Not enough feed: Options to increase

Lisa Miller, Southern Farming Systems

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Options to increase feed

Decrease utilisation of feed

- Reduce stock numbers
- Agist out stock

Increase pasture growth or availability

- Nitrogen and gibberellic acid
- Addressing deficiencies in fertility
- Sowing or introducing faster growing plants
    - Oversowing clover or ryegrass or a cereal
    - Sowing forage
    - Grazing crops

Decision: Do I retain this mob of animals and feed or sell them?

Critical factor	Consideration (tipping point)	Value	Score	Score
Returns V costs	Returns substantially exceed the cost of feeding	7		
	Around break even	4		
	Costs exceed the returns by a substantial amount	0		
Type of animal	High merit breeding stock, younger, essential to rebuilding	6		
	Lower merit breeding stock, older, useful for rebuilding	5		
	Non breeders, but additional value if grown out	3		
	Non breeders, easily replaced	0		
Anticipated length of feeding required	Short term (3 months or less)	5		
	Moderate period (3 to 6 months)	2		
	Extended period (greater than 6 months)	0		
Supp feed available	Lots available on farm or can replenish easily at good price	4		
	Some on hand, but would probably need more, price high but fair	3		
	Little on hand, would need to buy in, hard to get, expensive	0		
Infrastructure and time to successfully feed	Have enough infrastructure and labour to feed all stock if necessary	4		
	Some limitations but could make it work reluctantly	3		
	Limited infrastructure, equipment and time	0		
Emotional attachment	High, would hate to sell them	2		
	Some, but could do if had to	1		
	None	0		
		28	0	

Decision	Score
Retain and feed	20 or above
Sell	Below 19

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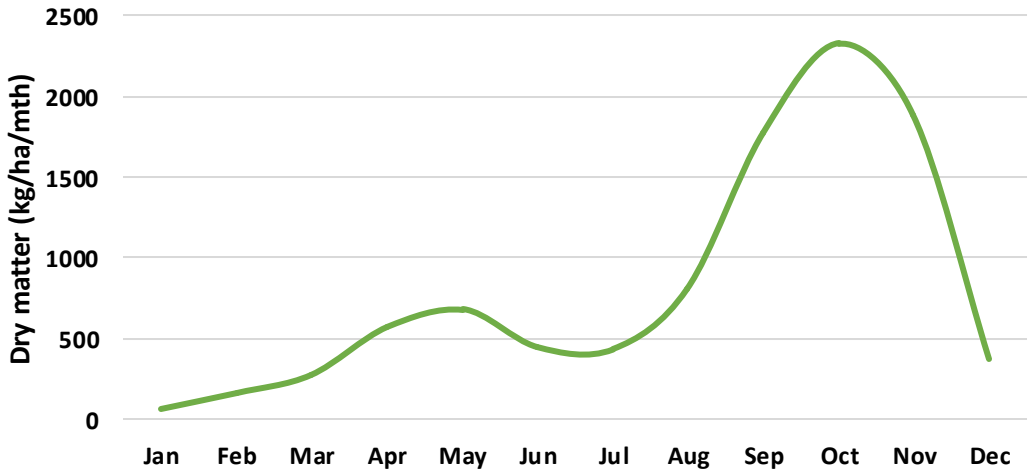
Pasture growth curve reflects nutrient plant demands

Nutrient demand is highest in autumn & spring when rapid growth occurs.

Nitrogen levels fluctuate during the season because of:

- Plant demand varies
- Mineralisation speed (release of nutrients via organic matter breakdown) varies due to microbe activity (active in warm wet weather).



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Times to apply Nitrogen fertiliser

- Winter because soil N has been used by plants for growth in autumn.
- Early to mid-spring, plants are responsive because of rapid growth.
- Sometimes after wet summers in autumn, because N has been used for summer growth or leached.
- Six weeks prior to fodder conservation.

- Soil test results show a combination of nitrate and ammonium is less than 20 mg/kg & plants are actively growing.

Nitrogen responses

Additional growth for each 1 kg of N applied:

Season	Kg DM	Typical response times
Winter	5-10	35 - 90 days
Spring	15-20	14 - 28 days

- E.g. Apply 50 kg N/ha = 250kg - 500kg DM/ha.
- Higher response rates on annual ryegrass > perennial ryegrass > phalaris.
- Higher response rates on grass-dominant pastures and soils with optimal fertility.
- Look for indications of N responses in urine patches.

N response in urine patches in mid Sept, urine patches tested 53 mg/kg N vs 7 in rest of paddock

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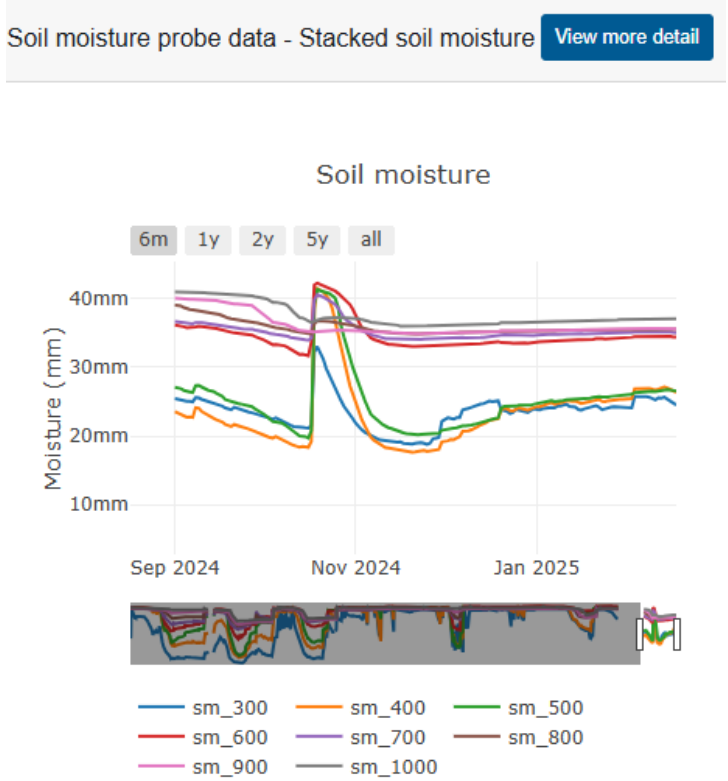
Other N fertiliser considerations

- Need 50 mm stored moisture to drive DM response
- Use rates of 25 to 60 kg N/ha.
- Apply soon after grazing as active growth occurs in the two weeks post grazing & needs N.
- Don’t graze post application until at least 3 leaves per tiller have grown, which takes 5 to 6 weeks.
- Poor response if low soil fertility, (P, K, S, soil acidity, Molybdenum on light textured soils).
- To avoid potential nitrate poisoning, don’t graze before 21 days.



25 mm of moisture for at 30cm

My Farm Dashboard

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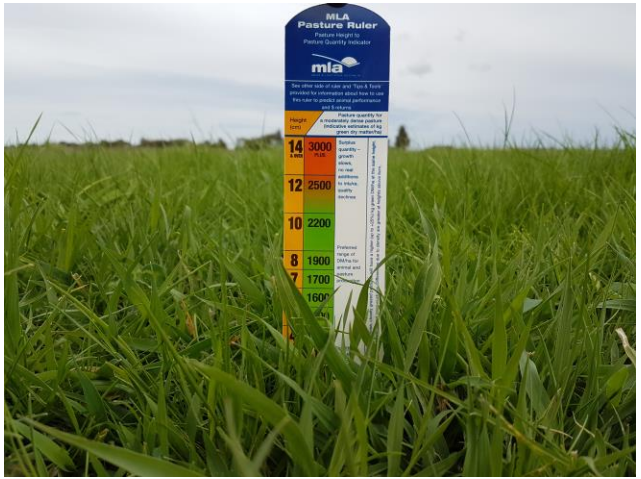
Nitrogen loss through fertiliser application to dry soils

Volatilisation of Urea -> Ammonia gas

Up to 20-30% loss occurs:

- <5-10mm rainfall events
- Drying soils
- Open canopies
- Wind
- ^ temperatures
- ^ soil pH
- ^ organic matter



- Aim to get N product absorbed into the ground as quickly as possible.
- Want 5 to 10 mm of rainfall to move N fert into the soil within 36 to 48 hours.
- If urea is applied to wet soil without rainfall to wash it in, volatilisation can still occur

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In winter consider Gibberellic acid

- Gibberellin hormone occurs naturally in roots, but when applied in winter, it stimulates growth.
- Application June to mid August.
- Maximum responses occur after 3-4 weeks but may continue to have an effect for another 4 weeks.
- Stimulates shoot and cell elongation, erect pasture, and yellowing (chlorophyll dilution).
- Can cause a decline in spring growth (redistribution of growth).
- Decline is due to plants reallocating energy and nutrients towards root growth & possible low soil N.

Meredith 2017, lighter green strip where Gibberellic acid has been applied.

Application notes

Cuyuac, 8 days following treatment, PPS MLA PDS report

- There must be leaf area present for uptake.
- Apply to established pastures > 1yr.
- Phalaris is very responsive, can use the lower recommended rate.
- Most grasses and plants are responsive to some degree
  - Can set back annual ryegrass growth (annuals don't store as much plant reserves, so can struggle to recover).
  - Tall fescue stands erect but not grow more DM.
  - Small increases in clovers.
  - Not proven to assist with weed removal.
- Applied as a liquid, can be applied with Easy N.
- N & GA effects are additive so can be applied together (300 + 300 = 600 kg DM/ha).

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Responses to Gibberellic acid

- Phalaris is more responsive (400 kg DM/ha) than perennial ryegrass (300 kg DM/ha) over 21 days.
- The best responses are from high content of phalaris (50%) and where pastures are not N deficient.
- CSIRO (Canberra): 460 kg DM/ha after 21 days.
- PPS trials (Ararat): avg extra 133 kg DM/ha, over 15 sites across 3 years after 21 days.

Costs

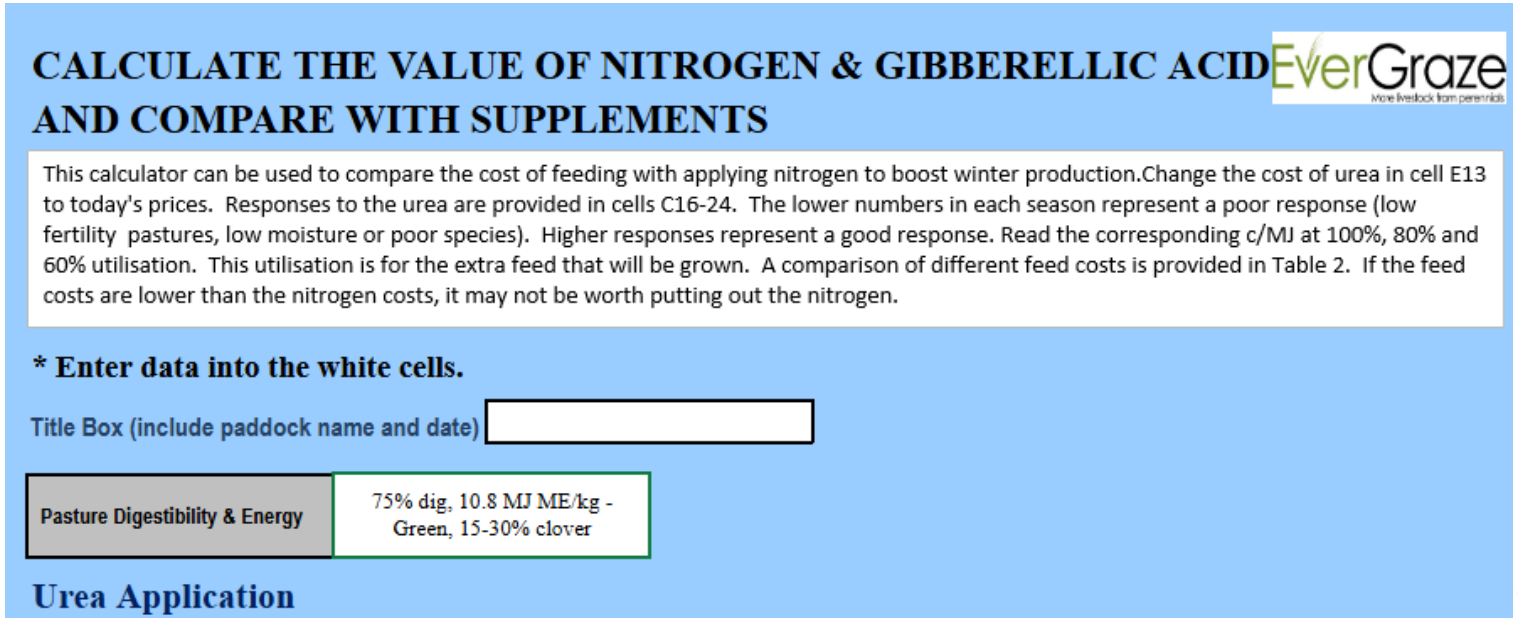
Costs of responses	Urea	Gibberellic Acid	Purchased grain
Dry matter response (assuming Phalaris)	Assuming 300 kg/ha DM	Assuming 300 kg/ha DM	300 kg
Rate	87 kg/ha of Urea (40 kg/ha N)	20 g/ha	
Product & application costs	$800/t delivered & spread	$13.60/ha for product* & $18.00/ha spray application	$400/t @ 90% DM
Total Cost applied ($/ha)	$70	$32	$120
Dry Matter cost (cents per kg) at 100% utilisation	23 cents	11 cents	44 cents
Dry Matter cost (cents per kg) at 80% utilisation	28 cents per kg DM	13 cents per kg DM	55 cents
Equivalent cost per ton of DM at 100% utilisation	$233/t	$105/t	$444/t

*Pro Gibb 250 gram container @ $170 for 400g/kg active product = $0.68 per gram

Calculators

Evergraze – Gibberellic acid and Nitrogen calculator

[evergraze_nitrogen_and_gibberellic_acid_tool_2016_v4.xlsx]



CALCULATE THE VALUE OF NITROGEN & GIBBERELLIC ACID AND COMPARE WITH SUPPLEMENTS

EverGraze
More livestock from perennials

This calculator can be used to compare the cost of feeding with applying nitrogen to boost winter production.Change the cost of urea in cell E13 to today's prices. Responses to the urea are provided in cells C16-24. The lower numbers in each season represent a poor response (low fertility pastures, low moisture or poor species). Higher responses represent a good response. Read the corresponding c/MJ at 100%, 80% and 60% utilisation. This utilisation is for the extra feed that will be grown. A comparison of different feed costs is provided in Table 2. If the feed costs are lower than the nitrogen costs, it may not be worth putting out the nitrogen.

*** Enter data into the white cells.**

Title Box (include paddock name and date)

Pasture Digestibility & Energy	75% dig, 10.8 MJ ME/kg - Green, 15-30% clover

Urea Application

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Fertiliser grows fat & wider leaves

Liebig's law - the nutrient in the least amount will limit pasture production.
Least nutrients tend to be N, P, K, S as plants have high requirements.

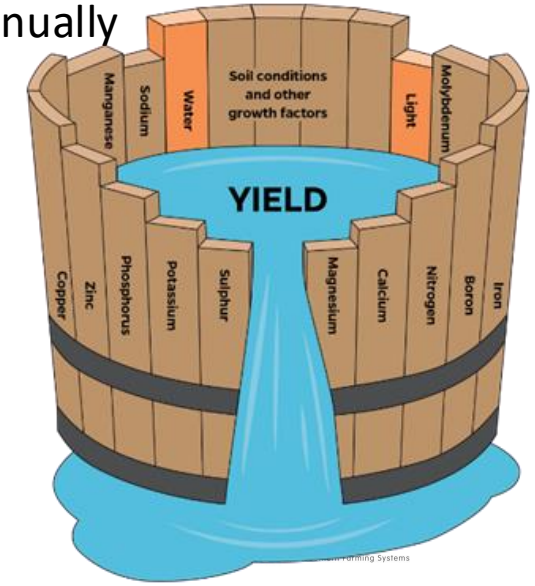
Example: Long term phosphate trial, Hamilton PVI

15 kg P/ha/year (Olsen P 13) grew 2.8 t DM/ha in winter and 12.4 t annually

1 kg P/ha/year (Olsen P 5 mg/kg) grew 1.6 t/ha in winter and 6 t annually

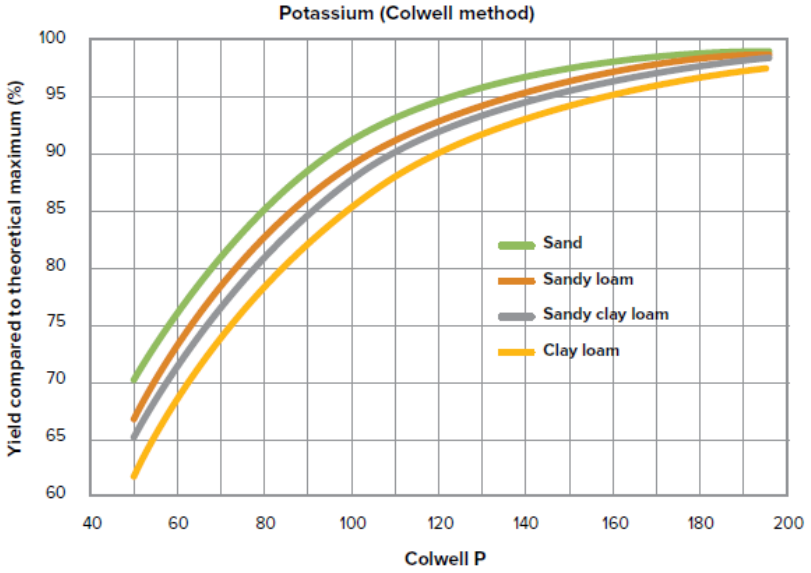
Target nutrient levels for achieving 95% of potential production

Nutrient	Target level
Phosphorus (Olsen)	15
Phosphorus (Colwell)	28 (PBI<70) to 54 (PBI>280)
Potassium (Colwell)	125 (sand) to 150 (clay),
Sulphur (KCl_{40})	8



Check for other nutrient deficiencies

Potassium response Maroona on sedimentary soil.



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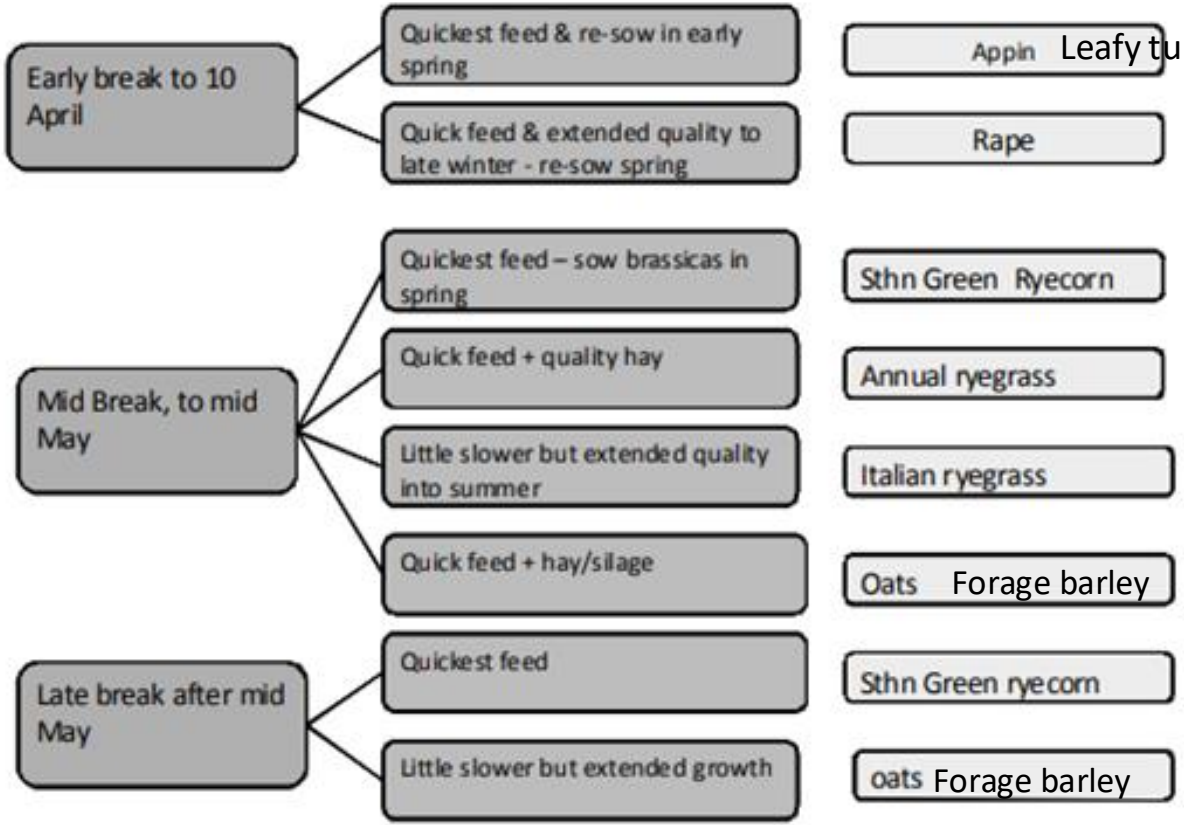
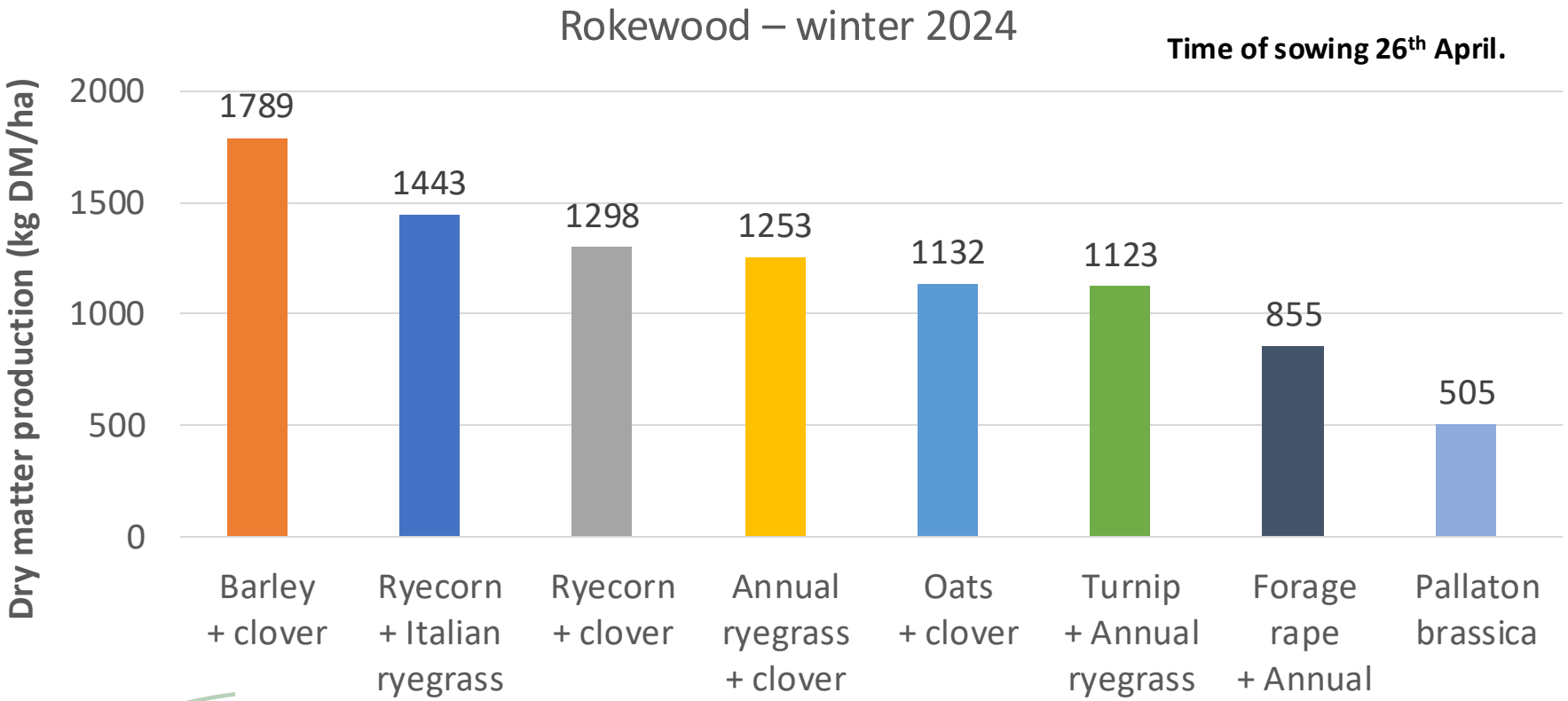
Quick winter forage options



- Best options depend on time of break
- These are all multi graze options.

Flow chart adjusted from Ref. Reg Hill, 2011, GSSA conference, Hamilton

Winter forage under dry conditions



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Grazing crops – key messages on grazing winter crops

Recommendation	Reasoning
Sow winter varieties early (March - April), on opportunistic soil moisture	Earlier sowing increases likely dry matter production providing the opportunity for earlier grazing and longer periods of biomass recovery.
Graze earlier (June/July) rather than later	The time and environmental conditions between the end of grazing and anthesis has a major influence on grain yield. The longer this recovery period the better.
'Clip graze' in lower rainfall or moisture stress years	Retaining some leaf area reduces the amount of new biomass that needs to be regrown after grazing but before anthesis.
Complete grazing before GS 30	Grazing after GS 30 may remove elongating grain ears.
Match variety to the growing environment	Grazing will also delay maturity and with long season varieties may expose ripening crops to heat and moisture stress.

- Canola established at a 'traditional' late autumn sowing time and then grazed in winter commonly incurred significant yield losses compared to ungrazed canola.
- Early autumn, or spring sowing appears to provide a more suitable dual purpose canola grazing opportunity.

Oversowing tips to improve success

- Use plants with vigorous seedlings such as perennial or annual ryegrass, sub-clover or a cereal.

- Reduce competitiveness of existing pasture
  - Use paraquat after autumn break to suppress competitive existing perennial ryegrass/phalaris and kill some annuals before sowing. Then wait for anchored seedlings before commencing grazing.
  - Control or reduce seed set of annual weeds the year before sowing.
  - Critical to keep the pasture well grazed to reduce existing pasture competitiveness .
- If existing pasture is weakly competitive, sow on the break and continue to heavily graze.

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Conclusion

Pastures are likely to be responsive to both Gibberellic acid & Nitrogen.

Gibberellic acid, oversowing and grazing crops are all relatively easy & cheap options for lifting feed availability.

Gibberellic acid is not a replacement for fertiliser, best responses are in fertile soil conditions

Forage crop selection is dependent on timing of the break and provide clean up benefits for resowing degraded pastures.

What's in your treatment plan?

Write down a few things that might suit.

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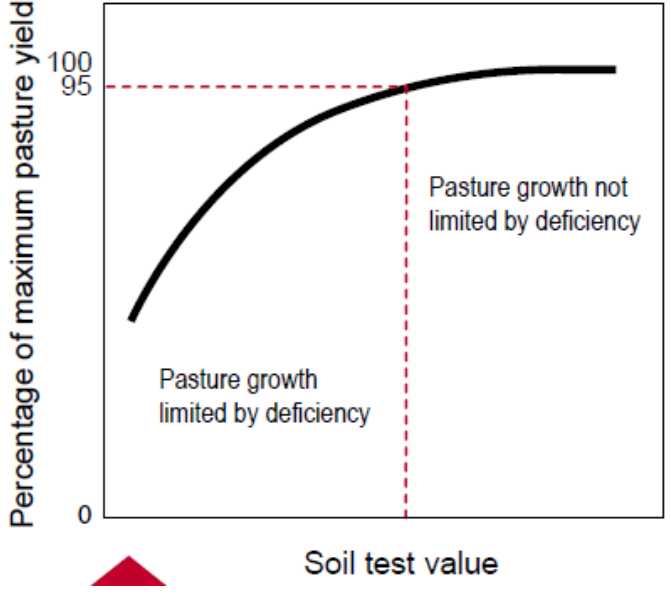
Fertiliser Decisions

- Poor pasture growth and low soil water reduces nutrient uptake by roots, so it's likely there is residual fertiliser left over.
- If you have feed in paddocks, you have imported nutrients.
- Potential to reduce maintenance rates of fertiliser by about half => soil test.

Soil testing – avoid feeding areas or urine patches or will overly represent nutrients present

What happens if I don't apply fertiliser?

- Likely decline in nutrient levels.
- The decline in production may be small if operating at the 'flat spot' of the response curve.



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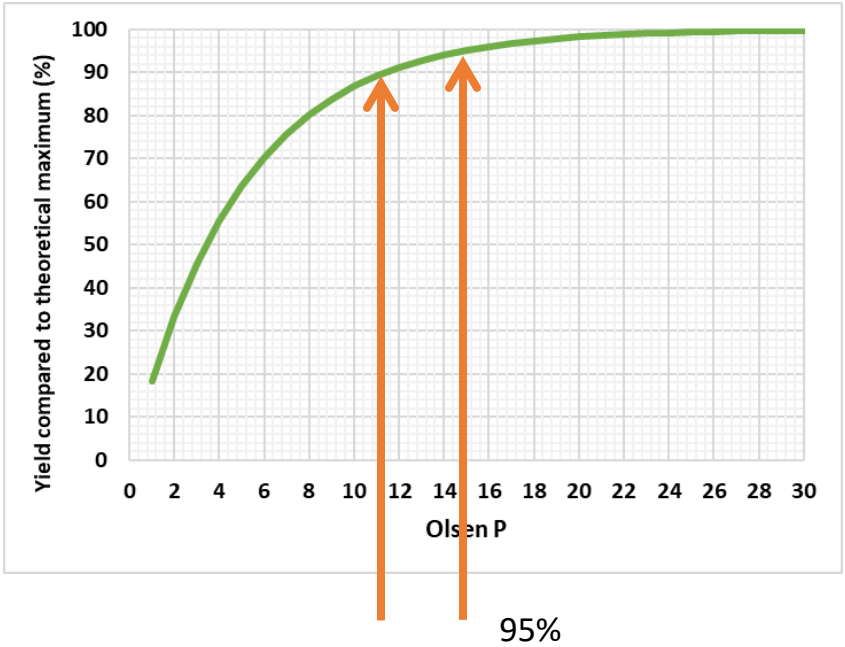
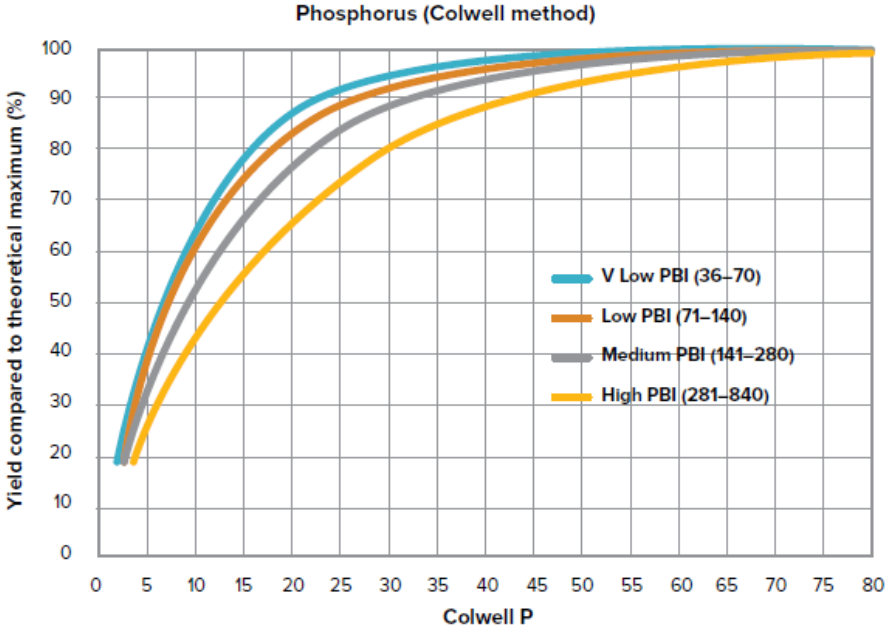
Phosphorous Olsen and Cowell response curves



95%

PGR modelled at 90% of potential production



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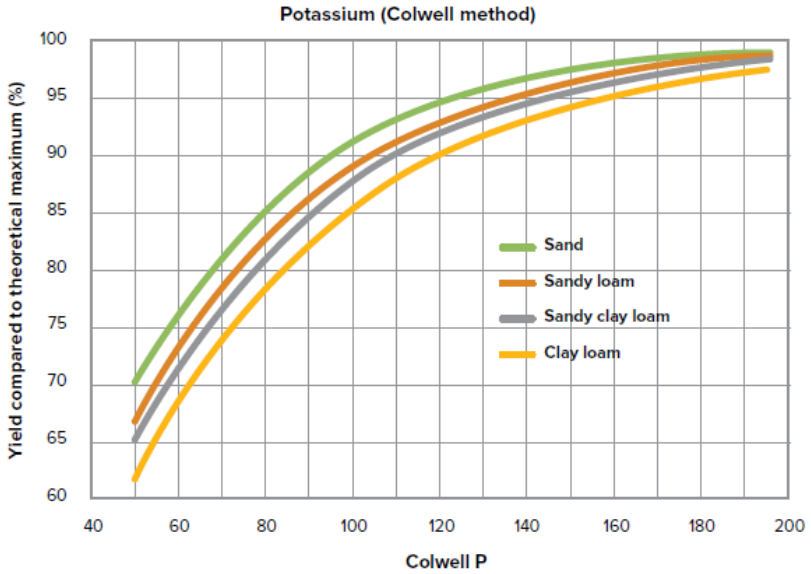
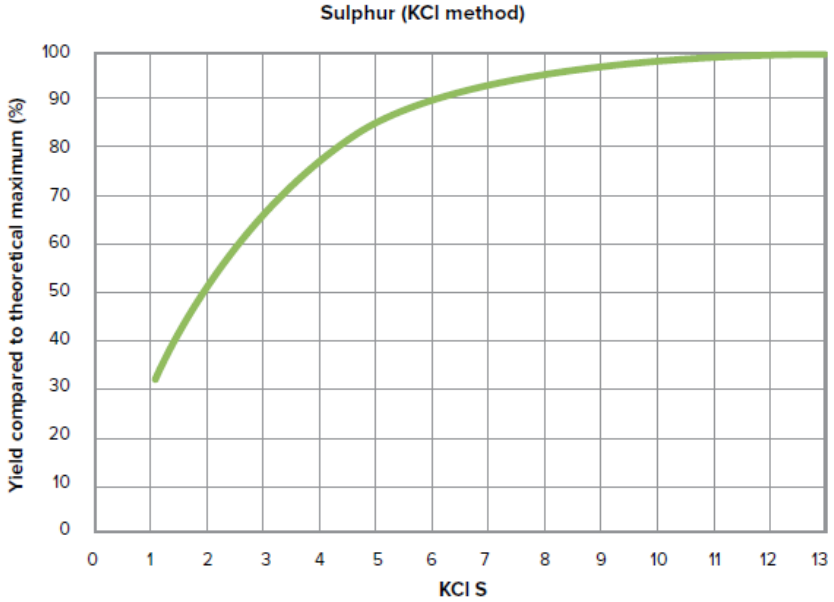
Potassium & Sulphur response curves





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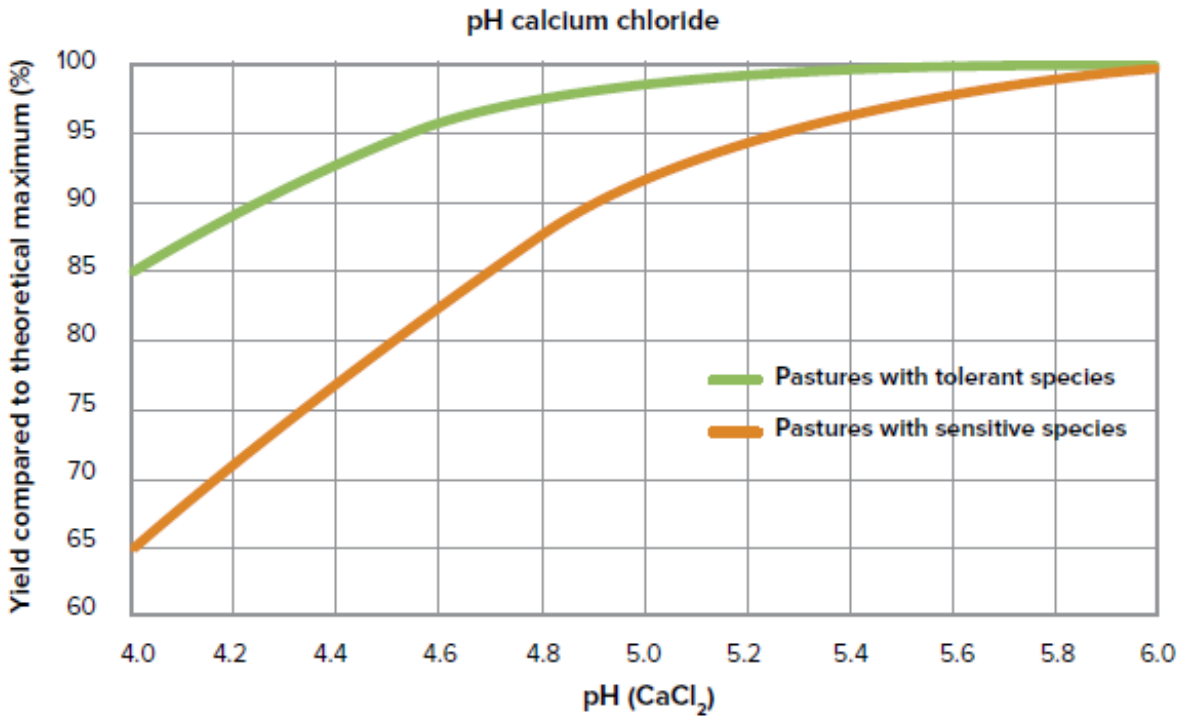
Soil pH response curves



Species more sensitive include Lucerne, phalaris.

Sub-clover tolerant but N fixation starts reducing as pH falls below 5.0

Lime (bicarbonate) becomes soluble at 5.5 so starts to move down profile.

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Capital fertiliser calculations

Capital application of nutrients

Capital nutrients refer to the amount of nutrient required to change the phosphorus, potassium or sulphur by 1 soil test unit.

There is information on a soil test results that help inform the capital nutrients required. This is the phosphorus buffering index (PBI), which gives an indication of the 'absorption' of phosphorus onto the soil.

Only capital phosphorus application is well understood, however indicative quantities for potassium and sulphur are presented (Table 7).

Table 7: Capital nutrients required to change one nutrient unit (kg).

Nutrient	PBI < 100	PBI 100 - 300	PBI > 300
Phosphorus (Olsen)	8	9	10
Phosphorus (Colwell)	2.3	2.5	2.8
Potassium (Colwell K)	2.0		
Sulphur (KCL_{40} S)	7 (maint) to 15 (if deficient)		

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Maintenance fertiliser calculations

The annual maintenance 'rule of thumb' required per DSE is provided (Table 6), although it can be quite variable. Maintenance phosphorus is influenced by the phosphorus buffering index (PBI). Maintenance potassium is influenced by soil texture.

Table 6: Suggested annual maintenance nutrient requirements (kg nutrient per DSE per year).

Nutrient	Maintenance
Phosphorus (P)	0.7 (PBI < 100) to 1.2 (PBI > 300)
Potassium (K)	1.0 (clay) to 1.8 (sand)
Sulphur (S)	0.7

What paddocks to prioritise for fertiliser?

- Paddocks with plant species that will respond.
- The higher the content of improved sown pasture species, the higher the priority.
- Paddocks you need to perform. Eg Lambing paddocks.
- Paddocks where fertiliser will give you the biggest bang for your buck (highest production increase at the cheapest cost).

Tip: Use the production curves to work out which nutrient gives the biggest constraint.