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CONTROLLING BLOAT IN BEEF CATTLE
Pasture and grazing management options

‘NORTHERN’ PASTURE UPDATE 2024 SUMMARY
Optimising pasture production in north-west NSW

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Editor's Note

It is hard to believe that it is already the end of March, as it seems not that long since we were finalising the last issue of the newsletter. However, much has happened since then and I'm sure many are very busy, particularly where conditions are favourable for planting. Here on the Northern Tablelands, we have been receiving reasonable rain and it is still rather mild for this time of year, so the pastures are generally looking very good.

Since taking on the role of editor, I have been enjoying the process of pulling together articles on a range of topics. It has been a good reminder of the many factors one must consider in a grazing enterprise and also how diverse our grazing systems are across NSW.

In this issue of the newsletter, there is an article about pasture and grazing management for the control of bloat in beef cattle (Page 4) and a summary of the 'northern' pasture update that was held at Tamworth last year, at which there were five presentations focused on optimising pasture production in north-west NSW (Page 9). I have also included a new section in this issue, 'From the Conference Proceedings Archive', which includes three past conference proceedings that consider pasture establishment (Page 16). I hope you find the content useful.

The next issue of the newsletter will be distributed in June. If you have something you would like to contribute, feel free to reach out to editor@pgnsw.com.au and we can come up with a plan for your contribution. Also, feel free to suggest topics of interest you would like us to consider. That way we can keep bringing you relevant information.

Jonathan McLachlan
Director/Editor

Pasture and grazing management for the control of bloat in beef cattle

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Abstract: *Most bloat treatment and control methods are based on the regular use of antifoaming agents, which cannot be administered frequently enough in extensive beef cattle grazing systems. After presenting a selective review of the literature on bloat control, I summarise the results from two investigations that I conducted with colleagues on bloat occurrence in beef cattle, one on grass/white clover pastures at Armidale in 1966–71 and the second on lucerne and subterranean clover pastures at Wagga Wagga in 1975–77. These investigations underpin management strategies for reducing the risk of bloat in beef cattle grazing grass-legume pastures on the tablelands and upper slopes of NSW, and lucerne or annual legume pastures in the wheat belt.*

Introduction

Bloat is due to the formation of a stable foam, which traps the gas produced from the fermentation of green dry matter ingested into the stomach of ruminants. This foam is primarily a consequence of animals grazing pastures that are dominated by our most popular temperate legumes. Unless animals stop eating legumes, or anti-foaming agents are administered to relieve the pressure of the rumen contents, the foam may eventually overwhelm animals, which die due to suffocation and circulatory failure.

This article first outlines the available chemical treatments for bloat control in ruminants. It then presents findings from research that I conducted with colleagues on the legume content of pastures and bloat incidence in steers grazing either permanent pastures on the Northern Tablelands or ley-phase pastures on the Southern Slopes. As will be explained, this research provides opportunities for bloat control in beef cattle, which are particularly vulnerable to bloat, using either pasture management or grazing management but neither approach offers a complete solution. Sheep, for reasons that can be guessed at but are still not fully understood, are a special case since they are much less susceptible to bloat than cattle.

Bloat occurrence, control and treatment

Bloat occurs in NSW on pastures containing excessive amounts of legumes, particularly white clover *(Trifolium repens)*, lucerne *(Medicago sativa)* and annual *Medicago* species, all of which can

ABOVE:
Hereford cows grazing a lush pasture near Blayney, NSW. Cattle are more susceptible to bloat than sheep, so it is important to monitor and manage your pastures accordingly

cause severe or lethal bloat in cattle. Subterranean clover *(Trifolium subterraneum)* is less dangerous due to its relatively prostrate growth habit when grazed continuously. Some temperate legumes, such as birdsfoot trefoil *(Lotus corniculatus)*, sainfoin *(Onobrychis viciifolia)* and cicer milk-vetch *(Astragalus cicer)*, plus some tropical legumes, are bloat-free because they contain suitable tannins that affect protein digestion and restrict foam production, but these legumes lack the broad agronomic adaptation and persistence of the 'big four'.

For 60 years, I have kept in touch with the literature on bloat research. Unfortunately, not much appears to have happened in devising new approaches to preventing cattle bloat, either with anti-foaming agents, microbial treatments or management approaches. The slow-release monensin-based rumen capsules for the control of bloat in beef cattle were withdrawn from the market in 2013, due to inconsistent performance, and a subsequent 2022–24 research program to evaluate reformulated bloat capsules was terminated early. Various anti-bloat licks are available commercially but there is considerable variation in their appeal and consumption by cattle. Also, there have been ongoing investigations into a major 'missing link', the pursuit of GM technologies to incorporate or boost the content of plant tannins into the suite of adapted temperate pasture legumes. Some success was reported by Coulman *et al.* (2000) on the development of a more slowly-digested 'low-bloat' alfalfa cultivar (Alfagraze) in Canada, but a quest in NZ (Caradus *et al.* 2022) for low-bloat high-tannin white clover (or red clover or lucerne) has not yet resulted in commercial success.

"It is the combination of legume-dominance and a high availability of green herbage that increases the risk of bloat"

It is the combination of legume-dominance and a high availability of green herbage that increases the risk of bloat and other disorders, such as enterotoxaemia (pulpy kidney) and other toxin-producing clostridial microbes, which may abnormally proliferate in the gut and hind-gut of grazing ruminants. These bacterial infections must be prevented in sheep and cattle with protective booster doses of multi-vaccines (such as 5-in-one or 7-in-one) prior to the expected flush of feed.

There are more avenues to control bloat in dairy cattle than in beef cattle, since the former are farmed more intensively, opening up opportunities to supplement their diet with anti-foaming agents such as oils and detergents that slow or relieve the formation of the stable foam. In a helpful video (https://www.youtube.com/watch?v=4rUSOzCFd3Q), a veterinarian employed by NSW LLS, Charlotte Cavanagh, describes the physiology and biochemistry of cattle bloat, including the factors in feed that lead to the formation of the gas-trapping foam, and its management or treatment with anti-foaming agents. Without the help of these agents, ruminants cannot easily release gas due to the stability of the foam and the inability of ruminant animals to vomit; in affected animals, the belching process is too slow for relief.

The treatment of cattle or sheep affected by bloat is also described in Primefact 416 (Bailey 2014), available on the NSW DPI website. Neither the video nor the Primefact provided any guidelines for the management of pastures and grazing to reduce the risk of bloat occurrence and severity in beef cattle. These topics are discussed separately below and some guidelines are given for grass-clover and lucerne pastures.

Experimental work conducted by Wolfe and coworkers on pasture management at Armidale

Pasture survey

In 1967, the owners/managers of 107 properties on the Northern Tablelands, collectively representing 117,000 ha, replied to my questionnaire on their pasture improvement practices and bloat incidence for the years 1961–66. The results from the survey indicated a slow buildup of the white clover content of improved pastures on the properties, with a prolonged phase of clover-dominance. In aerially-seeded pastures, a perennial grass was either not sown (>66% of cases) or its establishment was poor, whereas in pastures sown with ground equipment the establishment of grasses and clovers was successful. At the time of the survey, most pastures, ground or aerially sown, were clover-dominant; bloat was a problem especially in those pastures that had received a cumulative total of 650–1100 kg/ha of

single superphosphate. However, in ground-sown grass-clover pastures, many graziers had noticed a gradual increase in the sown grass component of pastures that had received in excess of 1100 kg/ha superphosphate; these pastures were approaching grass-dominance after first going through a period of clover-dominance lasting about 5-10 years.

Plot experiments

In several plot experiments conducted at the Armidale site, the yield and botanical composition of a range of perennial grass/white clover mixtures during pasture development (following former native pasture that was cultivated and sown in 1967) were recorded from 1967 to 1970 in response to split dressings (early May, late July) of single superphosphate (0–375 kg/ha/year) and nitrogen (ammonium nitrate, 0–112 kg N/ha/year). In the plots, which were grazed after each of four harvests in each year, pastures treated with the highest rate of superphosphate (375 kg/ha/year) were grass-dominant after two years. Unless a summer-active grass (tall fescue) was sown, clover-dominance occurred in the summer of the third year but throughout the final (fourth) year grass-dominance occurred in all three grass-clover mixtures (phalaris/clover, perennial ryegrass/clover and tall fescue/clover). The use of a high rate (112 kg N/ha/year) of expensive nitrogenous fertilizer in conjunction with a moderate rate of superphosphate (188 kg/ha/year) increased the proportion of grass, but grass-dominance achieved by this combination was less stable in an ecological sense than grass dominance achieved by the use of superphosphate and legumes.

Grazing experiment

In a grazing experiment on the Armidale site, a 10 ha area of former unfertilised native pasture was prepared and sown in autumn 1967 with a phalaris/white clover mixture fertilised with differential combinations of molybdenised superphosphate and 20:11:0 fertiliser. In 1968, the developing improved pasture was fenced into twelve 0.81 ha paddocks comprising four replicates of three pasture treatments (low clover LC, medium clover MC, and high clover HC, achieved by applying different combinations of additional N and P/S fertilisers in May and October of 1968, and July and October of 1969). Prior to grazing these treatments with experimental cattle (three steers per paddock) in Spring 1968 (4 x 3 weeks) and Spring 1969 (4 x 3 weeks), the area was grazed in common with sheep or cattle. Each group of cattle in each replicate grazed each pasture type according to a Latin-square statistical design.

"Pasture management, to speed-up the process of pasture development and eventually achieve safer, grass-dominant pastures, is a practical approach to lessening the annual threat of bloat"

Although no steers died on any of the treatments despite the high content of clover on the HC treatment (57%) in 1968, and on the MC (53%) and HC (82%) treatments in 1969, the incidence and severity of sub-lethal bloat (rated subjectively by the degree of rumen distention, 0–4 scale) was significantly higher on the HC>MC>LC treatments, with peak bloat levels recorded on HC in early and mid-spring and on MC in early spring. Liveweight gains of the cattle on HC pastures averaged 0.3 kg/hd/day less than the gains on LC and MC. This depression was highly significant in early and mid-spring 1968, mid-spring in 1969, and for the experimental period as a whole in each year; it was probably due to the effect of bloat on herbage intake (not measured).

Summary: pasture management for bloat control

It was concluded from the Northern Tablelands investigations that pasture management, to speed-up the process of pasture development and eventually achieve safer, grass-dominant pastures, is a practical approach to lessening the annual threat of bloat to animal health and production on grazed perennial grass/white clover pastures (NSW Tablelands).

"The target for grass-clover pastures grazed by cattle is a clover content of 20-40%; pastures that are above this clover content should be grazed with sheep"

-his approach can be extrapolated to the Central and Southern Tablelands and Slopes, where grass/subterranean clover pastures predominate. Since the early development of the companion grasses is restricted by a low soil nitrogen content, a burst of growth from the legume component characterizes the initial response to fertilisation. The clover-dominant phase is more intense and shorter (in years) when high initial rates of superphosphate (200–300 kg/ha/year supplying P, S and Mo) than if low rates (110 kg/ha/year superphosphate, the historical rate applied during the 1950s and 1960s on the NSW Tablelands) are applied. During the legume-dominant phase, it is important that stocking rates on the rejuvenated pasture are adjusted upward in line with the extra herbage production, not only to convert the extra dry matter into saleable livestock, meat or wool but also to encourage the natural return to the soil of the nitrogen-rich dung and urine derived from legume herbage. This pathway is primarily the means by which fixed-N is transferred from legumes to the companion perennial grasses (phalaris, perennial ryegrass and/or tall fescue). On the tablelands, the transition from legume-dominance to a stable grass-dominant phase can be achieved in as little as two to three years after rejuvenation. The target for grass-clover pastures grazed by cattle is a clover content of 20–40%; pastures that are above this clover content should be grazed with sheep.

Grazing management for bloat control in lucerne pastures on mixed farms in the wheat belt

General considerations. Pasture management is different in the case of lucerne-based pastures in the sheep-wheat belt on the slopes and plains of NSW. Lucerne, lucerne/subterranean clover, and medics are common components of the pasture phase of crop-pasture rotations, where the objective is to enhance soil N levels for the subsequent cropping phase. Perennial grass/lucerne pastures, with or without herbs such as chicory, are not recommended because they limit the fertility (N) buildup and are difficult to manage due to plant competition between the perennial grass/herb and lucerne components. In any case, the erect habit of lucerne encourages the preferential selection of lucerne instead of the other pasture components.

Grazing experiment, Wagga. In an investigation conducted on a site near Wagga Wagga (1975–77), where steers were grazed on two pasture types for three years (54 steers in each year), there was little difference between the lucerne/subterranean clover and subterranean clover pasture types in terms of the incidence or severity of sub-lethal bloat but there were more deaths in the steer groups that grazed lucerne/subterranean clover (7 deaths) compred to those that grazed the subterranean clover pasture type (3 deaths) – observations and post mortem examinations established bloat as the cause of death in eight cases and was reasonably suspected as the cause of death in the two steers that were not autopsied.

"Lucerne, lucerne/subterranean clover, and medics are common components of the pasture phase of crop-pasture rotations, where the objective is to enhance soil N levels for the subsequent cropping phase"

Seasonally, when green herbage was abundant and bloat was prevalent (e.g. August-September 1977) the total legume content of the diet was more important to bloat occurrence than the ratio of lucerne to clover selected. When green herbage was scarcer, the incidence of sub-lethal bloat was influenced more by the lucerne component since this species was easier to select than clover (June-July 1977) or more of it was grown (October 1976). As occurred in the Armidale grazing experiment conducted on grass/white clover pastures in Spring 1968 and Spring 1969, sub-lethal bloat decreased liveweight gains by 0.2–0.3 kg/hd/day for a short 3-week period in October 1976 on lucerne/clover and in August 1977 on both pasture types. Annual liveweight gains were 20% more on lucerne/clover than on subterranean clover in a normal winter-dominant rainfall year (1975 and 1977) and 80% more in a drought year (1976) that was unfavourable for subterranean clover growth.

Summary: grazing management for bloat control

At Armidale, bloat occurrence was moderate to severe for several weeks in spring but the steers modified their grazing behaviour to prevent deaths

from bloat. At Wagga, where the pastures were grazed year-round, only an occasional case of mild bloat was observed from November to early June in each year, the period that lucerne is most active.

From June to October, the deaths due to bloat occurred on both pasture types, while the incidence of sub-lethal bloat was higher on lucerne/clover than clover pastures in 1975 and 1976 (a drought year) but higher on clover pastures in 1977; during these months bloat occurrence may have been affected by rotational grazing (practiced on both pasture types) and by the severe frosting of a wiregrass component, particularly on the clover pasture type in early winter 1977. These observations support a grazing management approach to minimizing the risk of bloat on both pasture types since, in the wheat-sheep belt, alternative forages (crop stubbles, grazing cereals, short annual grass/subterranean clover pastures) are available for long periods. The following principles apply:

- From late spring to late autumn in the cropping zone, lucerne or lucerne/subterranean clover pastures can be grazed safely with cattle, taking care when cattle are introduced initially or, since lucerne requires rotational grazing for survival, when moving them onto a fresh pasture of lucerne.
- During late autumn and early winter, cattle may be grazed on early-sown winter cereals or canola, or cattle may be swapped with sheep to shorter, safer pastures;
- From late autumn on both pasture types, rotational grazing may be stopped on both pasture types so that cattle do not experience abrupt changes from short pastures to pastures that are more abundant. On shorter legume pastures that are grazed continuously, cattle have less opportunity to select and gorge on legumes and they must graze for longer periods each day. Given that opportunity, cattle may learn to cope with bloat on leguminous pastures by changing their eating pattern when continuously grazing shorter pastures.

> *"Pastures are expensive to grow and they must be utilised by grazing animals"*

Caveat: Pastures are expensive to grow and they must be utilized by grazing animals. However, the actual strategies for the management of pastures and grazing to mitigate bloat on beef cattle farms need to be devised and applied by individual managers, based on their experience, knowledge, inquiry and observations.

Acknowledgments

I am forever grateful to Professor Alec Lazenby for his supervision and guidance during my PhD studies at Armidale, and for his friendship over 59 years. Professor Lazenby and his wife live actively in Canberra. I also acknowledge my colleagues (scientific, technical and field) during the research described. I welcome any additional pasture management or grazing management guidelines or comments from readers about this article.

References

Bailey G (2014) Bloat in cattle and sheep. Primefact 416, available on the NSW DPI website at https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/111411/Bloat-in-cattle-and-sheep.pdf

Caradus JR, Volsey CR, Cousin GR, Kaur R, Woodfield DR, Blanc A, Roldan MB (2022) The hunt for the "holy grail": Condensed tannins in the perennial legume white clover *(Trifolium repens* L.*) New Zealand Journal of Agricultural Research* **77**, 111-123.

Coulman B, Goplen B, Majak W, McAllister T, Cheng KJ, Berg B, Hall J, McCartney D, Acharya S (2000) A review of the development of a bloat-reduced alfalfa cultivar. *Canadian Journal of Plant Science* **80**, 487-491.

FitzGerald RD, Wolfe EC, Laby RH, Hall DG (1980) Beef production from lucerne and subterranean clover pastures. 2. Bloat incidence and effect of anti-bloat capsules. *Australian Journal of Experimental Agriculture and Animal Husbandry* **20**, 688-694.

Wolfe EC, Lazenby A (1972) Bloat incidence and liveweight gain in beef cattle on pastures containing different proportions of white clover *(Trifolium repens L). Australian Journal of Experimental Agriculture and Animal Husbandry* **12**, 119-125.

Wolfe EC, Lazenby A (1973a) Grass-white clover relationships during pasture development. 1. Effect of superphosphate. *Australian Journal of Experimental Agriculture and Animal Husbandry* **13**, 567-574.

Wolfe EC, Lazenby A (1973b) Grass-white clover relationships during pasture development. 2. Effect of nitrogen fertilizer with superphosphate. *Australian Journal of Experimental Agriculture and Animal Husbandry* **13**, 575-580.

Tamworth Pasture Update 2024 Summary

Lester McCormick and Jonathan McLachlan | November 2024 | editor@pgnsw.com.au

Introduction

The 'Northern' pasture update was held at the Tamworth Agricultural Institute on Thursday 7 November 2024. About 60 producers and advisors gathered for an informative day that included a range of presentations that were focused on optimising pasture production in north-west NSW. There were five presentations in total, which are summarised below. There was also a panel session that focused on growing year-round quality feed. The presentations and panel session were all recorded and can be viewed on our website at the following link: https://www.pgnsw.com.au/videos-1. Outside temperatures hit 38°C on the day; there were no paddock visits and it was a good day to stay indoors.

Seasonal conditions outlook – Sean Murphy, NSW DPIRD

Sean was the first presenter of the day. He provided a summary of recent conditions in Tamworth and then a seasonal outlook. It is useful to be reminded of how good (or bad) recent conditions have been because it helps us to make more informed decisions going forward.

The majority of 2023 was relatively dry and the 3-month outlook at the start of summer was ominous; drying conditions and below median rainfall were expected. There were predictions of an El Nino, along with a positive Indian Ocean Dipole and a negative Southern Annular Mode Index. Each of these would suggest hot and dry summer conditions were ahead.

Yet, what occurred was a rapid shift to above median rainfall, high soil moisture levels, and excellent pasture production. In total, 949 mm of rain was recorded across the next 12 months.

By October 2024, rainfall on a 5-year cumulative rainfall total basis (see Table 1) was still in the 98th percentile which highlights how good conditions had been. Even though the winter of 2023 was extremely dry, it was one of the wettest 5-year periods on record by October 2024.

TABLE 1.

Cumulative rainfall totals at Tamworth, NSW for the last five years until October 2024.

PERIOD (MONTHS)	RAINFALL (MM)	PERCENTILE (%)
12	949	94.5
24	1541 (770)*	78.8
36	2591 (864)	94.9
42	2943 (841)	95.0
48	3486 (871)	97.9
60	4188 (837)	97.8

* The rainfall in brackets is the annualised rainfall.

This very wet five year period, with an accumulated rainfall total exceeding 4000 mm, has only occurred three times in the past; in 1889, 1952 and 2012. However, the reality is that there has been some extreme variability, with extended dry and very wet periods becoming more frequent. This makes managing the grazing feedbase more difficult, considering we have been operating in an 800+ mm rainfall environment recently which is much more favourable for growing grass than a 450 mm environment.

So how should we keep abreast of seasonal conditions? Online information and tools such as local rainfall data, the NSW State Seasonal Update (including a new Drought Forecast map), and the Farming Forecaster are all useful. The NSW State Seasonal Update for example, which is provided

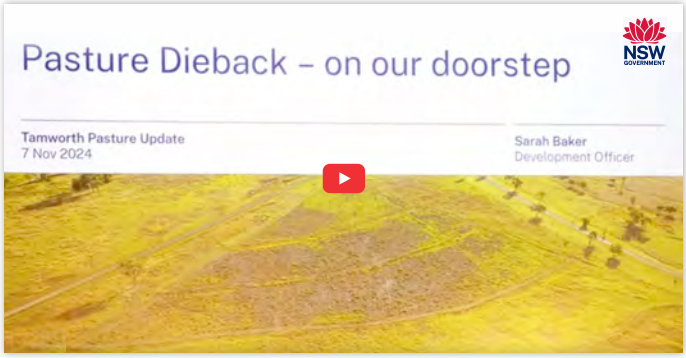
by the NSW DPIRD (https://www.dpi.nsw.gov.au/climate_applications/state-seasonal-update), is now a one stop shop for all things seasonal conditions. The recently released Drought Forecast map allows you to look three months ahead, using the indicators of rainfall, soil moisture and pasture growth rate along with climate forecast data. When all these indicators are below a certain threshold, the Drought Forecast map will indicate drought. The climate group delivers a monthly webinar to provide an update about the seasonal conditions and current climate drivers.

> *"The recently released Drought Forecast map allows you to look three months ahead"*

Another useful tool is the Farming Forecaster, which incorporates local weather stations and uses a series of soil moisture probes and pasture modelling to indicate current pasture growth conditions. Individual probes can be explored for details about soil moisture status and pasture availability relative to historic trends. It can be used to answer the question, are current pasture growth rates consistent with, or are they below or above, the historic average?

What tools do you use to keep abreast of seasonal conditions?

Pasture Dieback: What can we expect this summer? – Sarah Baker, NSW DPIRD



Pasture dieback was first discovered in southern Queensland and is now common on the NSW North Coast, having first been observed there about four years ago. Recently, there has been a large shift in pasture dieback; it has moved ~100 km within the last 12 months on the coast and it is getting closer to north-west NSW. Indeed, recent observations suggest that it has now crossed the border into NSW around Goondiwindi.

Pasture dieback impacts sown tropical perennial grasses and native summer growing grasses, whereas legumes and broadleaf weeds are not impacted. To date, there is no evidence that pasture dieback impacts temperate grasses either.

Good growing conditions, like we have had this season, appear to favour the spread of pasture dieback. However, it is now also occurring in relatively low rainfall areas. For example, it was thought that pasture dieback only occurred in areas that receive more than 600 mm AAR, but in QLD it has been observed in areas that receive as little as 500 mm AAR.

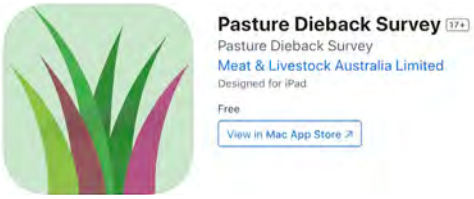
> *"The symptoms you need to be on the lookout for include red/yellow leaf discolouration ..."*

The symptoms you need to be on the lookout for include red/yellow leaf discolouration and even purpling in paspalum. However, there are other causes of leaf discolouration such as nutrient deficiency and other causes of stress. The next phase in the development of pasture dieback is stunted plant growth, including low tiller numbers and small root systems. What follows is plant death. Once the plants have died, weed invasion often occurs. This is when most producers notice they have lost their pasture. This progression of discolouration through to plant death is a strong indicator of pasture dieback.

It is thought that the pasture mealybug is involved in causing pasture dieback as they are often observed on live plants that are growing in areas impacted by pasture dieback. However, there are other factors that influence the prevalence and severity of pasture dieback. These include the susceptibility of the particular species, large amounts of grass biomass, hot and humid conditions, and if there are secondary infections caused by viruses.

There have been some interesting observations from dairy farmers on the NSW North Coast. They have noticed that the pastures on their milking platform, which are well managed through fertiliser application and grazing management, are not being impacted by pasture dieback. In contrast, areas where they have dry cows and there is less intensive management are being impacted more.

Have you seen pasture dieback on your property? If so, you should report it to the Exotic Plant Pest hotline on 1800 084 881, contact LLS on 1300 795 299 or download the MLA App: (https://apps.apple.com/au/app/pasture-dieback-survey/id1591527141)



Mixed forages: Unlocking livestock benefits – Carol Harris, NSW DPIRD

Mixed fodder crops include a combination of plants that represent different functional groups including grasses, legumes, brassicas and other broadleaves. A typical mix might include oats, annual ryegrass and a brassica, or oats, annual ryegrass and a clover. The idea is to match these different groups of species to give a mix with some resilience to variable seasonal conditions, while providing a diverse feedbase to supply adequate nutrition for grazing animals. There can also benefits in terms of weed suppression.

The autumn to early-spring feed gap has traditionally been filled by a winter cereal (e.g. oats or wheat), but when grown alone there have been metabolic issues for grazing livestock. There was also the risk of complete failure of the fodder crop under adverse seasonal conditions. The benefits of adopting a mixed fodder crop include extending the grazing period with an increased amount of feed, balancing the nutritional profile and reducing metabolic issues, and enhancing overall livestock performance. Improvements in soil fertility from the nitrogen the legumes provide and weed control via competition are additional benefits.

The challenge associated with mixed fodder crops is that there is limited local data about their performance and profitability, yet many graziers are already using these mixtures successfully. A further challenge is the increased complexity of sowing, including the time of sowing and the placement of seed (due to the range in seed size), plus there are animal health risks when brassicas are included and fewer in crop weed management options.

> *"Trials have been conducted across the New England region to understand the fit of mixed fodder crops"*

Trials have been conducted across the New England region to understand the fit of mixed fodder crops. Carol presented the results of a trial that investigated the quantity and composition of various fodder crops across three years in Glen Innes. From late autumn through to spring, when fodder crops were established and assessed, 2021 was very wet, 2022 was relatively wet, while 2023 was quite dry. In 2021, some of the mixes produced more than 30 tonnes of biomass. In 2022, yields were lower but the mixes produced ~18 t/ha compared to straight oats which produced 10 t/ha. In 2023, yields were lower again but the mixes were still more productive than the straight oats fodder crop.

Across the three years, the composition of the mixes changed. 2021 was dominated by annual ryegrass, because it was able to respond to the abundant soil moisture which was not as conducive for the growth of brassica or vetch. In 2022, brassica made a greater contribution to feed supply. In 2023, the other components of the mixes were more productive than the oats.

TABLE 2.

Carcass quality of lambs grazing three fodder crops at Glen Innes.

TREATMENT*	HSCW (KG)	CARCASS FAT SCORE (MM)	CARCASS GR FAT (MM)	DRESSING (%)	VALUE ($)
O	20.7a	13.1a	9.5a	41.1a	162.90a
O+AR+B	23.2c	14.9b	12.5c	43.2b	192.40c
O+AR+C	21.7b	14.3b	10.7b	41.7a	176.50b
sed	0.34	0.43	0.54	0.33	4.33
P value	<0.001	0.013	0.004	0.002	0.001

* O = oats, AR = annual ryegrass, B = brassica, C = arrowleaf clover

HSCW = Hot Standard Carcass Weight
GR site = 10–11 cm from the midline on the second last long rib
Dressing % = weight of the carcass expressed as a percentage of liveweight

Feed quality is another important consideration. Work by Suzanne Boschma at Tamworth (NSW DPIRD) showed that there was not much difference in digestibility between the mixes and oats, but there were differences in crude protein across the growing season. In early winter, the crude protein of the mixes and oats was ~25%. The oats maintained quality whereas the mixes started to lose quality in late winter. Nearer the end of the season, however, the quality of the mixes has been maintained whereas the crude protein of the oats had dropped to 10%.

> *"The mix with brassica was the standout of the three treatments as it produced the highest value carcass"*

A grazing experiment was also conducted at Glen Innes and reported by Carol. There were three treatments; 1) oats, 2) oats + annual ryegrass +brassica, and 3) oats + annual ryegrass + arrowleaf clover. The fodder crops were sown in 1 ha plots that were grazed with 20 lambs each. Biomass measurements were taken before the lambs went onto the plots and then every 30 days to assess biomass, growth rate and feed quality. Animal measurements were taken at the same time, including weights and sampling to determine the mineral content of their blood plasma.

The results showed that the contribution of all the components of the mixtures was consistent across the grazing trial. In terms of liveweight gain, the oats resulted in a liveweight gain of 178 g/hd/day, oats + annual ryegrass + brassica 213 g/hd/day, and oats + annual ryegrass + arrowleaf clover 195 g/hd/day over the 91-day period. These differences were statistically significant. Differences in carcass quality are also shown in Table 2.

The mix with brassica was the standout of the three treatments as it produced the highest value carcass. It also produced the most feed, it was higher quality than the other treatments, it showed the greatest potential to turn off lambs faster, and it has the potential to reduce methane production. The cost of seed to plant the mixes would be the only difference if a gross margin was completed for each treatment.

The learnings to date about sowing are to recognise when the feed gap occurs and to sow early within the sowing window to ensure feed is available earlier in the season. To make mixed fodder crops profitable, you need to have the animals available to utilise the additional feed. In terms of species in the mix, it is best to select species that are suited to your area. For example, brassicas provide early, high quality feed while arrowleaf clover will continue growing throughout the season and provide high quality feed well into spring. In terms of seed placement, the depth must be suitable for the smallest size seed of the mix to emerge successfully.

Pasture legumes - managing for productivity and persistence – Jonathan McLachlan, UNE

Legumes are an important component of many pastures because they increase feed quality and fix atmospheric nitrogen. Even though the value of legumes is well understood, questions are often asked about how to ensure that the legume component of a mixed pasture sward remains productive. This requires an understanding of how plants respond to the prevailing environmental conditions so that we can manage them more effectively.

> *"Even though the value of legumes is well understood, questions are often asked about how to ensure that the legume component of a mixed pasture sward remains productive"*

Many pasture swards have a combination of species that are all actively competing for resources so that they not only survive but thrive. The productivity and persistence of the legume component of a mixed pasture sward largely depends on how successful the legumes are at acquiring the resources they need which in a large part is determined by how we manage them. We need to select the right species, ensure successful establishment, and then manage our pastures through appropriate fertiliser and grazing management to allow the legume component to thrive.

The challenges associated with maintaining the legume component of a pasture need to be understood. For example, legumes are generally higher quality than grasses which means they are often selectively grazed. If grazing isn't managed appropriately, it's possible that the legume component will decline which will reduce overall pasture productivity. There are also challenges with the morphology of legumes; their growing points are generally more exposed to damage by grazing and their roots are not as effective as grasses at foraging the soil for nutrients.

Legume Choice

Choosing an appropriate species for the expected conditions is the first step to ensuring a productive and persistence legume component. Key considerations include climatic conditions (particularly annual average rainfall), soil type, and other management factors (e.g. expected enterprise type, pairing suitable species etc.). If the incorrect legume is chosen (e.g. due to not enough annual rainfall or an unsuitable soil texture), then it is unlikely to contribute to the overall productivity of your pasture. Important things to consider when selecting a legume species include the value of an annual vs. perennial lifecycle, the expected growing season length (days to flowering), differences in hardseededness, and if there is a risk of bloat.

Legume Establishment

Adequate preparation prior to pasture establishment cannot be over emphasised. Preparation is particularly important for weed control prior to sowing. Other factors such as timing of sowing, determined by soil moisture and temperature, must also be considered. If establishment is not successful, you will not have a productive pasture.

Legume Management

The two key considerations here are grazing management and soil fertility. In terms of grazing management, it is important that the pasture sward is managed carefully to allow the legume to thrive. For example, if an annual legume like subterranean clover is grown with digit grass, these two components are

growing at different times of the year. Subterranean clover must regenerate each year so it requires enough space and light to emerge in autumn (relatively heavy grazing) plus it must also have enough time to set seed at the end of its growing season (lax/no grazing). In terms of soil fertility, legumes require more phosphorus and sulfur than grasses so fertiliser applications should be aimed at maintaining the legume component.

Summary

- Legumes generally require active management to ensure ongoing productivity.
- When choosing legumes, consider climatic conditions, soil type and other management factors.
- When establishing legumes, remember the importance of preparation, timing, placement, and the need for amendments.
- When managing legumes, ensure appropriate and timely grazing to maintain composition, seedling regeneration and seed set of annual species, and maintain adequate soil fertility for the legume component.

Temperate grasses: Are they worth it in the North West? – Tony Stewart, Elders

The value of temperate grasses in north-west NSW is determined by your expectations. If you want a pasture that will provide long-term productivity, then temperate grass pastures are not the answer. However, if you want a lower cost 3–10-year option to fill feed gaps in winter and the shoulder seasons, then they have a fit. Furthermore, if you want to reduce the money and time associated with planting winter forages each year, they also have a fit.

The temperate grasses of interest for north-west NSW include phalaris, tall fescue (Mediterranean types), cocksfoot (Hispanicum types), and in some cases brome and prairie grasses. There are two Phalaris types; the Australian and the winter-active types. It is the winter-active types that are most productive in north-west NSW. Among the tall fescue varieties, there is a large range in dormancy and it is the summer dormant varieties that will survive better. This is the same for the cocksfoot varieties; we need to use the summer dormant varieties. Among brome and prairie grasses, the bromes tend to be a little more persistent. Brome and prairie grasses will both recruit from seed and they are used to compliment the deeper-rooted perennial species.

> *"In terms of productivity, phalaris is a good all-rounder across a range of input levels"*

In terms of productivity, phalaris is a good all-rounder across a range of input levels. Tall fescue tends to be more productive where there is higher fertility, but productivity declines when fertility runs down. Cocksfoot can be very persistent, but it is generally less productive than either phalaris or tall fescue.

What follows is a case study that Tony used to demonstrate the value of temperate grasses in north-west NSW. The aim of this example was to try and reduce the area sown to forage crops each year by instead using perennial grasses to provide more shoulder season growth.

The following observations started in 2016. This was a wet year but the rain stopped in October. What followed was a dry summer leading into a dry autumn and when the break came it was quite late. There was a paddock of phalaris (established in 2015) while the paddock next to it was sown to winter wheat in late April 2017. The winter wheat was not ready to graze until 17 June 2017, whereas the phalaris was used to join ewes and then wean calves. The phalaris kept the

calves going forward until the wheat was ready to be grazed.

This is the fit of phalaris, tall fescue, cocksfoot and other temperate grasses in the slopes of north-west NSW. They can contribute to late autumn and early winter feed production, which is important because by including temperate grasses we have reduced the area of annual forages. It is unlikely we can stop planting winter forage crops, because we can store summer rainfall in a fallow to be utilised by these crops, but the inclusion of temperate grass pastures adds real value.

What follows is an assessment of the profitability of temperate grasses. In the establishment year of a phalaris plus clover pasture, the input costs totalled $545.74/ha. The pasture was grazed at 3 hd/ha for 100 days with livestock gaining 1 kg/hd/day at $3.40 /kg, so a total income of $1020.00 or a gross margin of $474.26/ha. This gross margin improves as the price of beef increases. Input costs include $200 worth of seed, $75.60 worth of DAP and $82 worth of urea.

In the second year of the phalaris and clover pasture, there are no establishment costs but there are still fertiliser inputs. This includes 100 kg/ha of DAP to replace the P from the previous year and 100 kg/ha of urea to maintain productivity. Herbicides were also used as they were in the establishment year. Based on the phalaris/clover pasture producing 6.5 t/ha (or growing to knee height twice), the input costs have dropped to $275.84, but the income based on gaining 569 kg/ha at $3.40/kg is now $1934.60, so the gross margin is $1658.70/ha.

Summary

- Temperate grass pastures are a medium-term option in north-west NSW.
- They are complimentary to tropical grass pastures and winter forage crops.
- They are important for supplying feed during the shoulder seasons and can reduce the amount of money and time spent on annual forage crops.
- They are high quality and, with good legume content, can result in liveweight gains of at least 1 kg/hd/day, so the economics stack up.

From the Conference Proceedings Archive

Below are a selection of papers from past conference proceedings that focus on pasture establishment. Successful pasture establishment requires careful planning, so it is good to start thinking about what is required so that you are prepared. Full papers can be found on our website using the links provided below.

Ten tips for better establishment of sown tropical perennial grasses in northern New South Wales

G.M. Lodge and L.H. McCormick

Proceedings of the 25th Annual Conference of the Grassland Society of NSW (2010)

Abstract: Successfully sowing tropical perennial grasses requires planning for paddock and species selection, the use of high quality seed, sowing at the correct time and depth and pre- and post-sowing weed control.

https://www.pgnsw.com.au/conference-proceedings/conference-2010

Rejuvenation of run-down perennial pastures

F.J. Leech and R.B. Garnsey

Proceedings of the 32nd Conference of the Grassland Society of NSW Inc. (2021)

Abstract: Persistence of productive, high quality perennial pastures remains one of the greater challenges in our grazing systems. Pasture decline can be the result of several causal factors, including overgrazing, lack of soil fertility, drought or poor species selection. An assessment of existing pastures is required before embarking on any renovation program, to determine the most appropriate course of action. In many cases, complete pasture re-sowing is not required and less expensive pasture manipulation techniques can be used to rejuvenate these paddocks into highly productive perennial pastures. Techniques including non-sowing management options as well as over-sowing of existing stands are discussed in detail.

https://www.pgnsw.com.au/conference-proceedings/conference-2021

Managing the establishment of productive perennial pastures

H.K. Best

Proceedings of the 32nd Conference of the Grassland Society of NSW Inc. (2021)

Abstract: The establishment phase of a perennial pasture is when the pasture is the most vulnerable. Farmers are often reluctant to invest in modern perennial pastures due to the perception they do not persist. This paper aims to simplify the decision-making process when deciding which perennial species to plant by outlining the importance of factors such as temperature, annual rainfall, rainfall distribution, soil type and expected insect pressure. It also outlines some of the key steps involved in successfully establishing temperate perennial pasture species such as planning, paddock preparation, sowing depth, soil temperature, insect control, weed control and early grazing technique. After taking note of these important factors, farmers should be able to renew pastures with increased confidence.

https://www.pgnsw.com.au/conference-proceedings/conference-2021

Research Updates

Keeping you up-to-date with the latest pasture and grassland research in Australia. We reprint the abstracts of recently published research articles so you can follow up the full paper if you wish.

Choice of companion legume influences lamb liveweight output and grain yields in a dual use perennial wheat/legume intercrop system

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Abstract

Context

Perennial cereals are being developed for dual roles of forage and grain production. Like other cereals, perennial wheat (PW) forage requires mineral supplementation if grazed by ruminants.

Aims

To investigate the effect on liveweight gain in lambs grazing PW/legume intercrops in comparison to grazing PW with a mineral supplement. Effects of intercropping and impact of grazing on PW grain yield were also investigated.

Methods

Lambs (14-week-old, n = 144) grazed one of four treatments, namely PW with a mineral supplement (PW + Min) or PW intercropped with either lucerne *(Medicago sativa)* (PW + L), subterranean clover *(Trifolium subterraneum)* (PW + C), or French serradella *(Ornithopus sativus)* (PW + S) for 12 weeks. Treatments were arranged in a randomised block design with six replicates. Following grazing, grain yield from each treatment was compared with an ungrazed control upon maturity.

Key results

Intercropping with either subterranean clover or French serradella increased carrying capacity and total liveweight grain, similar to the PW + Min treatment and supported a higher stocking rate compared with the PW + L treatment. Sodium concentration was approximately 10-fold higher in the herbage of subterranean clover and serradella compared with PW, and 5-fold higher than lucerne. Grain yields from intercropping were lower compared with PW + Min due to the reduction in perennial wheat density. However, proportionally, PW grain yield was improved in the PW + S and PW + L treatments with a Net Effect Ratio (NER) > 1.

Conclusions

Increased feed availability from the provision of forages, such as subterranean clover and French serradella, enabled greater liveweight output through greater carrying capacity of grazing lambs when compared with a PW + L diet. However these were not different to PW + Min. Improved sodium intake is also implicated in this result, however not confirmed by this study. Grain yields were not affected by grazing, although they were reduced by intercropping. However, the comparative improvement in PW grain yield (NER) in combination with a compatible legume, along with increased grazing days, highlight the potential of intercropping where more than one product is produced in a multi-functional, dual-purpose perennial grain system.

Implications

The comparative improvement in grain yield from intercropping, coupled with increased liveweight change, supports the use of compatible legume intercrops in dual-purpose perennial grain systems.

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https://doi.org/10.1071/AN24246

Exploring the impact of replacement rates on carbon footprint in south-east Australian dairy herds

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Abstract

Context
Greater replacement rates in dairy herds lead to increased costs for rearing and/or purchasing replacement heifers and greater herd greenhouse gas (GHG) emissions.

Aims
This study aimed to estimate current GHG emissions and potential improvements in net farm emissions (NFE) and emission intensity (EI) by reducing replacement rates (percentage of calvings in the herd in the year that were by first calving heifers) using a series of eight case study farms.

Methods
The research was conducted by modelling eight Australian case study farms (five from northern Victoria/southern New South Wales and three from the Gippsland region) using farm-specific data. Data included herd structure, milk production, feed quality and quantity, and energy, fuel, and fertiliser usage. GHG emissions were estimated using the Dairy GHG Accounting Framework tool (ver. 14.5), calculating NFE and EI in megagram of carbon dioxide equivalents (Mg CO_2e) and kilograms of carbon dioxide equivalent per kilogram of milk solids (kg CO_2e/kg MS). The study modelled reducing the replacement rate by 5, 10, and 15 percentage points.

Key results
The average (±s.d.) EI per kilogram of MS for the eight case study farms was 15.8 ± 3.5 kg CO_2e/kg MS. A 15-percentage point reduction in replacement rate was estimated as leading to reductions in EI per kilogram of MS ranging from 0.9 to 1.7 kg CO_2e/kg MS across the case-study farms. However, NFEs were estimated as increasing with reductions in replacement rate for five of the eight case study farms.

Conclusions
Reducing the replacement rate can reduce EI (measured in kg CO_2e/kg MS) but increase NFEs.

Implications
The findings underscore the importance of considering both environmental factors, such as GHG emissions, and economic aspects, such as net farm income, when evaluating and implementing strategies for sustainable dairy farming.

Animal Production Science **65**(5) 1–12
https://doi.org/10.1071/AN24247

Next Newsletter

The next edition of the newsletter will be distributed in June 2025. If you wish to submit an article, short item, a letter to the Editor or a photo please email your contribution to:

editor@pgnsw.com.au

The deadline for submissions is
Friday 16 May.

From the Chairperson

The weather over summer in the north of the state has been relatively dry along with high temperatures, but fortunately we received some rain recently because of cyclone Alfred. Our thoughts go out to our North Coast farmers who have had to endure the floods and damage caused by the cyclone.

The central districts have been short of rain; hand feeding is underway and large numbers of livestock are being sent to the saleyards. In the Riverina and southwestern districts, it has been very dry and they are now in drought. I was in Hay last November and the conditions weren't too bad, as there was storm rain at the time, but it dried out very quickly.

I am pleased to announce the return of our grasslands conference to be held in Tamworth in 2026. Planning is already underway to bring you an exciting event. Our conference has previously specialised in a variety of topics about the latest pasture and grazing science, along with presentations on its practical adoption by farmers. This dissemination of relevant information is one of our strengths, so we thought it was time to reintroduce the conference. While we have focused on holding regional pasture updates which have been successful, we see the conference as our flagship event.

> *"I am pleased to announce the return of our grasslands conference, to be held in Tamworth in 2026"*

In the past, our grasslands conference has been an avenue for scientific publications that do not qualify for scientific journals yet are frequently searched for on our website. This has been updated so that past conference proceedings are easier to find than before. I have had the opportunity to attend a number of agronomy conferences, but they often do not feature the level of pastures and grazing content that we have at our grasslands conference.

In preparation for the conference, the sponsorship prospectus has been updated and added to our website. The sponsorship prospectus includes a range of sponsorship packages along with several bespoke offerings. We are in the process of contacting our sponsors to support us again.

While on the topic of conferences, the Australian Grassland Association Symposium – Seeds of Change will be held at Hahndorf in the Adelaide Hills of South Australia in July this year. Of particular interest to me will be the presentation 'Modelled potential distribution of C4 pasture species in current and future climates for Australia, with focus on southern Australia'.

To continue promoting our rebrand to Pastures & Grazing NSW, I will be attending the Tocal Field Days on 2–4 May along with Neil Griffiths who I thank for volunteering to assist me on the stand. If you are attending, there will be a colouring competition for junior primary students and two competitions for patrons; those wishing to test their luck by guessing the number of pasture seeds in a jar and by identifying several pasture species without the use of any guides (including smart phones). I look forward to meeting our current members and any potential new members at the site, so come in and make yourself known.

Yours in Pastures & Grazing,

Lester McCormick
Chairperson (on behalf of the Board)
Pastures & Grazing NSW