UNIVERSITY of TASMANIA
TIA
Tasmanian Institute of Agriculture

TASSIE DAIRY News

Produced as a part of the Dairy HIGH 2 project

September 2024

Inside this issue

Managing pugged paddocks

Jacob Lightman, TIA

The high rainfall we've received over the past weeks has caused many farmers' soils to become saturated, leading to severe pasture and soil damage by animal hooves (pugging) on some farms. As soil moisture increases, soil strength decreases - the water acts like a lubricant, allowing the soil particles to be squished together more easily - and a bunch of heavy cows walking on it can lead to the pasture being pushed into the mud and damaged or killed. Traffic on wet soil can lead to compaction and water infiltration and drainage is significantly reduced.

Effects of pugging

Light pugging isn't worth worrying about - the losses in pasture utilisation and production are minimal (in the academic lingo: statistically insignificant). For the most part, it's just cosmetic and a bit bumpy to drive/walk across.

Moderate to severe pugging, on the other hand, has a significant (and costly) effect. In experiments in south-western Victoria, medium–heavy pugging in winter reduced pasture yield in the following spring by 40–42%, pasture utilisation by 34–40%, and perennial ryegrass tiller density by 39–54%. Pugging can also lead to animal health and weed proliferation problems. And unfortunately, soil that's already been pugged is more susceptible to pugging in the future (until full pasture cover is achieved).

Cost of replacing lost production

If you were to replace this loss in pasture production with bought-in feed, here's what the pugging might cost you:

Normal production: 10 t DM/ha
40% yield loss from pugging: 10 t DM/ha*0.4 = 4 t DM/ha loss.
Total pasture available: 10 t DM/ha – 4 t DM/ha = 6 t DM/ha available

Continued on page 2

Utilisation under normal conditions (80%): 6 t DM/ha * 0.80 = 4.8 t DM

40% decrease in utilisation from pugging: 4.8 t DM/ha * 0.4 = 1.9 t DM/ha.

Pasture utilised: 4.8 t DM/ha – 1.9 t DM/ha = 2.9 t DM/ha.

Total loss due to pugging: 10 t DM/ha – 4-1.9= t DM/ha = 4.1 t DM/ha

Cost to replace herbage loss: Assuming $500/t DM, 4.1 t DM/ha * $500/t DM = $2,050/ha

What to do

Before you take action, you need a plan. In short, you need to assess how bad the damage to the pasture and soil is, decide what type of intervention you're going to take, how and when you're going to do it, and how you're going to manage the area after your intervention.

Assess the damage

Sometimes you can just eyeball your paddocks to determine the pugging severity and whether it's worth addressing. This is easiest when it's either very light, or very heavy pugging. The difficulty comes when you're in that medium grey area - if you assess it incorrectly, you're either going to lose production over an extended period of time (thinking it's light and not doing anything about it) or spend money renovating a paddock unnecessarily (thinking it's moderate-heavy when it's light).

If you're unsure, put your mind at ease and measure. There are a couple of methods I'd recommend (both correlate highly with each other).

Using the puggology chart

The first step is measuring pugging depth. Take out a ruler or measuring tape and measure how deep the hoof indentations into the soil are. Measure 20 or so and average them (add the measurements together and divide the total by the number of measurements you took).

The next step is to estimate how much of the paddock is impacted by pugging. Choose areas to sample that are representative of the pugging damage present and visually estimate the proportion of bare ground. This is most accurate with the help of a square quadrat, preferably 250x250 mm but no bigger than 500x500 mm, which can be made out of PVC or similar. Alternatively, you can stand with your feet shoulder-width apart and imagine a box on the ground in front

PUGGOLOGY CHART (Area x Depth matrix)

Depth of Pugging (cm)	Area of Paddock Pugged (%) 1 (0 - 25%)	2 (25 – 50%)	3 (50 – 75%)	4 (<100%)	5 (100%)
Shallow (0 – 2 cm)	O - VL	VL (Very Light)	VL	L Light	L
Medium Depth (2 – 5 cm)	VL	L	M (Medium)	S (Severe)	VS
Deep (5 - 8 cm)	VL - L	M	VS (Very Severe)	VS	VS
Very deep (> 8 cm)	L - M	S	VS	VS	VS

Figure 1: 'Puggology chart' from Mickan, F. 2013. Pasture Recovery from Pugging Damage. Victorian Government Department of Environment and Primary Industries, Melbourne, Victoria.

› Continued on page 3

of you and estimate the percentage of bare ground within that box.

To help categorise pugging damage, a density (area) x depth matrix chart was created (Figure 1). If the pugging damage is medium to very severe, it will be significantly impacting the pasture grown and utilised.

Chain method

The second method is measuring surface roughness using the chain method. Take a length of chain roughly 1 m long, measure it so you know exactly how long it is when it's straight, then lay it on the ground over the pugged area, making sure that the chain follows the contour of the pugged soil. Then, measure how long the chain is on the ground. The reduction in chain length (as a percentage) indicates the pugging severity. e.g. 1 m (100 cm) chain placed on pugged ground measures 90 cm. The percentage reduction = (1 - 90/100)x100. If it's easier, you can put this into your calculator in stages.

90/100 = 0.9

1-0.9 = 0.1

0.1x100 = 10%

The more measurements you take and the more representative your measurement locations are of the overall paddock, the more accurate your average will be. In other words, don't just take a couple of measurements in the most pugged area near a gate or something, because on paper the condition will be horrendous. I'd aim to take at least 10 measurements.

Expected reductions in chain length would be:

- No pugging: <5%
- Lightly pugged: 5-10%
- Moderately pugged: 10-15%
- Severely pugged: >15%

Deciding on Remediation

Once you've assessed the damage, the next step is to decide on the appropriate course of action.

Very light - light: Likely to recover naturally; however, well-timed rolling may help level the ground.

Medium: Prior experience, local knowledge, and personal preferences really come into play here, because practices vary widely. Options range from rolling to more intensive methods such as power harrowing, seeding, cover harrowing, and rolling. It's important to weigh the cost of intervention against the potential long-term loss in productivity if insufficient action is taken.

Severe: This level of damage may require resowing the pasture, depending on whether the pugging is widespread or very deep. Cultivation might also be necessary to break up any compaction.

Very severe: Complete renovation is necessary. In some cases, incorporating a cropping phase is advised, particularly to help manage spring-germinating weeds like fat hen, wireweed, and cape weed.

Rolling: Helps level uneven ground and increase seed-soil contact. It needs to be performed at the correct time, particularly for levelling, or it risks creating more damage (if too wet) or not being effective (too dry). This window is often narrow. The general rule of thumb is that if the soil can withstand your tractor, it can withstand rolling.

Ripping and cultivating: For paddocks with compacted soil, breaking up the compacted layer is essential. However, it's crucial not to cultivate too deep, as this can lead to deeper compaction issues which are harder to remediate. Soil moisture must also be appropriate; the soil should be crumbly and not too wet. To test, try rolling a tablespoon of soil into a thin worm roughly 5 cm long. If it holds together the soil may be too wet for cultivation.

Important considerations:

- Don't take on more than you can manage effectively
- Seed-soil contact is critical for good germination
- Rolling may not be beneficial where soils are prone to glazing or where the seed bed has become very powdery.

If you are going to do some remediation/renovation work, especially if it's going to involve cultivating, you should also consider whether you want to address any other issues that may be present and limiting production potential - pH, drainage, nutrient levels, etc.

Grazing after renewal/ renovation

If you've gone to the effort of resowing or oversowing, don't undo your hard work by grazing too heavily too soon. Renovated or resown areas should be kept free of livestock at least until the grass is able to pass the "pull test" - i.e. it's not easily pulled out of the ground. Graze lightly the first time, leaving a slightly higher residual than usual, and monitor the repaired areas closely. How you manage a new pasture could have relatively long-term effects.

Resources

- Mickan, F. 2013. Pasture Recovery from Pugging Damage. Victorian Government Department of Environment and Primary Industries, Melbourne, Victoria. https://nla.gov.au/nla.obj-2803380598/view
- Pasture Plus – Pasture Management for Tasmanian Dairy Farmers https://www.utas.edu.au/__data/assets/pdf_file/0008/1663865/Pasture-Plus-Pasture-management-for-Tasmanian-dairy-farmers.pdf
- Soil Management – A Guide for Tasmanian Farmers https://nre.tas.gov.au/Documents/Soil-Guide.pdf
- Land Drainage for Farming in Tasmania – 5. Diagnosing the Problem https://landdrainagetasfarming.com.au/diagnosing-the-problem
- Land Drainage for Farming in Tasmania – 10. Maintenance and Management https://landdrainagetasfarming.com.au/maintenance-and-management

TIA Dairy HIGH2 Farmlets Monthly Report - August 2024

26/08/24 - Week 8	Farmlet 1		Farmlet 2		Farmlet 3		Farmlet 4	
# Cows	29		29		29		22	
SR (cows/ha)	3.94		3.94		3.94		2.99	
Pasture species	Perennial ryegrass & white clover		Perennial ryegrass & white clover		Perennial ryegrass, white clover & plantain		Mixed species	
Nitrogen (kg N/ha.yr)	300		150		150		0	
Daily Production								
	Per ha	Per cow	Per ha	Per cow	Per ha	Per cow	Per ha	Per cow
Litres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protein (kg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fat (kg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Milk Solids (kg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pasture Performance								
Pasture Growth (kg DM/ha.day)	44		36		36		42	
Pasture Cover (kg DM/ha)	2581		2489		2463		2400	
Nitrogen Use								
	This Period	Season	This Period	Season	This Period	Season	This Period	Season
Nitrogen applied (kg N/ha)	0	3	0	2	0	2	0	0

Report comments

Cows

Cows entered the farmlets on Monday, 26 August. There are currently 19 cows in Farmlets 1-3 and 18 cows in Farmlet 4. The herd for each of the farmlets is a similar as possible - they are balanced for liveweight, milk production, body condition score, lactation, and genetic capacity. The remainder of the cows will be added to the farmlets in the next 2-3 weeks. Farmlets 1-3 will have 29 cows and Farmlet 4 will have 22 cows. There was discussion at the end of last season about whether to increase the stocking rate of Farmlet 4 as the pasture growth over the season was very similar to the other farmlets. However, the research farmlet steering group (consisting of researchers, farmers and industry) decided to leave it the same so the research is comparable between the years.

Pasture

Pasture growth rate is currently between 30-40 kg DM/ha/day. Farmlet 4 has had a lower growth rate than the other farmlets and so has a slightly lower average pasture cover. This is due to the larger proportion of clover in Farmlet 4.

As is being experienced state-wide, paddocks are very wet at the moment. Some nitrogen has been applied to Farmlets 1-3 post-grazing but applications have been paused while it is so wet. This will help to minimise nitrogen loss from leaching or run-off. There is some slug pressure at the moment with visible damage on the plantain. Slug bait won't be used while it is raining as it dissolves quickly and so would have minimal impact on the slug population.

The cold and wet weather is reducing pasture utilisation because the cows are trampling pasture and spending more time standing in corners of the paddocks with their backs to the wind. This reduced intake decreases the amount of energy the cows are consuming each day which impacts on the protein percentage of the milk (has decreased from 3.35% to 3.24%) and with the extended length of these wet and cold conditions, we expect there will also be an impact on the volume of milk being produced.

Results presented in this report cover only a snapshot in time and should not be used as indicative of long-term results.

Subscribe to receive the monthly Farmlet Research report directly to your email here: https://www.utas.edu.au/tia/news-and-events/subscribe-to-newsletter

Nitrogen use this spring

Symon Jones, TIA

After last season's poor spring, where fodder reserves both on and off farm were not only depleted but became extremely expensive, farmers will be working to increase fodder reserves for hay and silage this season.

Therefore, as we move closer to the middle of spring, the question concerning the economics of applying nitrogen to actively growing pasture to boost both silage and hay production compared to buying an alternative supplement is often asked.

Pasture growth rates as we move past break even exceed pasture demand, therefore, generally, there is no real need to do anything more than conserve the surplus growth above current stock demands. This is considered the most cost-effective option.

However, following a dry spring last season where pasture conservation was usually at least 50% less than previous seasons and forage prices significantly increased as a result, consideration should be given to the benefits of increasing pasture yield with timely applications of N.

Response Rates

Response rates to nitrogen (extra kg DM grown per unit of N applied) are highest during spring. Applications of 40 to 60 kg/N can be applied at this time when response rates of at least 10-15 to 1 can be expected. At a 10 to 1 response rate, 1 kg of N will provide an extra 10 kg of pasture DM so if 100 kg urea/ha is applied, this is 46 kg N/ha so a 10:1 response would result in an extra 460kg DM/ha.

Research has found it to be less effective when applying less than 25 kg/N or exceeding 60 kg/N in a single application.

In a typical year, the profitability of applying N during spring is often questionable. Pasture growth is already surplus to immediate cow requirements so paying to further increase the pasture growth rate and then having to pay to conserve the extra grass grown is an expensive way to manage pasture. Nitrogen is most effectively used as a management tool to increase pasture cover, lengthen the grazing rotation or used to fill an immediate or predicted feed gap.

A feed budget is an essential decision -making tool for predicting pasture surpluses deficits and a vital tool to determine if nitrogen applications can be cost effective.

Economics are not the only consideration

Last season many farms experienced low pasture growth through autumn which increased the need for purchased fodder. As fodder became less available, prices increased dramatically. This may be making you consider boosting spring pasture growth with nitrogen as a way of reducing the risk of not being able to secure purchased fodder at reasonable prices.

The profitability of applying nitrogen in spring will depend on the milk response to the supplement grown with the additional nitrogen and the extra cost of conservation.

For most farms the timing of pasture conservation will be very different.

› Continued on page 6

Continued from page 5

Predicting a genuine pasture surplus will depend on the farm's calving date, stocking rate and Dry Matter Intake (DMI) for the dairy herd and the current and expected pasture growth rate.

(SR x Intake kg/DM/cow = DMI/ha)

Knowing pasture demand is essential to predicting how much pasture can be conserved on farms.

Knowing current and expected growth rate is also essential for predicting how much of the farm can be shut up for silage.

(Pasture growth rate kg DM/ha – DMI/ha = Surplus pasture)

(Surplus pasture ÷ pasture growth rate x 100 = percentage of farm that can be shut up for silage.)

Once this is known the pasture yield on the allocated silage area can be boosted by applying nitrogen.

The timing of the application will also be important so that the full response to the nitrogen is captured at the time of harvest. The greatest response will be achieved if nitrogen is applied immediately after grazing and the pasture is allowed to reach the 3-leaf stage for ryegrass before harvesting. Cutting pasture for silage at the 3-leaf stage allows the silage paddocks to re-enter the rotation without compromising dry matter intake on the milking platform.

Calculating the cost of N

The cost of a nutrient can be calculated using the following formula.

Cost per tonne ($/tonne) ÷ kg of nutrient per tonne = Cost per 1 kg of nutrient ($/kg)

Urea is 46% nitrogen therefore 1 tonne of urea contains 460 kg of nitrogen. Using the formula and assuming the cost per tonne of urea is $800 we can calculate the cost of 1 kg of nitrogen in urea.

$800 ÷ 460 = $1.73/kg of N.

If we assume a minimum 10:1 response per kg of N applied the cost per kg of additional dry matter grown is 0.17 cents. ($1.73 ÷ 10 = 0.17) **No cartage and spreading added.*

By growing an additional 460 kg/DM/ha the cost will be around $78.00 per hectare or $42.00 per bale before harvest assuming 250 kg DM per bale

While the additional feed grown could be considered an opportunity cost over and above the cost of conserving the genuine surplus, the cost of harvesting, wrapping and storage should also be factored in, as should the wastage component at the time of feeding.

Estimated variable costs at harvest

In this example, the cost of silage is estimated at $0.42/kg DM which includes the cost of growing (nitrogen $0.17/kg DM) and the cost of conservation ($0.25/kg DM; see Table 1).

Table 1 Estimated cost of conserving and feeding out silage

Conservation operation	Cost per bale	Cost $/ kg DM
Mowing/ raking/baling/ wrapping	$50	$0.20
Cartage from paddock	$3	$0.012
Feed-out cost	$10	$0.04
Total cost	$63	$0.25

Accounting for an assumed wastage factor of 15% at feeding, the cost per kg/DM increases to $0.49/kg DM ($0.42/0.85 = $ 0.49/kg DM) or $490 per t DM. The purchase price of silage last season varied between ($120 - $200 per bale) $0.48 - $0.80/kg DM last season, before cartage, feeding out and wastage costs are factored in. If similar prices are anticipated in the current season, applying nitrogen to

boost silage yields should be considered.

Table 2 shows the comparison between the cost of silage made and other available supplements. While alternative supplements can be measured in cents per MJ ME, these examples use cents per kg/DM.

While Table 2 shows the cost of silage as being comparable to grain supplements, it important that the feed ration is always balanced. Whilst concentrates will have a higher energy density than silage (i.e higher metabolisable energy/kg DM), silage may provide a much-needed fibre source at times when pasture is in short supply. Animal production response, be it milk or growth, from silage together with the cost of making the silage is a key factor in determining the returns to feeding. The expected production response from silage will depend on its feed quality. The feed quality of silage made on farm or silage purchased should be determined with a feed test.

Table 2 Comparison cost of supplements on dry matter (DM) basis

Feed	$/tonne	$/kg DM
Silage—made on farm with N	$420/t DM	$0.42
Silage—purchased ($100 per bale to $200 per bale; 250 kg DM/bale)	$400-$800/t DM	$0.40-$0.80
Concentrate pellet 12MJME, 12%CP*	$510/t	$0.56
Concentrate pellet 12MJME, 14%CP*	$525/t	$0.58
Barley*	$475/t	$0.52
Wheat*	$500/t	$0.55
Maize*	$510/t	$0.56

** Flat price type based off Melbourne new crop pricing*

How big a response to nitrogen

Table 3 shows three different response rates to nitrogen:

- 10:1 which is 10 kg DM grown for each kilogram of nitrogen applied
- 15:1 which is 15 kg DM grown for each kilogram of nitrogen applied
- 20:1 which is 20 kg DM grown for each kilogram of nitrogen applied

While everyone would like the highest response rate, what actually determines what response is achieved? There are quite a few factors including: soil temperature & moisture, soil fertility and pasture species. If any of these are limiting, the response to nitrogen is reduced. Basically, if pasture growth rates are high, you will get the highest response from nitrogen.

The result of any on-farm decision will be influenced by good management, careful planning and attention to detail. The importance of having a feed budget to predict a genuine pasture surplus and a feed deficit should not be underestimated.

Table 3 Example of how to calculate the cost of extra pasture grown with nitrogen with varying nitrogen response

	10:1 response	15:1 response	20:1 response
Cost of urea per tonne	$800	$800	$800
Amount of nitrogen in tonne urea (46%N)	460 kg	460 kg	460 kg
Cost of N/kg	=800/460=$1.73/kg N	=800/460=$1.73/kg N	=800/460=$1.73/kg N
If apply 100 kg urea/ha = 46 kg N/ha			
Extra grass grown	=46x10 =460 kg DM/ha	=46x15 =690 kg DM/ha	=46x20 =920 kg DM/ha
Cost of N/ha ($1.73/kg Nx46kgN/ha)	$80/ha	$80/ha	$80/ha
Cost of extra grass grown	=$80/460kg DM/ha =$0.17/kg DM	=$80/690kgDM/ha =$0.12/kg DM	=$80/920kg DM/ha =$0.09/kg DM
If a bale is 280 kg DM, the N boosted bale is costing an **extra** (this does NOT include cost of making bale):	$47.60/bale	$33.60/bale	$25.00/bale
This is equivalent to: (divide the weight of the bale by the extra cost of the bale to convert to cents/kg DM then multiply by 1000 to convert to $/tonne DM)	=280kgDM/$47.60 =$0.17/kg DM x 1000 =$170/t DM	=280kgDM/$33.60 =$0.12/kg DM x 1000 =$120/t DM	=280kgDM/$25.00 =$0.09/kg DMx1000 =$89/t DM

Dairy Science Snapshots

A summary of some recently published dairy research articles

Colostrum important for dairy beef calves too!

A study in California involving over 1000 dairy beef cross calves highlighted the importance of achieving transfer of passive immunity through good colostrum management. Calves in the study were classified in four different categories:

1. Poor immunity (failure of passive transfer of immunity)
2. Fair immunity
3. Good immunity
4. Excellent immunity

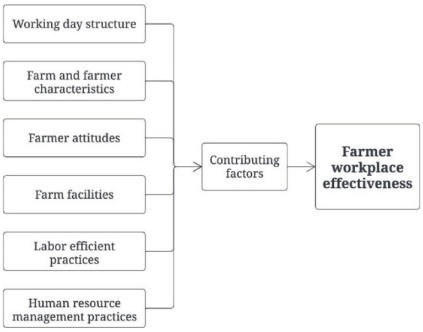
Calves in the excellent group were 43.2% less likely to be treated for illness and 82% less likely to die than calves in the poor group. Calves with poor and fair immunity had growth rates approximately 100 grams per day lower than calves with good or excellent immunity.

Association of morbidity, mortality, and average daily gain with transfer of passive immunity in dairy-beef crossbred calves up to 60 days of life. Pereira, Jessica M.V. et al. Journal of Dairy Science, Volume 107, Issue 10, 8223 - 8233. October 2024.

Better workplaces

A research team in Ireland surveyed over 300 Irish dairy farmers to improve their understanding of what makes a better workplace on pasture-based dairy farms. The farmers surveyed were split into four groups (quartiles) based on the farm's productivity, flexibility and standardisation. The average farmer in the survey was 51 years old, milked 125 cows, reported working 69.6 hours per week, took 10.3 days holiday per year, and had a finish time of 19:52 in the spring. Farmers in the most effective workplace (highest quartile) group reported reduced hours worked per week (58.6 vs. 82.6 h/wk), more holiday days (16.6 vs. 5.1 d) and weekends off (8.3 vs. 2.4) per year, and earlier finish times (18:41 vs. 21:14 [h:min] in the spring) compared with the least effective quartile.

The highest quartile for farmer workplace effectiveness was more positive about the industry's potential to offer an effective work-life balance, would be more likely to encourage young people to pursue careers in dairy, and had more positive attitudes toward attracting and retaining workers compared with the least effective quartile.



The factors contributing to better workplaces for farmers on pasture-based dairy farms. Hogan, C. et al. Journal of Dairy Science, Volume 107, Issue 10, 8044 - 8057. October 2024.

Contact us

Tassie Dairy News is provided free to Tasmanian dairy farmers and is funded by Dairy Australia and the Tasmanian Institute of Agriculture (TIA) as part of the Dairy HIGH 2 project.

For more information, please contact Lesley Irvine on 0428 880 287 or email Lesley.Irvine@utas.edu.au

Electronic copies of this newsletter are available at utas.edu.au/tia/resources

	Phone:	Socials:
TIA	(03) 6226 2121	@TasInAg
DairyTas	(03) 6432 2233	TasInAg
TasTAFE	1300 655 307	Tas Dairy Discussions
Rural Alive & Well	1800 729 827	

Disclaimer