dieback?

Survey respondents were able to tick all relevant responses in Survey Monkey or the printed survey form.

3.3 Producer events and property visits

Across central and coastal Queensland, support and coordinate a series of property visits and producer events to share research outcomes, learnings and experiences about pasture dieback management.

3.4 Producer demonstration sites and case studies

Establish three on-farm producer demonstration trials for testing dieback management strategies. Complete three case studies. Site locations were from southern inland and south east Queensland. Paul and Majella Erbacher's from Dorset Station hosted a producer field walk on 9 February 2022 to share their experiences amongst 49 other producers and other participants.

3.5 Photo library of pasture dieback symptoms

Collate 50 annotated, high-quality images of pasture dieback symptoms across a range of affected pasture species. The images were generated by AgForce staff from visiting pasture dieback affected sites and from paddock walks at producer events across eastern Queensland. Pasture species depicted include Bisset creeping blue grass *Bothriochloa insculpta,* Gayndah Buffel grass *Cenchrus*

ciliaris, Green Panic *Megathyrsus maximus,* Floren bluegrass *Dicanthium aristatum,* Pangola grass *Digitaria eriantha.* Pasture dieback field situations, pasture mealybug photos and social media photos from pasture dieback events are also included.

4 Results

4.1 GIS crowdsource web map.

The pasture dieback ArcGIS crowdsource web map, questions and database were developed, refined after producer and researcher feedback and released for use to land managers and advisors. The link to the web map (https://agforce.maps.arcgis.com/apps/CrowdsourceReporter/index.html?appid=154b9d7e4a2d4f598968322a6bf81c53)was emailed to 2,560 producers, agribusinesses and resellers on 16 November 2021. Within the first two days or release, interaction rate with the email EDM message was 40 per cent. The web map launch was also promoted through an AgForce media statement (AgForce 2021).

In February 2022, graziers were urged to map dieback in the Queensland Country Life newspaper. In June 2022, direct emails were sent to 2400 AgForce members, 660 non AgForce members and 73 regional and industry colleagues across Qld and northern NSW. Although producer responses doubled from this June 2022 promotion, the response rate of 41 from a target of 300 mapped areas is very poor (Fig. 1). This is partially due to time constraints and survey fatigue of producers. The response report from the June 2022 electronic direct email reminder to 2,400 recipients showed 51 per cent opening rate and 31 per cent clicking on the map and quiz link.

The ArcGIS web map enables users to see other mapped pasture dieback areas, symptom details and uploaded photos. Personal contact data was not displayed. Only those users who agreed to share their contact data were included in the project milestone 4 report to MLA.

For each mapped pasture dieback area, producers responded to a series of questions on year dieback was first noted (Fig. 2), pasture species affected (Fig. 3), symptoms (Fig. 4), spreading or contracting, pasture diversity and biomass, dew period, insect pests or disease sighted (Fig. 5), contact details and an option to upload photos.

Click on this safe link to open the web map to start mapping and/or view other affected areas

- The map requires internet connectivity.
- **Clickhere** (https://agforce.maps.arcgis.com/apps/CrowdsourceReporter/index.html?appid=154b9d7e4a2d4f598968322a6bf81c53)
- Before using the web map for the first time, AgForce recommends you open and read the brief instructions on the front page, listed within "*Click here before starting*"

What happens to everyone's information on the crowdsource map?
Any contact details supplied through the web map are securely stored by AgForce. You have a choice to share, or not to share contact details with Meat and Livestock Australia MLA and the pasture dieback research team.

What's in it for me?
Users of the crowdsource map can view other mapped pasture dieback areas, site observations and any uploaded photos. Check if pasture dieback has been recorded from nearby you, so you can be alerted to check for early symptoms and timely management decisions to help reduce impact over grazing pastures.

Why map?

- Areas of impact combined with ongoing research into causes and management of pasture dieback will help find solutions.
- Determining total areas affected will confirm the economic cost of reduced carrying capacity to the grazing industry and environmental impacts due to reduced ground cover. Current estimate is a $2billion loss to the Queensland grazing industry.
- The crowdsource map will help predict vulnerable areas to future pasture dieback outbreaks and collate photos of symptoms across a wide range of improved pasture species.

We encourage you to map dieback areas and share this web map link with other land managers and agribusinesses affected by pasture dieback.

Development of the AgForce pasture dieback crowdsource map

Developed by AgForce through joint funding from Meat & Livestock Australia MLA and the Australian Government's National Landcare Program.
If you require mapping assistance, please contact AgForce on 07 3236 3100 or email agforce@agforceqld.org.au

More information on pasture dieback symptoms and research updates

- MLA's pasture dieback hub
- DAF Future Beef
- DPI NSW

A reminder to map pasture dieback areas was also included in AgForce ENVOY June 2022 hard copy newsletter which was posted to 6400 AgForce members.

Help AgForce help you by adding your specific feedback to the pasture dieback web map survey, which you can access by scanning the above QR code.

Using the app allows you to:

- draw the area of potential pasture dieback
- upload photos of the pasture dieback site
- answer questions to help identify the symptoms across the range of affected pasture species

Importantly, all data is de-identified, allowing anyone who visits the app to see dieback location responses from others without showing names and contact details.

Want to know more about pasture dieback and access more great resources?

Visit MLA's pasture dieback hub for a range of useful resources, including the management guide for producers and agronomists:
mla.com.au/research-and-development/Grazing-pasture-management/pasture-dieback.

Alternatively, call DAF on **13 25 23**, contact your local Future Beef extension officer, or visit **futurebeef.com.au/knowledge-centre/pasture-dieback.**

ENVOY WINTER 2022 | 19

Figure 1. Key findings from the 41 responses to the AgForce pasture dieback crowdsource map. 41 pasture dieback mapped areas are outlined in red – April 2023. Total mapped area affected is 65,048ha.

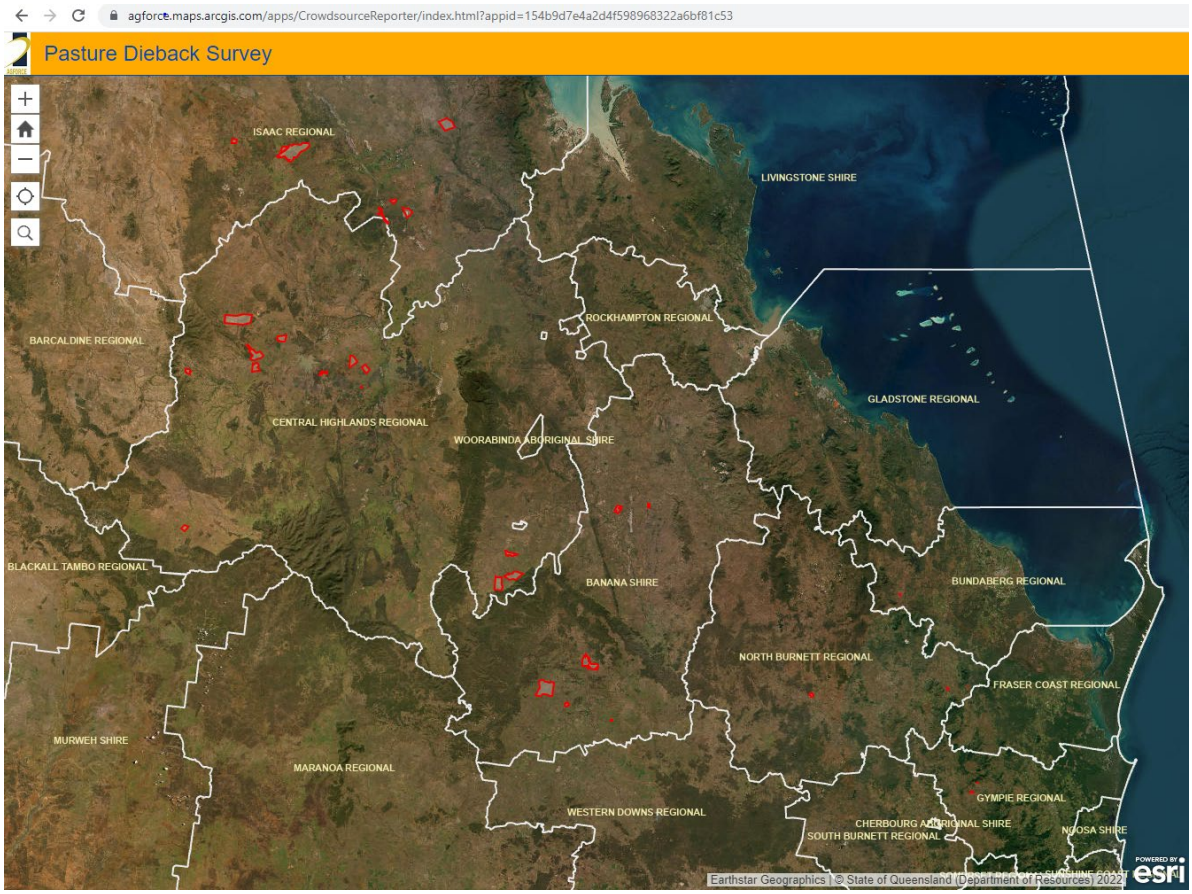


Figure 2. Pasture dieback was mainly noticed in 2018 and 2019.

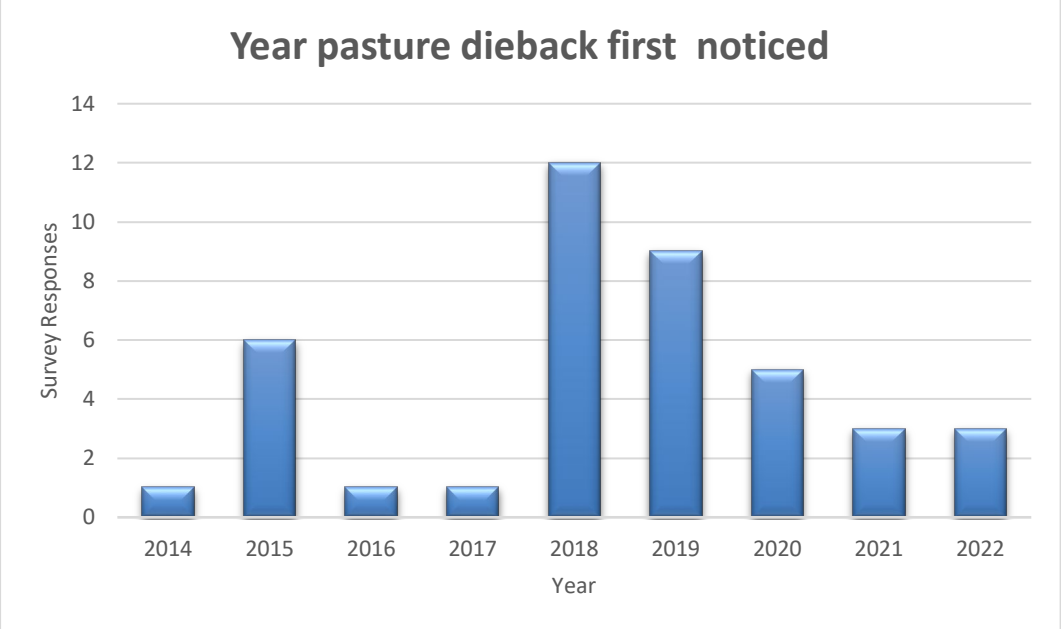
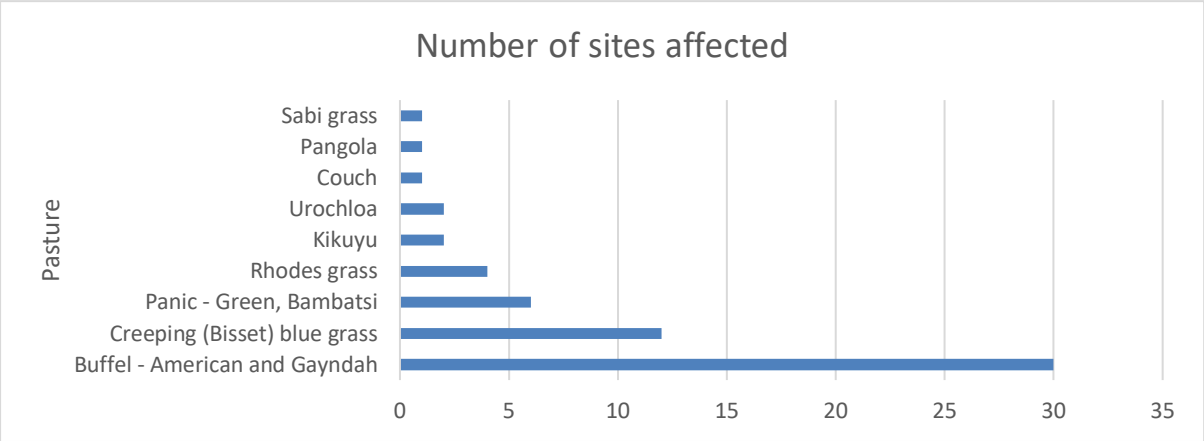


Figure 3. The predominant improved pastures affected by pasture dieback were American and Gayndah buffel, Bissett creeping blue grass and green or Bambuti panic.



Over 80 per cent of pasture dieback sites were high biomass, bulky pastures. Dieback was noted to be spreading further from 65 per cent of mapped sites.

Figure 4. Producers generally notice pasture dieback after pasture had died, legumes persist and weeds had invaded. Some notice pasture stress symptoms of red and yellow streaks in leaves. Very few notice the early onset signs of small dead patches of pasture. Ideally the onset of pasture dieback is when management decisions about high pasture utilisation should occur (e.g. "*Use it or lose it*").

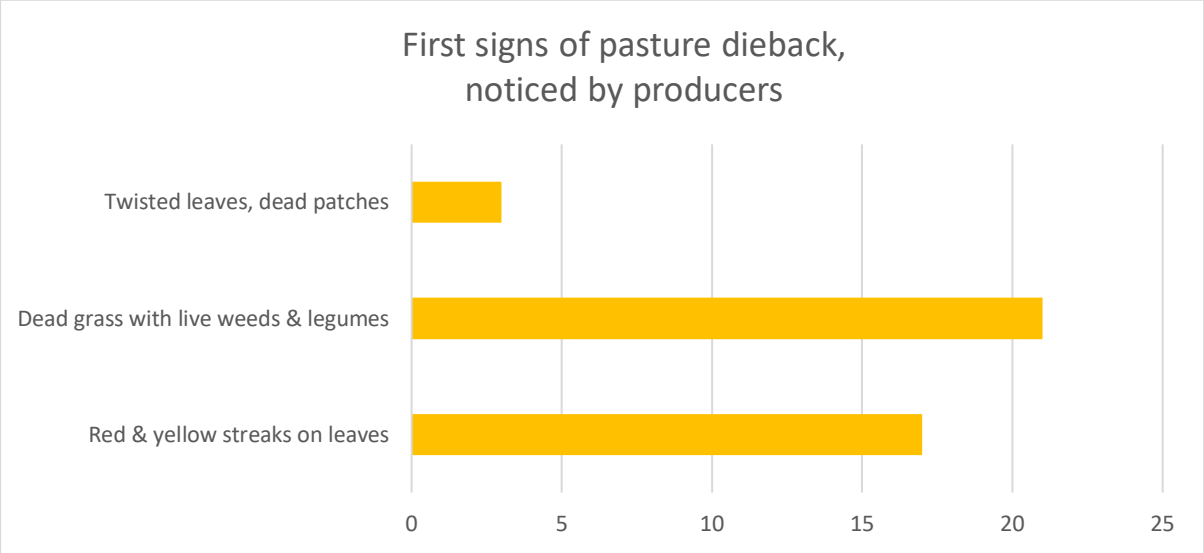
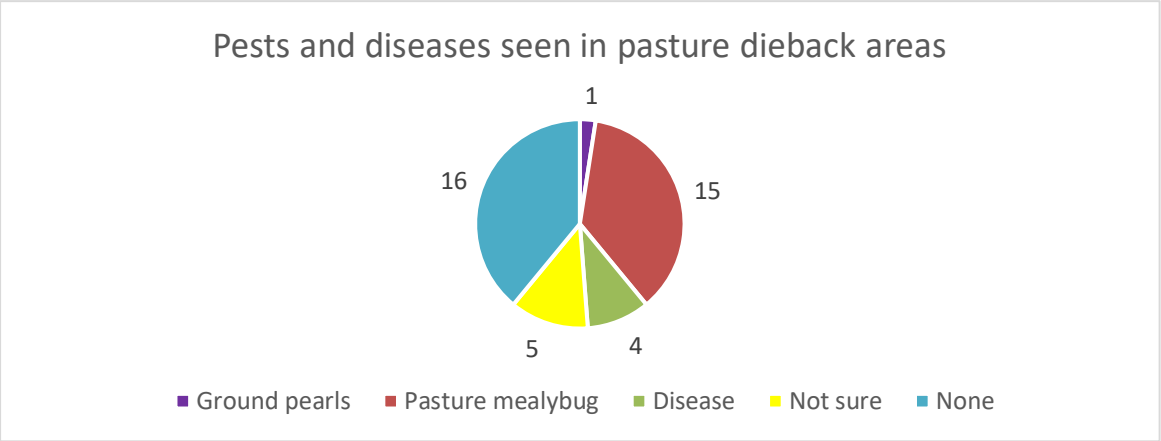


Figure 5. The most visual pest or disease was pasture mealybug (36 per cent of sites). Although 40 per cent of sites had no visual signs of any pests or diseases.



4.2 Producer survey results from 2022 and compared to 2023.

Although producer survey response numbers were less than originally targeted, results do show an increase in identification skills and management options over the two years of pasture dieback research (Fig.6) and most producers had seen pasture dieback (Fig.7).

Figure 6. There was a positive shift in producer skills and confidence in identifying pasture dieback symptoms over the two years of pasture dieback research.

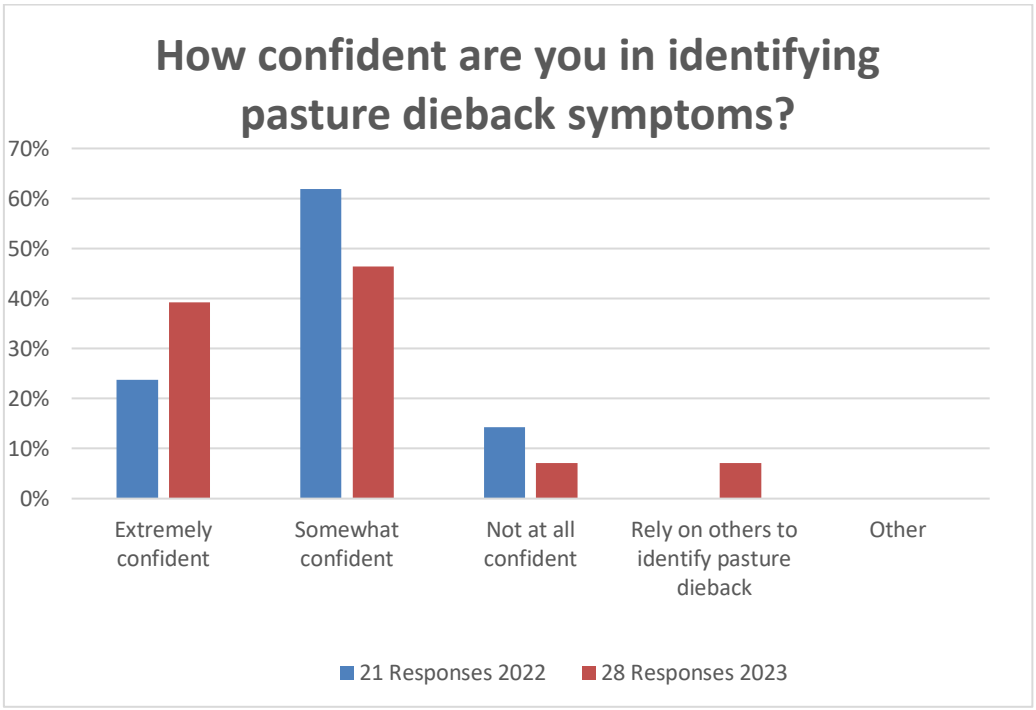
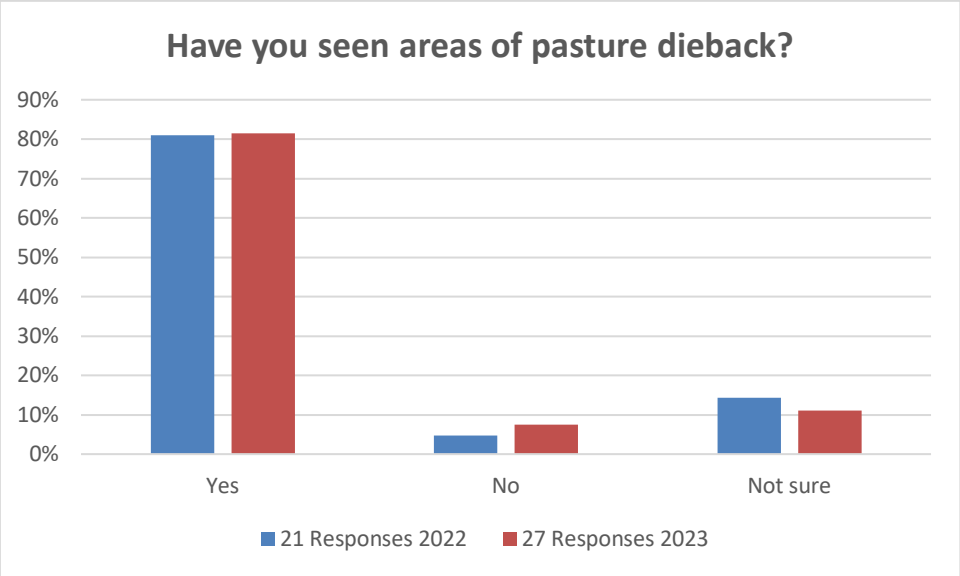
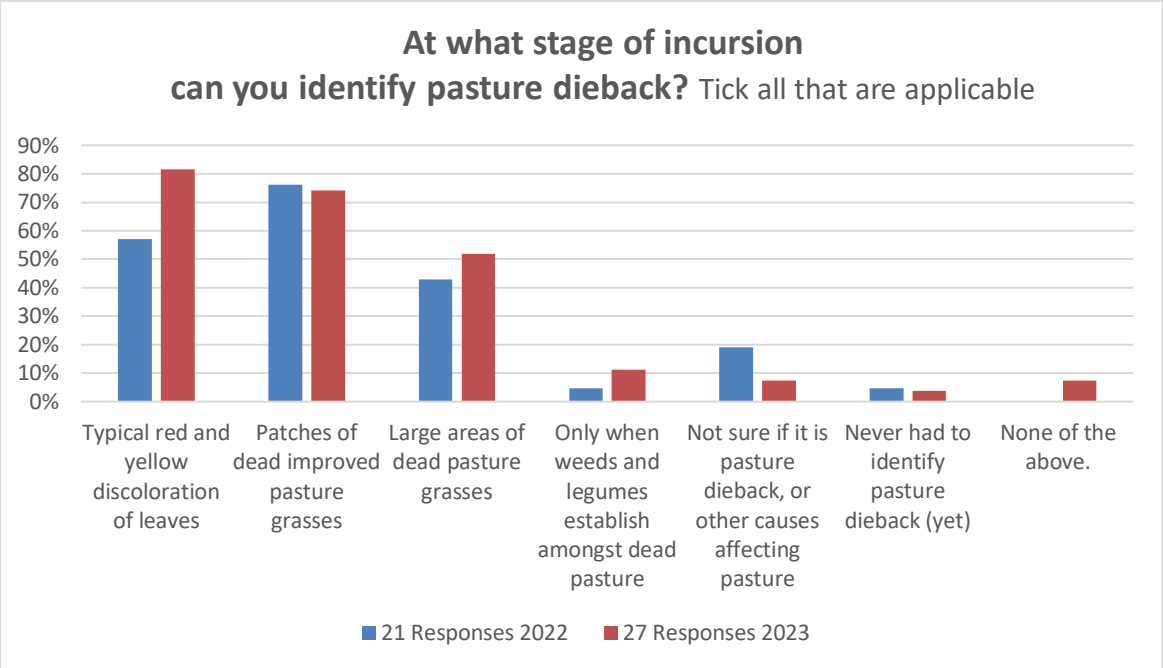


Figure 7. Over 80 per cent of producer respondents had previously seen pasture dieback.



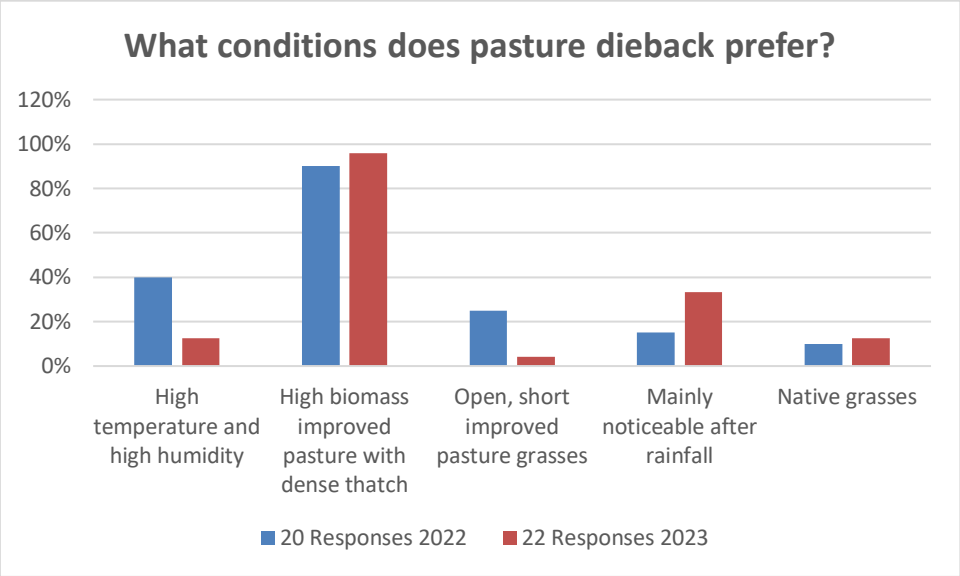
Producers first notice pasture dieback when patches or large areas of pasture start dying. By the second year of the project, producers were starting to become more aware of the initial signs of stressed pasture which was the red and yellow streaking in leaves. Survey responses (Fig.8) were like the ArcGIS crowdsource web map responses (Fig. 4).

Figure 8. Producers recognise the advanced stages of pasture dieback when there are patches or large areas of dead pasture grass. In the second year of the project, more producers started to also detect the early indicator of pasture stress with the red and yellow discoloration of leaves.



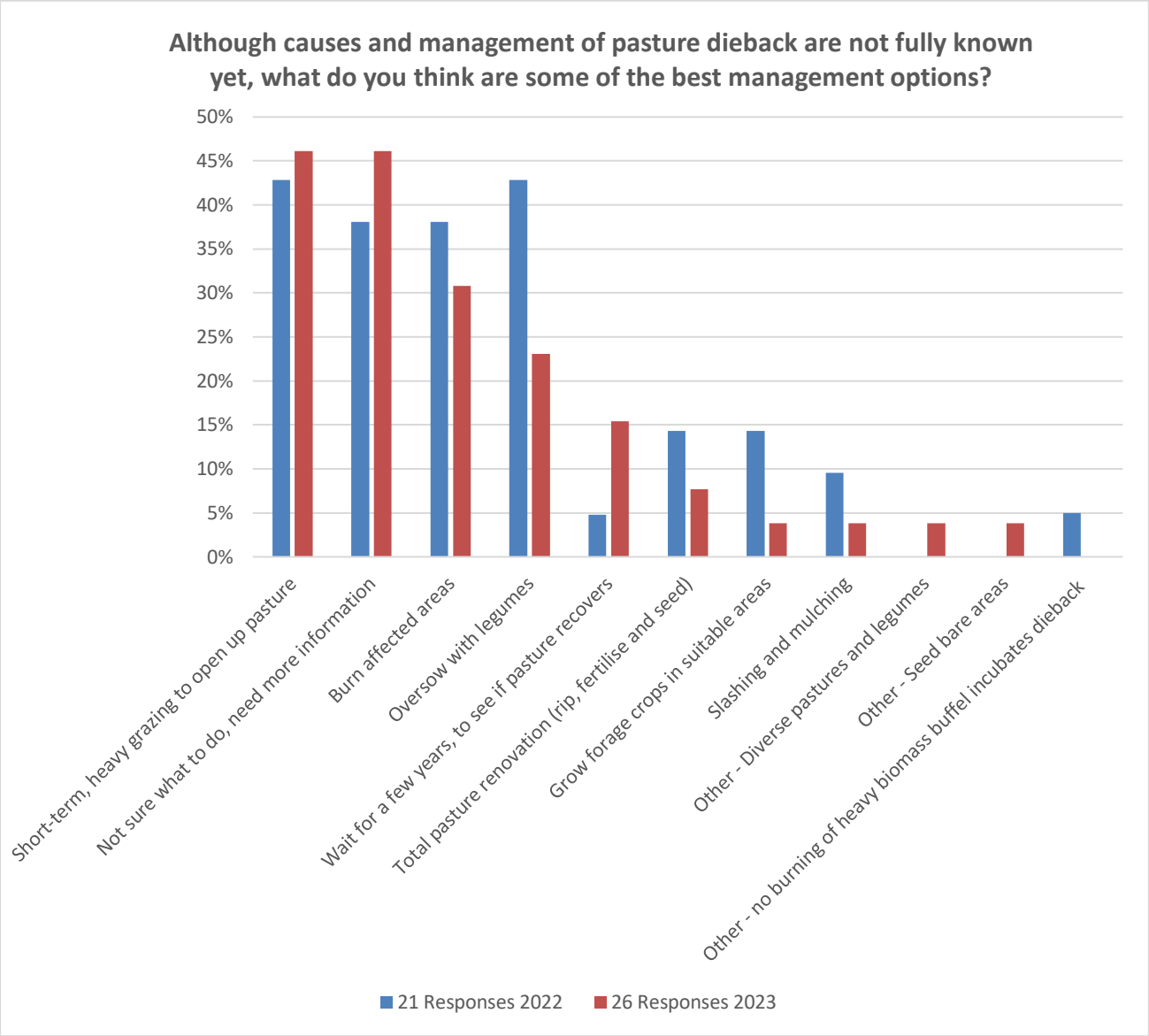
In both years, over 90 per cent of producers are aware pasture dieback is most prevalent in high biomass, conservatively grazed pastures, particularly after rainfall and when temperature and humidity are high (Fig. 9). This indicates a different grazing regime is required during conditions when the imminent risk of pasture dieback incursion is high. Heavy pasture utilisation during these risk periods may be a best bet, cost effective option.

Figure 9. Over 90 per cent of producers are aware that pasture dieback is most prevalent in high biomass grass with dense thatch or organic matter underneath.



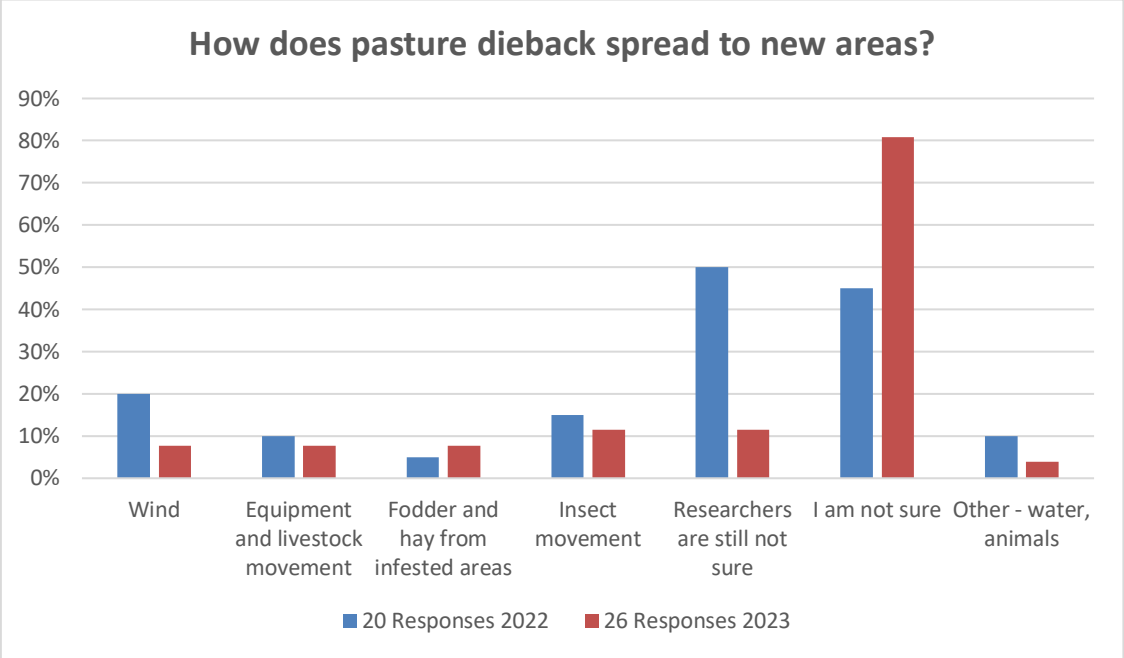
The main producer practices for managing pasture dieback include short-term heavy grazing to reduce pasture biomass, burning affected areas or over-sowing with legumes. Nearly half of the producers still require more information to help decide best management options (Fig. 10). In 2023, an additional 10 per cent of producers are waiting to see if pasture recovers naturally, without any intervention and with changes in seasonal conditions. Twenty per cent less of producers are considering oversowing with legumes in 2023, possibly due to the variable success rate of establishing legumes in existing pasture. These survey responses demonstrate producers are reluctant to invest resources into pasture rehabilitation unless there is certainty with carrying capacity and pasture dieback will be arrested.

Figure 10. Nearly 50 per cent of producers require more information before deciding what to do about pasture dieback. Over the last two years, the main management response has been short-term heavy grazing to open the pasture up and be less susceptible to pasture dieback. One third of surveyed producers have burnt affected pasture areas. There has been a 20 per cent drop in considering to oversow legumes into dieback areas.



There is very limited information available on preventing spread of pasture dieback into new areas. Pasture dieback is caused by a complex of unconfirmed factors, including the pasture mealybug insect. Over the two-year project, there was a 30 per cent increase in the number of producers not sure what to do to minimise spread. Although 80 per cent of producers are not sure how to prevent spread, they believe researcher knowledge has increased about spread pathways (Fig.11). AgForce recommends further research into limiting pasture dieback spread and protection of new areas.

Figure 11. The proportion of producers not knowing how pasture dieback spreads increased to 80 per cent in the second year of the project. Conversely, only 12 per cent of producers considered researchers did not know causes of spread in 2023, compared to believing 50 per cent of researchers had no idea in the year prior.



During the two years of pasture dieback research, there has been a shift from DAF Future Beef and MLA being the main information sources to utilising other producer peers for shared learnings (Fig. 12). Producer information sessions, including paddock walks are a valued information source to 36 per cent of producers.

Extension delivery methods for future pasture dieback information should include several pathways. The four most popular information sources include DAF Future Beef staff and website, local producer information sessions, rural newspapers, grazing consultants and produce agencies (Fig. 13). Other extension pathways include online industry newsletters (e.g. Beef Central), MLA website, online factsheets and ABC Radio Rural Report and Country Hour.

Figure 12. During the two years of pasture dieback research, producers have transitioned from using DAF Future Beef and MLA as the main source of information towards learning from other producers and producer information sessions.

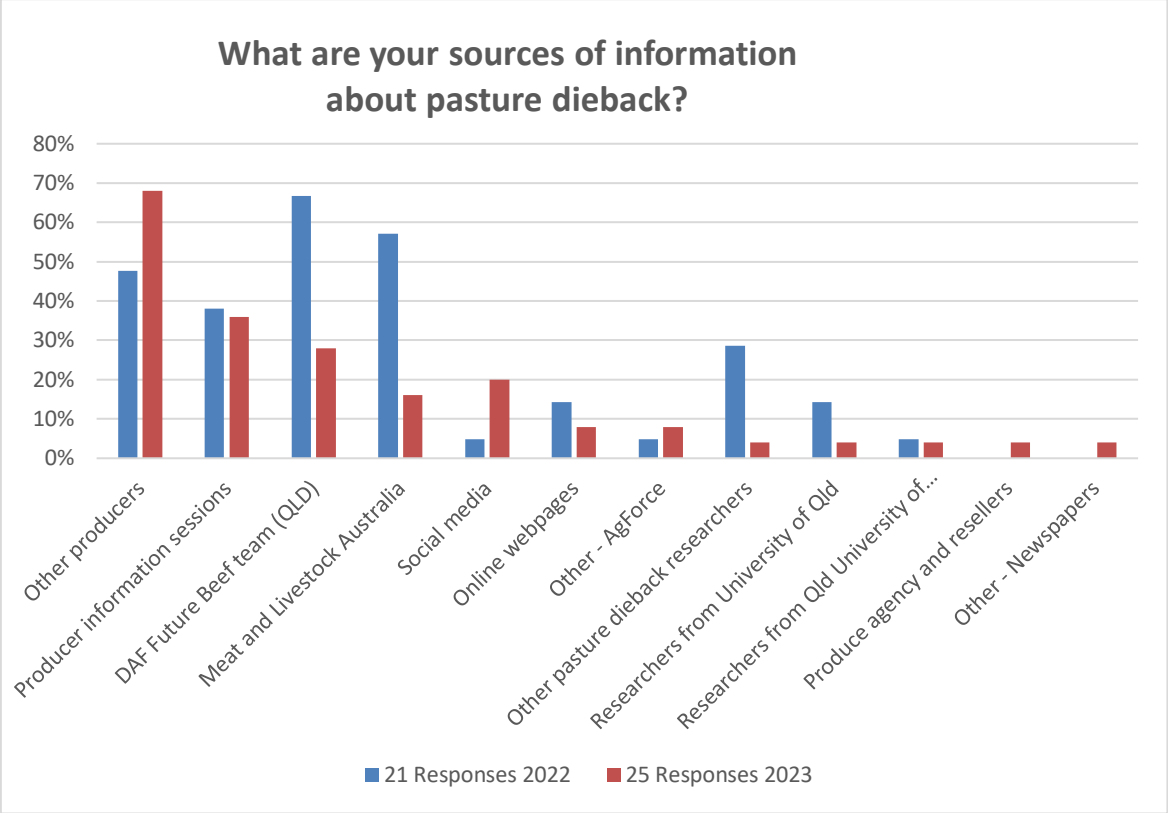
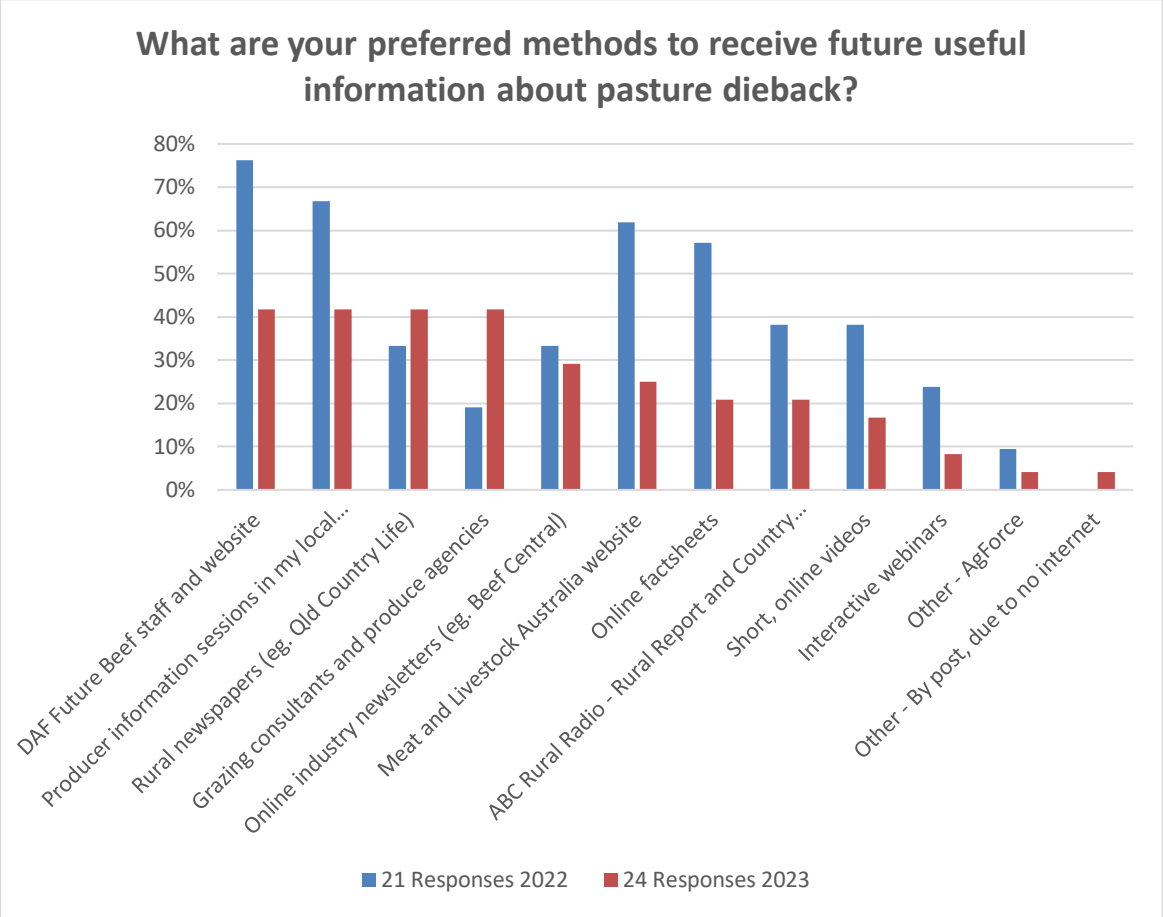


Figure 13. Future pasture dieback information should be shared across multiple extension pathways, including DAF Future Beef, local producer information sessions, rural newspapers, grazing consultants, produce agencies, online newsletters and MLA website.



4.3 Producer events and property visits

AgForce Regional Managers Sara Cue, Ann Maree Johnson and Andrew Sinnamon coordinated 19 producer events and property visits to enable sharing of pasture dieback research information amongst producers.

DATE	LOCATION	PROPERTY or VENUE	ATTENDANCE
16/3/23	Central Qld	Lochington	32
15/3/23	Central Qld	Kilcummin	4
14/3/23	Central Qld	Clarke Creek	14
18/3/22	Central Qld	Moora Plains, Gogango	9
17/3/22	Central Qld	Banana Hotel & Banana Station	30
16/3/22	Central Qld	Bungawarra and Coonabar, Rolleston	52
10/3/22	Southeast Qld	AgForce SEQ Regional Forum, Moffatdale	92
10/5/22	Central Qld	Paradise Valley, Yalbaroo	68
9/5/22	Central Qld	Keilambete, Rubyvale	
9/2/22	Southern Inland Qld	Dorset, Guluguba	49

DATE	LOCATION	PROPERTY or VENUE	ATTENDANCE
28/1/22	Central Qld	Jambin	40
27/1/22	Central Qld	Gaeta	30
17/12/21	Central Qld	Clarkwood, Clarke Creek	60
16/12/21	Central Qld	Sondella, Moranbah	88
29/7/21	Southern Inland Qld	Devon Court, Drillham	38
30/7/21	Southern Inland Qld	Hillside, Guluguba	39
23/6/21	Central Qld	Bauhinia	12
22/6/21	Central Qld	Miriamvale and Calliope	23
21/6/21	Central Qld	Gin Gin	15
	TOTAL ATTENDANCE AT 19 EVENTS		**695**

Dispersed 1,720 copies of the DPINSW and DAF pasture dieback identification ute guide (Baker *et al*, 2021) at these events and other AgForce events.

Shared pasture dieback research updates through media and newsletters

DATE	MEDIA TYPE	TITLE	LINK
17/2/22	Queensland Country Life. Circulation 77000	"Graziers urged to map dieback"	
4/2/22	Qld Country Life. Circulation 77,000	"Research into alternative pasture and legume species helping CQ graziers manage dieback"	https://www.queenslandcountrylife.com.au/story/7608015/graziers-trialing-new-plant-species-in-fight-against-pasture-dieback/
2/2/22	Qld Country Life. Circulation 77,000	"Pasture dieback risk heightened after high summer rainfall"	https://www.queenslandcountrylife.com.au/story/8066059/pasture-dieback-returns-after-wet-weather/
22/12/21	Allora Advertiser, Clifton. Circulation 1150	Pasture dieback	https://issuu.com/advertisingcc/docs/alloraadvertiser221221/1
12/21	AgForce Envoy quarterly newsletter- Summer 2021 edition. Circulation: 5900	"Fight pasture dieback: Use AgForce's new crowdsourcing map app"	http://ebooks.printcraft.com.au/books/dgth/#p=34
23/11/21	AgForce media statement	"AgForce launches a new web map to help fight pasture dieback"	https://www.agforceqld.org.au/knowledgebase/article/AGF-01476/
31/5/21	AgForce Action e-newsletter. Circulation: 3900	"Solving the mystery of pasture dieback"	https://www.agforceqld.org.au/knowledgebase/article/AGF-01359/
4/21	AgForce Envoy quarterly newsletter- Autumn 2021 edition. Circulation: 5900	"New identification guides to help in the fight against pasture dieback"	http://ebooks.printcraft.com.au/books/vnlx/#p=38
12/20	AgForce Envoy quarterly newsletter- Summer 2020 edition. Circulation: 5900	"Producer involvement critical to ending spread of pasture dieback"	http://ebooks.printcraft.com.au/books/lizo/#p=18

Attended pasture dieback research trial site events and forums to acquire knowledge to share with producers.

DATE	RESEARCH TRIAL SITE	LOCATION	AGFORCE REPRESENTATIVE
1/4/23	DAF Stuart Buck update	Jambin, CQ https://www.facebook.com/AgForceCQ/videos/stuart-buck-australian-department-of-agriculture-fisheries-and-forestry-pasture-/581482910604350/ (270 views, 17 likes)	Sara Cue
31/3/23	AHR & QUT – pasture trials and mealybug	Gaeta, CQ https://www.facebook.com/AgForceCQ/videos/naomi-diplock-applied-horticultural-research-and-caroline-hauxwell-qut-queenslan/952377739529618/ (502 views, 12 likes)	Sara Cue, Ivan Naggs, Marie Vitelli
26/3/23	DAF pasture trial site	Gundebah, Middlemount, CQ https://www.facebook.com/profile/100063894377006	Sara Cue, John Baker
16/3/22	QUT mealybug	Bungawarra, CQ https://www.facebook.com/AgForceCQ/videos/627902444942609/ (636 views. 19 likes)	Sara Cue
20/10/22	MLA extension tool working group	MLA Board Room, Brisbane	Marie Vitelli
3 & 4/5/22	MLA research update	QUT campus, Brisbane	Marie Vitelli
30/1/22	AHR Jambin & Gaeta sites	Jambin and Gaeta https://www.facebook.com/7NEWSCQ/videos/3080669418865080/ (Ch 7 News - 2,300 views)	Sara Cue, Geoff Maynard, Will Wilson
19/5/21	DAF pasture dieback field day	Brian Pastures Research Station, Gayndah	Marie Vitelli, Ivan Naggs, Ken Cunliffe

4.4 Producer demonstration sites and case studies

Two case studies and one demonstration site on producer experiences and dieback management options were collated (Appendix 1).

1. Paul and Majella Erbacher, Dorset Station, Guluguba, Southern Inland Queensland.
2. Rob Lethbridge, Yo Yo Station, Taroom, Southern Inland Queensland.
3. John Cowan, Bilburrie Station, Mundubbera, South East Queensland.

4.4.1 Producer videos discussing pasture dieback experiences and impact

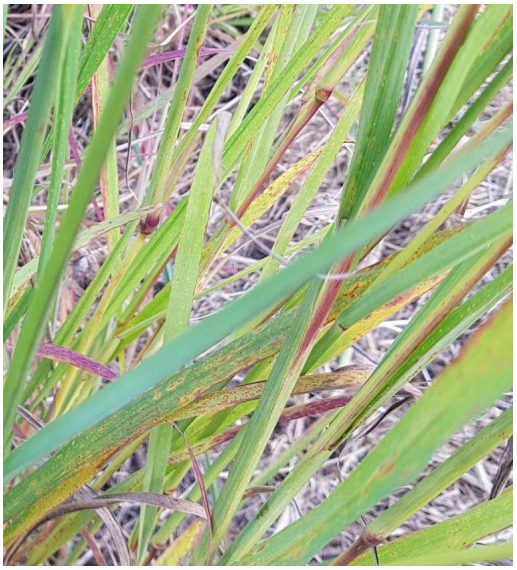
AgForce Regional Manager Sara Cue and contracted videographer Kent Murray compiled Central Queensland producer interviews, which were posted onto Facebook social media. AgForce Regional Manager Ann-Maree Johnson provided social media coverage of pasture dieback events hosted in Southern Inland Queensland. A total of 10 producer interviews were video-recorded and uploaded onto Facebook social media and one video was used by Channel 7 news.

DATE	PRODUCER AND LOCATION	WEBLINK TO VIDEO	VIEWS, LIKES & SHARES (as per June 2023)
3/5/22	Tom Marland, Bundaberg, SEQ	https://www.facebook.com/watch/?v=667669924548626	533 views, 9 likes
26/3/22	Loretta Smith, Moura, CQ	https://www.facebook.com/AgForceCQ/videos/515251869992021	391 views, 11 likes
23/3/22	Andrew Lawrie, Gogango, CQ	https://www.facebook.com/AgForceCQ/videos/687813465988721	963 views, 29 likes
23/3/22	Bloss Hickson Arcadia Valley, Cameron Gibson MLA & John Baker, Coonabah, CQ	https://www.facebook.com/watch/?v=1021467588750596	322 views, 16 likes
4/3/22	James Pisaturo, Dingo, CQ	https://www.facebook.com/watch/?v=527790742289493	858 views, 8 likes
22/2/22	John Baker & Marie Vitelli, CQ – buffel blight identification	https://www.facebook.com/AgForceCQ/videos/293404712832352	261 views, 7 likes
21/2/22	Ian Winter, agronomist, Bundaberg, SEQ	https://www.facebook.com/watch/?v=1631331147230330	255 views, 16 likes
17/2/22	Harvey & Brett Campbell, Dysart, CQ	https://www.facebook.com/watch/?v=1569793270068005	515 views, 12 likes
16/2/22	Stewart Wallace, Clarke Creek, CQ	https://www.facebook.com/AgForceCQ/videos/268434798732271	822 views, 17 likes
15/2/22	Dennis Clair, Goovigen, CQ-Channel 7 News.	https://www.facebook.com/watch/?v=1007664200102171	1,900 views, 25 likes
11/2/22	Paul & Majella Erbacher, Guluguba, SIQ	https://www.facebook.com/AgForceSouthernInland/posts/4564409800334463	15 likes, 2 shares

4.5 Photo library of pasture dieback symptoms

4.5.1 Pasture dieback symptoms on pasture species

Bisset creeping blue grass – *Bothriochloa insculpta*

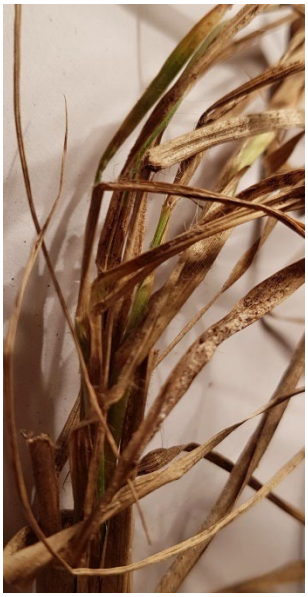




Biosecurity Queensland laboratory in Brisbane assisted with obtaining fungal isolates and identification from dieback-affected creeping blue grass samples collected from Brian Pastures pasture dieback trial site on 19 May 2021. Samples of the fungal isolates were lodged in Queensland's Plant Pathology Herbarium BRIP (Table 1). These fungal isolates may be saprophytic or pathogenic.

Table 1. Fungal isolates identified from dieback-affected creeping blue grass (*Bothriochloa insculpta*) collected from Brian Pastures Research Station trial site at Gayndah, on 19 May 2021.

Fungal genus and species	Herbarium BRIP Accession Number
Alternaria sp.	BRIP 72747, 72752, 72768, 72759
Cladosporium sp.	BRIP 72757
Curvularia sp.	BRIP 72749, 72760
Epicoccum italicum	BRIP 72755
Epicoccum sp.	BRIP 72748, 72750, 72751, 72761, 72762
Nigrospora spaerica	BRIP 72756

Gayndah Buffel grass – *Cenchrus ciliaris*



Gayndah Buffel grass – *Cenchrus ciliaris* infected with Buffel blight (*Pyricularia grisea*)

Although researchers considered buffel blight to be external to the pasture dieback complex across eastern Australia, this pathogen (*Pyricularia grisea*) was prevalent across central Queensland.

Buffel blight was confirmed in Queensland at Baralaba and Banana in 1998 (Perrott and Chakraborty 1999), after an epidemic between 1996 to 1998. Buffel blight pathogen was isolated from dying circular patches of American buffel, up to 10 metres in diameter. Similar to pasture dieback, blight is most prevalent during high temperature and high humidity conditions (eight to ten hours greater than 75 per cent relative humidity). In Texas and Mexico, buffel blight previously caused 43 per cent loss in American buffel grass production and 33 per cent loss in seeding during the 1996 to 1998 epidemic (Rodriguez *et al* 2007)).

Green panic – *Megathyrsus maximus*



Floren bluegrass – *Dicanthium aristatum*


Pangola grass – *Digitaria eriantha*




4.5.2 Pasture mealybug – *Heliococcus summervillei*



4.5.3 Pasture dieback situations

4.5.4 Management methods used by producers

Pasture renovation to overcome pasture dieback.

4.5.5 Photos from pasture dieback events and research trial sites

March 2023 – Twenty five (25) photos from Applied Horticulture Research AHR pasture dieback trial sites at Moura and Gaeta, CQ. Hosts were Pearson and Chris Roffey. Speakers included Naomi Diplock, Caroline Hauxwell, Stuart Buck, Gordon Rodgers and Marie Vitelli. https://www.facebook.com/AgForceCQ/posts/pfbid0HU6dswuWGPE55RohvzrEWhKpn2Jvo1GZtktGkgKpeNsyg2heH5McUfnLnRB8vXHRl?__tn__=-R

February 2023 – Thirty (30) photos from CQ pasture dieback and producer information sessions at Clarke Creek, Kilcummin and Lochington https://www.facebook.com/profile/100063894377006

March 2022 - Fifty (50) photos from three CQ pasture dieback field days at Bungawarra and Coonabar, Rolleston; Banana Station, Banana and Moora Plains, Gogango. Hosts were Rodney Perrett, Bloss Hickson, Cameron and Kristy Gibson, Mark and Belinda Wilson, Andrew and Meagan Lawrie. Speakers included Professor Caroline Hauxwell, Rod Linke, Kurt Mayne, Brendan King, Josh Connolly, Jacob O'Brien, Dr Greg Leach, Marie Vitelli and Will Wilson. The four events were sponsored by Agrimix, MLA and Australian Government National Landcare Program funds. https://www.facebook.com/AgForceCQ/posts/5147554021942625

January 2022 – Twenty (20) photos from AHR pasture trial sites at Mt Eugene and Gaeta. Hosts were Geoff Maynard and Chris Roffey. Speakers included Gordon Rogers, Naomi Diplock, Professor Caroline Hauxwell and Will Wilson. https://www.facebook.com/profile/100063894377006

5 Discussion

AgForce strength is an extensive established network of producers and agribusinesses; the ability to engage producers to attend localised paddock walks and events; and share meeting outcomes through media and social media. Project objectives to improve awareness about pasture dieback and associated management strategies amongst producers was achieved. A collation of pasture dieback symptoms across a range of improved pasture species was achieved. The response rates to the producer survey and ArcGIS crowdsource web map were below target, although sufficient to show trends in producer awareness, management adoption and preferred communication styles.

Two-way communication is essential for research and adoption

The two-way interaction with producers affected by pasture dieback has confirmed general awareness for identifying signs of pasture stress and associated dieback. Management options vary and often depend on other factors such as cash flow, paddock terrain, access to pasture renovation machinery, willingness to use fire as a pasture management tool, current stocking rates and enterprise urgency for optimising livestock carrying capacity. Producers are reluctant to invest in pasture rehabilitation and oversowing with legume and pasture seed, unless there is certainty with future carrying capacity and dieback impacts will be minimised.

Producers sought advice from other producers, agronomists, pasture consultants and dieback researchers. A wide range of pasture renovation practices were trialled and adopted by producers across central Queensland buffel-dominant pastures. Common practices include cool fire burns; ripping, seeding and fertilising pastures with synthetic or organic fertilisers; heavy pasture utilisation before the onset of dieback; and slashing mature tussocks to reduce biomass.

Causes of pasture dieback

Throughout central Queensland buffel pastures, many producers agree dieback is triggered by the pasture mealybug. There are varying views about dieback causes amongst other producers from other regions.

- Pasture mealybug is part of the cause. There may be other causative issues such as nutritional deficiencies in previously cleared Brigalow soils and plant diseases.
- Stunted roots of dieback-affected pasture plants can also be a sign of heavy grazing pressure and compacted soils.

Consensus amongst most producers

- Short, cropped pastures are less susceptible to dieback. Key message is “Use it, or lose it” with short-term grazing pressure, when pasture dieback risk in the region is high.
- Pasture renovation is needed to combat pasture dieback, in many situations.
- Areas receiving several days of continuous rain showers have less pasture dieback.
- We will never beat pasture dieback. It is here for good. We need to manage dieback, as time goes on.

Unanswered questions and additional research recommended by livestock producers

- Why does pasture dieback often stop at a fenceline? Is this a management issue or why?
- Size and rate of spread of dieback areas varies greatly. Is this linked to management practices?
- Pasture plant death –can it be avoided with early intervention?
- Soil tests in pasture dieback affected areas. Soil tests indicate below optimal range of essential, available nutrients for functioning soils, such as nitrogen, phosphorus, zinc, sulphur and calcium to magnesium ratio. What nutrient range do soil experts recommend for minimising risk of pasture dieback? Are there soil test differences between areas with and without dieback? What nutritional macro and micro-elements are missing from the soil in dieback affected areas?
- Current pasture dieback research has focused on pasture mealybug induced dieback. How much are other factors such as leaf and soil pathogens, available soil nutrients contributing to ill thrift and dieback trigger?
- How does pasture dieback spread? What farm practices can reduce risk of spread? Is there a risk that infected pasture seed or infested hay could spread pasture dieback into new areas?

Best bet extension delivery methods

Future extension delivery methods should include several pathways. Seventy per cent of producers utilise other producers for shared learnings. Other popular producer information sources include DAF Future Beef staff and website, local producer information sessions, rural newspapers, grazing consultants, produce agencies, online industry newsletters, Meat & Livestock Australia website, online factsheets and ABC Radio Rural Report and Country Hour.

Project learnings – survey fatigue

The poor response to the producer survey and web map is a sign of producer fatigue with online requests to complete surveys. Best survey response rate was through handing out printed survey forms during producer events. AgForce’s new Microsoft 365 hub for client relationship management and digital marketing autogenerates electronic direct mail EDM’s for surveys and removes the personal touch of individual emails. Other innovative survey methods need to be explored for interacting with producers such as Slido, Poll Everywhere and Menti Meter. These online engagement and evaluation tools require participants to have smart phones and require digital connectivity, which does not occur in all rural, remote areas.

6 Conclusions/recommendations

6.1 Future communication

This communication project has confirmed the best method for information delivery is through paddock walks, video interviews shared on social media and robust, localised discussion amongst producers and researchers.

Most producers have accepted pasture dieback is here to stay, the current focus is how to economically reduce dieback signs while retaining or improving pasture productivity.

Key messages - managing pasture dieback

1. Check pasture response after summer rain.
2. If susceptible to pasture dieback, graze pastures low and utilise pasture.
3. Open, short-cropped pastures are least susceptible.
4. Pasture dieback affects most improved pasture species, with high biomass and during periods of high humidity and warm temperature.
5. If resowing, consider including legumes or forage crops.
6. Strive for pasture diversity and avoid monocultures.
7. Some pastures are coming back after a few years.

6.1.2 Future research and development

Promote ongoing active participatory research. Research learnings are shared throughout the pasture dieback research program and not just at the project end in final reports. Foster two-way communication between researchers and producers to solve pasture dieback management and the complex of causes. Producers are excellent observers of changes occurring in their paddocks and can contribute to solutions.

Continue to foster the Pasture Dieback Industry Network developed by the Department of Agriculture and Fisheries Future Beef team in conjunction with Meat & Livestock Australia as the main channel for future extension of pasture mealybug-induced dieback. AgForce to remain informed and supportive of the network but not involved in pasture dieback extension delivery.

Consult with dryland crop pathology experts to isolate and identify any pathogenic leaf rusts and plant diseases associated with improved pasture species, especially during times of high relative humidity and temperature.

Ensure pasture dieback research outcomes are shared amongst the network of pasture agronomy consultants across eastern Australia to help producers and land managers choose the best options for dieback management.

7 Bibliography

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Rodriguez O, Gonzalez-Dominguez J, Krausz JP, Odvody GN, Wilosn JP, Hanna WW, Levy M (2007) 'First report and epidemics of Buffelgrass Blight caused by Pyricularia grisea in South Texas'. Plant Disease 83:398. https://apsjournals.apsnet.org/doi/10.1094/PDIS.1999.83.4.398D

8 Appendix 1

8.1 Producer Case Studies

8.1.1 Paul and Majella Erbacher, Dorset Station, Guluguba, Southern Inland Queensland

We first noticed pasture dieback at the Guluguba property in approximately April 2020.

Some areas had the appearance of “waterlogged grass” at first and then we started noticing large patches of tap root weeds and no grass. Other patches, the grass, had a steely grey dead look.

There seems to be no uniformity in how quickly it spreads. Some patches stay about the same as when it was first noticed, and other patches take off quickly. It seems to love to run up gullies, where there are more rank grasses. In the last three years, over 600 ha has been affected by pasture dieback.

We have used fire as a method to control the spread. An early fire between September to December stimulated grass comeback. We feel it has been successful in slowing the spread and in turn encouraging other weeds and grasses to grow giving the cattle some feed at least. Biloela buffel is not as susceptible to pasture dieback.

One of the areas we went to on the Information Day (held in February 2022) was 103 ha of blade ploughed country (three years ago) which had a large percentage of dieback in it. The bladeplough area was affected first and dieback spread out from there. We decided to plough and plant a mix of medics, silk sorghum and Bambatsi panic.

Photos from Dorset Station after a scrub pulling chain had been pulled over the blade plough area prior to ploughing, to plant a mix of medics, silk sorghum and Bambatsi panic.

8.1.2 Rob Lethbridge, YoYo Station, Taroom, Southern Inland Queensland

Rob Lethbridge – Yo Yo, Taroom

2015
The dieback is affecting the grasses on the side of the road at the bottom of the range between Taroom and Theodore.
Approximately 100km northeast of Cadellia on the opposite side of the range.

2018
During May (start of weaning) we found small areas under fence lines and in a few paddocks (a few meters squared). In these patches there was usually a couple of plants that had been dead (Blackish/grey colour) for a longer period than the rest. The fresh dieback looks like it has been sprayed with roundup.
After rain in September/October the dieback started to spread. It pretty much infected all of our country which had been blade ploughed (mostly done since 2009) and stopped at the edge of it.

2019
Was extremely dry. The dieback didn't spread much because of lack of ground cover. We hoped it may have stopped it.

2020
We had extremely good rain in January/February/March. All country responded very well early and looked as though the dieback may have passed. But within a few weeks it started to spread profusely, to the point we could see it spreading each day. It didn't stop at the edge of the blade ploughing like before, it consumed whole paddocks. The dieback had infected approximately 70% of our pasture areas. And within that area 90% to 95% of the grass had been affected.
We did soil samples in March from within the dieback area as well as unaffected areas on Cadellia as well as our other places which didn't have visible signs of dieback. There were no glaring deficiencies in the top 150mm-200mm.
While mustering in May/June we would come across large amounts (millions) of Lacewings in country that still had grass that wasn't completely dead.
During winter there were also areas that we didn't see the visual effects of dieback, but once it rained the grass didn't respond it only grew weeds.
In September we started burning some paddocks that would still carry a fire. We were lucky enough to get some rain in October, where we found the burnt country pretty much re grassed with some weeds continuing. Where we didn't burn or there wasn't enough grass within the burn to carry a fire it stayed as just weeds.

2021
In May we aerial seeded with medics (burr, snail, barrel). With the rain that followed we got a terrific strike with very little competition.
We were wanting to burn as much country as possible in September, but with bits of rain the weeds were green and a complete lack of grass for fuel to carry a fire, very little got burnt.
Then in November we had exceptional rainfall. We have found in most places grasses are re-establishing in amongst the weeds, with very little fresh dieback.

Grasses affected badly:
- American Buffel
- Gayndah Buffel
- Bissett Blue
- Urochloa
- Any off the soft(palatable) natives

Grasses not affected badly:
- Biloela Buffel
- Green Panic
- Purple Pidgeon
- All the less palatable natives

Could have done better:
- We should have planted summer legumes while there was limited competition.
- We should have burnt more country when we first found it as there wasn't enough fuel to carry a fire once the die back was completely established.

February 2020 blade ploughing in the background over the fence line. Responded than all died a few weeks after this photo

Was all dieback,burnt the right hand side of the road, but not the left.

8.2 Producer Demonstration Sites

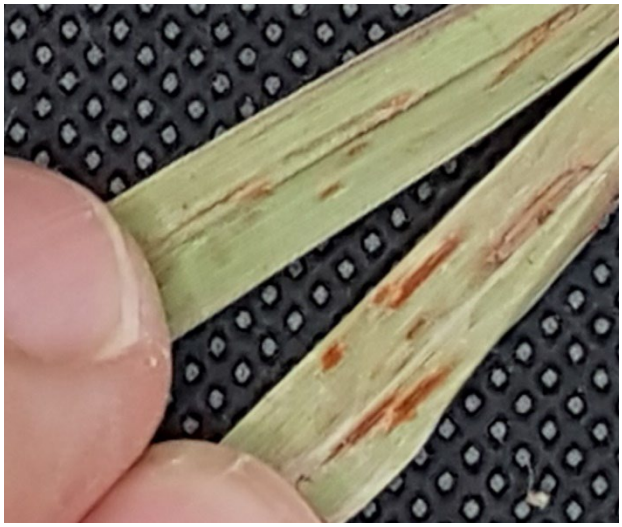
8.2.1 John and Marian Cowen, Bilburrie Station, Mundubbera, Southeast Queensland.

Pasture dieback situation

- Major floods over paddocks in 2013 and 2015.
- Severe pasture dieback since November 2018.
- Pasture dieback affected pastures are mainly American buffel, Gayndah buffel, creeping blue grass and panic.
- Secca stylo is stunted, yellow leaf margins and woody similar to 'reversion' symptoms. Possibly due to sulphur deficiency.
- Compacted clay soil in cultivation paddock and ridges.
- Sandy loam in river paddock.

Pasture dieback symptoms at Bilburrie Station, Mundubbera – June 2019.
Total pasture collapse, with only weeds and some legumes remaining.

A site assessment of dieback across two trial areas was conducted in October 2021 and soil nutrient tests analysed by Nutrien in January 2022. Recommended nutrient treatment options were provided by pasture agronomy consultant Ross Newman from Gracemere.



Left: Lesions on top of Gayndah buffel grass leaf blade.

Below: Lesions on underside of buffel grass leaf blade indicate impact from a plant pathogen such as a rust or mosaic virus.

Bilburrie Station, January 2022

Above left: Only a few mealybugs were found in pasture dieback areas at Bilburrie Station, January 2022.

Above right: Adults of the striped ladybird – (*Micraspis frenata*). Often found on tall grasses. Aphid predators and larvae feed on grass seed smuts, pollen and nectar. (Atlas of Living Australia https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:b1c0d1b3-bf22-4a60-8910-67f6306a2257#gallery)

Above: Many of the Secca Stylo (*Stylosanthes scabra*) legume plants are stunted and deformed at Bilburrie Station. (October 2021 and January 2022). Gavin Peck and Stuart Buck DAF confirm this unlikely to be 'reversion', caused by a phytoplasma disease spread by leafhoppers https://keys.lucidcentral.org/keys/v3/pastures/Html/Shrubby_stylo.htm.

Agronomist Ross Newman from Gracemere indicated the stunted Secca Stylo with yellow leaf margins is a sign of sulphur deficiency. It is not "reversion".

Nutrien soil test results - Cultivation paddock – 12 January 2022

Nutrient Advantage®

NUTRIENT REPORT

JOHN COWEN		Service Provider:	NAA CASH_SOIL
BILBURRIE, 1544 COONAMBULLA RD		Advisor/Contact:	NAO Cash
MUNDUBBERA		Phone:	97313100
QLD 4626		Purchase Order:	JOHN COWEN
Sample No		**130000478**	
Paddock Name		CULTIVATION	
Sample Name		CULTIVATION	
Sample Depth (cm)		0 - 10	
Sampling Date		12/01/2022	
Test Code		E85	
Sample Type		Soil	
Analyte	**Unit**	**Result**	
Soil Colour		Grey	
Soil Texture		Clay	
pH (1:5 Water)		5.9	
pH (1:5 CaCl2)		4.6	
Electrical Conductivity (1:5 water)	dS/m	0.03	
Electrical Conductivity (Sat. Ext.)	dS/m	0.2	
Chloride	mg/kg	<10	
Organic Carbon (W&B)	%	0.6	
Nitrate Nitrogen	mg/kg	1.2	
Ammonium Nitrogen	mg/kg	1.6	
Phosphorus (Olsen)	mg/kg	5	
Phosphorus (Colwell)	mg/kg	10	
Phosphorus (Mehlich 3)	mg/kg	15	
Phosphorus Buffer Index		32	
Phosphorus Environmental Risk Index		0.31	
M3PSR		0.030	
Potassium (Colwell)	mg/kg	180	
Potassium (Mehlich 3)	mg/kg	150	
Sulphur (KCl40)	mg/kg	4	
Sulphur (Mehlich 3)	mg/kg	5	
Cation Exch. Cap. (CEC)	cmol(+)/kg	1.4	
Calcium (Amm-acet.)	cmol(+)/kg	0.5	
Calcium (Mehlich 3)	mg/kg	140.0	
Magnesium (Amm-acet.)	cmol(+)/kg	0.4	
Magnesium (Mehlich 3)	mg/kg	57.0	
Sodium (Amm-acet.)	cmol(+)/kg	0.05	
Sodium (Mehlich 3)	mg/kg	10.00	
Potassium (Amm-acet.)	cmol(+)/kg	0.36	
Available Potassium	mg/kg	140	
Aluminium (KCl)	cmol(+)/kg	0.2	

Nutrient Advantage®

NUTRIENT REPORT

JOHN COWEN		**Service Provider:**	NAA CASH_SOIL
BILBURRIE, 1544 COONAMBULLA RD		**Advisor/Contact:**	NAO Cash
MUNDUBBERA		**Phone:**	97313100
QLD 4626		**Purchase Order:**	JOHN COWEN

Aluminium (KCl)	mg/kg	15.0
Aluminium (Mehlich 3)	mg/kg	250.0
Aluminium % of Cations	%	12.0
Grass Tetany Risk Index		0.43
Calcium % of Cations	%	33.0
Magnesium % of Cations	%	26.0
Sodium % of Cations (ESP)	%	3.30
Potassium % of Cations	%	26.00
Calcium/Magnesium Ratio		1.2
Zinc (DTPA)	mg/kg	0.37
Zinc (Mehlich 3)	mg/kg	0.4
Copper (DTPA)	mg/kg	0.28

The results in this report pertain only to the sample submitted. Analyses performed on soil dried at 40°C and ground to 2mm or less, excluding moisture tests, or as otherwise indicated. Analyses performed on plant dried at 70°C and ground to 1mm or less, excluding moisture tests, or as otherwise indicated. Water analyses performed on an 'as received' basis. Analytical results reported by the laboratory as 'less than' the level of reporting, will be deemed by NA Pro as being equivalent to the level of reporting for both calculation and interpretive purposes. This document shall not be reproduced except in full.

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Comparing test results to optimal, essential soil nutrient levels:-

Cultivation and river paddocks are:-

- **Nitrate nitrogen – very low**
- **Phosphorus (Colwell) – very low (cultivation)**
- **Calcium : Magnesium ratio – very low**
- **Zinc – low (river) and very low (cultivation)**
- **Calcium -very low (cultivation)**

Recommended treatment options for Cultivation Paddock (from Agricultural and Pastoral Consultant Ross Newman, Gracemere)

(a) **Option A:** Fertilising with DAP (diammonium phosphate fertiliser) with one per cent zinc trace element added**.** Pasture agronomist Ross Newman from Gracemere recommended a similar fertiliser blend for pasture renovation on David and Elizabeth Hill's Clarkwood Station, Clarke Creek.

(b) **Option B:** Paddock required some amelioration to improve soil balance and chemistry. Based on the test results, the paddock requires, 1T/Ha of Lime to correct the low calcium level and aid in improving soil pH, in conjunction with 125kg / Ha of ZincGard (D) 2%. ZincGard D (2%) fertiliser is 17.6% Nitrogen, 16.9% Phosphorus, 4.5% Sulphur, 2% zinc.

(c) **Option C:** Alternatively, 250kg / Ha of Guano Sulphur Gold® fertiliser. Requires ripping and placing fertiliser in top 10cm of soil for nutrients to be available in the root zone. Guano Sulphur Gold® is an organic, granulated fertiliser with 10% phosphorus, 13% sulphur, 21% silica, 25% calcium and 0.25% zinc. Approximate cost is $1169/tonne and potentially not cost-effective in low return pastures. Adam Coffey, grazier from Miriamvale has also trialled this fertiliser product https://www.queenslandcountrylife.com.au/story/7523881/cq-producer-trialling-guano-fertiliser-as-synthetic-prices-soar/

Cultivation Paddock in January 2022 showing signs of pasture dieback in buffel and green panic improved pastures.

Producer John Cowen was certain that pathogens were the main cause of pasture dieback. The adjacent fodder hay paddock under centre pivot and high levels of fertiliser, showed no signs of pasture dieback.

Nutrien soil test results - River paddock – 12 January 2022

Nutrient Advantage®

NUTRIENT REPORT

JOHN COWEN		Service Provider:	NAA CASH_SOIL
BILBURRIE, 1544 COONAMBULLA RD		Advisor/Contact:	NAO Cash
MUNDUBBERA		Phone:	97313100
QLD 4626		Purchase Order:	JOHN COWEN

Sample No		130000477
Paddock Name		RIVER
Sample Name		RIVER
Sample Depth (cm)		0 - 10
Sampling Date		12/01/2022
Test Code		E85
Sample Type		Soil
Analyte	**Unit**	**Result**
Soil Colour		Brown
Soil Texture		Sandy Loam
pH (1:5 Water)		6.9
pH (1:5 CaCl2)		5.9
Electrical Conductivity (1:5 water)	dS/m	0.05
Electrical Conductivity (Sat. Ext.)	dS/m	0.5
Chloride	mg/kg	<10
Organic Carbon (W&B)	%	1.1
Nitrate Nitrogen	mg/kg	1.2
Ammonium Nitrogen	mg/kg	1.7
Phosphorus (Olsen)	mg/kg	13
Phosphorus (Colwell)	mg/kg	30
Phosphorus (Mehlich 3)	mg/kg	30
Phosphorus Buffer Index		23
Phosphorus Environmental Risk Index		1.30
M3PSR		0.081
Potassium (Colwell)	mg/kg	370
Potassium (Mehlich 3)	mg/kg	220
Sulphur (KCl40)	mg/kg	5
Sulphur (Mehlich 3)	mg/kg	4
Cation Exch. Cap. (CEC)	cmol(+)/kg	7.2
Calcium (Amm-acet.)	cmol(+)/kg	4.8
Calcium (Mehlich 3)	mg/kg	1,500.0
Magnesium (Amm-acet.)	cmol(+)/kg	1.9
Magnesium (Mehlich 3)	mg/kg	320.0
Sodium (Amm-acet.)	cmol(+)/kg	0.04
Sodium (Mehlich 3)	mg/kg	9.70
Potassium (Amm-acet.)	cmol(+)/kg	0.47
Available Potassium	mg/kg	180
Aluminium (KCl)	cmol(+)/kg	<0.1

Nutrient Advantage®

NUTRIENT REPORT

JOHN COWEN		**Service Provider:**	NAA CASH_SOIL
BILBURRIE, 1544 COONAMBULLA RD		**Advisor/Contact:**	NAO Cash
MUNDUBBERA		**Phone:**	97313100
QLD 4626		**Purchase Order:**	JOHN COWEN

Aluminium (KCl)	mg/kg	<9.0
Aluminium (Mehlich 3)	mg/kg	270.0
Aluminium % of Cations	%	<1.0
Grass Tetany Risk Index		0.07
Calcium % of Cations	%	66.0
Magnesium % of Cations	%	27.0
Sodium % of Cations (ESP)	%	0.56
Potassium % of Cations	%	6.50
Calcium/Magnesium Ratio		2.5
Zinc (DTPA)	mg/kg	1.70
Zinc (Mehlich 3)	mg/kg	2.5
Copper (DTPA)	mg/kg	0.59

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Soil core from sandy loam in river paddock. Soil across the river and cultivation paddock were compacted due to previous floodwater impacts. One metre of flood water over an area is equivalent to one tonne per square metre of compaction (Ross Newman, *pers.comm*.).

Recommended treatment options for River Paddock (from Agricultural and Pastoral Consultant Ross Newman, Gracemere)

This soil has sufficient and adequate balance of all nutrients, apart from Sulphur. Renovate with a ripper to a depth of 15 to 20cm and sow a summer cover crop (e.g. millet, Sudan sorghum, Sunn hemp, lab lab, tillage radish, forage brassica, sunflower). A summer crop will improve soil biology, infiltration and can be grazed.

Optimal nutrient range for coastal pastures in Queensland

Recommendation from Hortus Technical Services.

Element	Optimal Range	Units
pH	6 – 6.5	
EC (1:5)	0.1 – 0.25	mS/cm
Ammonium Nitrogen	10 - 25	mg/kg
Nitrate - N	40 - 60	mg/kg
Total Carbon	3.5 -5.5	%
Phosphorus (Colwell)	50-100	mg/kg
Phosphorus Environmental Risk Indicator	0.05 - 2	Ratio
Potassium (exchangeable)	78- 156	mg/kg
Calcium (exchangeable)	1100 – 3300	mg/kg
Magnesium (exchangeable)	200 – 480	mg/kg
Sodium (exchangeable)	50 – 72	mg/kg
Sulfate – S	30 – 50	mg/kg
Chloride	10 – 120	mg/kg
Boron (Hot CaCl2)	1 – 2	mg/kg
Silicon (BSES)	120 – 2000	mg/kg
Zinc (DTPA)	2 – 5	mg/kg
Copper (DTPA)	0.3 – 3	mg/kg
Iron (DTPA)	20 – 80	mg/kg
Manganese (DTPA)	4 – 8	mg/kg
Soluble silica (CaCl2)	40 - 80	mg/kg
Effective Cation Exchange Capacity (CEC)	7 – 25	cmol/kg
Calcium Ca / Cation %	65 - 75	% (cmol/kg)
Magnesium Mg / Cation %	15- 20	%..(cmol/kg)
Potassium K / Cation %	3 – 6	% (cmol/kg)
Exchange Sodium Na %	3 - 4	% (cmol/kg)
Calcium: Magnesium Ratio	3.8 – 4.2	Ratio
Potassium: Magnesium Ratio	0.2 – 0.3	Ratio

Outcome

Pasture response was better in fertilised areas.

A change in weather pattern in 2022/2023 reduced the prevalence of pasture dieback.

John Cowan has closely observed dieback-affected pasture species around Muttaburra. He strongly believed plant pathogens were the main cause of pasture dieback. Pasture leaf samples collected in April and December 2022 confirmed un-identified plant pathogens were present.

In April 2022, leaf lesions on green panic from near the Mundubbera demonstration site were confirmed to be rust pustules by Steven Simpfendorfer, Cereal Pathologist, DPI NSW and GRDC.

In December 2022, five samples from five dieback-affected pasture species (Green panic, Pangola, Gayndah buffel, creeping blue grass and hatch blue grass) were sent to the University of Sydney 2022-23 Australian Cereal Rust Survey Laboratory. Although the samples tested negative for cereal rusts, Matthew Williams from the laboratory confirmed that a rust infection was present on the pasture leaves.

The objective of this MLA-AgForce project was pasture dieback communication information arising from the contracted researchers and primarily focusing on pasture mealybug induced dieback. Further investigation into pasture pathogens was out of scope of this communication project.