Resilient Forages:

How to design productive and nutritious perennial multispecies pastures

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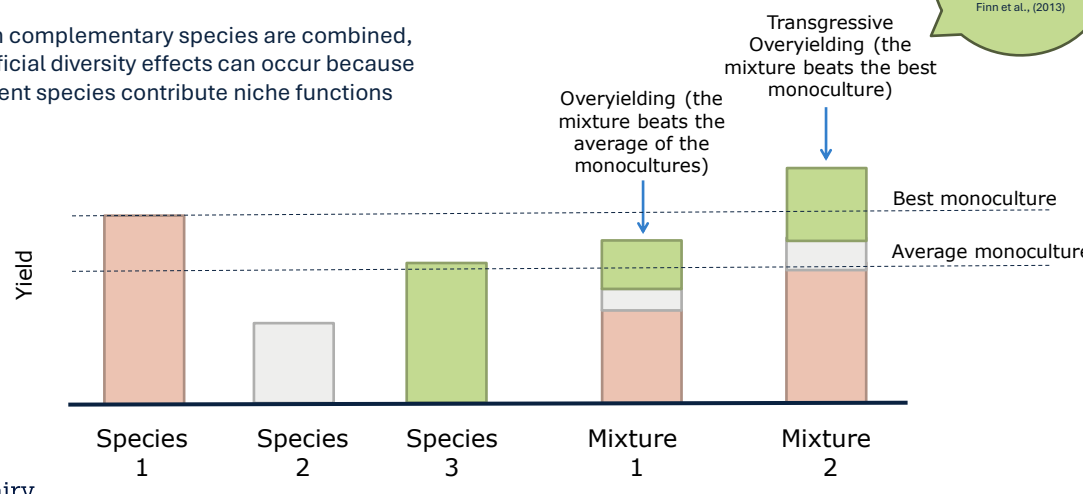
The theory behind multispecies mixtures…

When complementary species are combined, beneficial diversity effects can occur because different species contribute niche functions

65%
Finn et al., (2013)



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Aims of Resilient Forages

1. To show that diversity in sward species offers productivity benefits with fewer inputs
(Validating findings already shown in other European/NZ studies and further investigated in DairyHigh 2)

2. To take a precision approach to multispecies sward design and management to maximise benefits from such systems.

Targets

- Multispecies swards with similar or higher nutritive value than PRG
- 10% more grazed forage with 25% less N fertiliser
- Reduced enteric methane production using multispecies swards

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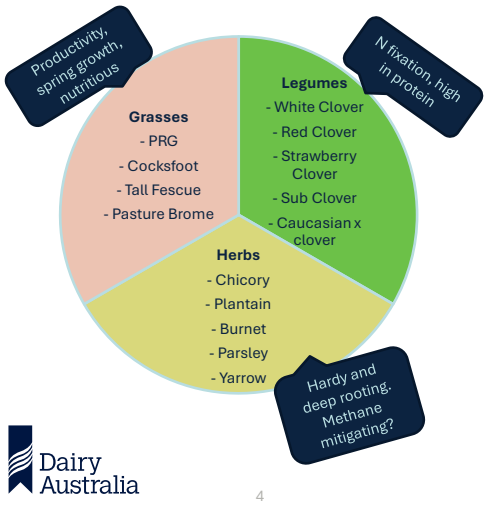
Taking a precise approach to multispecies design:
The roles of functional groups and species within functional groups



PRG	Productive and high nutritive value
Cocksfoot	Deeper rooting that PRG – cont/med type? Avoid clumping
Tall fescue	Summer active species – cont/med type?
Pasture Brome	Summer active, slow establishment
White clover	Leaf type – small/medium? Grazing tolerant
Red clover	tap root, choose type bred for persistence under grazing
Strawberry clover	prostrate growth, resistant in waterlogging environments
Sub clover	annual but self-seeding, must sow in Autumn
Caucasian x clover	Like white clover but deeper rooting
Chicory	tap root, for summer activity and high yield
Plantain	Winter active. Choose upright type (e.g. Captain CSP)
Yarrow	deep rooting, year-round growth, persistent, high essential oil content
Sheep's Burnet	Deep rooting, year-round growth, high tannin content
Parsley	Deep rooting, antioxidant content, slow establishment/two-year life

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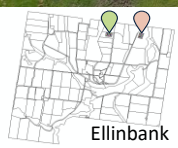
The Resilient Forages Experimental platform

Experiment 1: Agronomy Study



Experiment 2-4: Animal studies in various seasons

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Treatments

Treatments are defoliated according to defined 'readiness' indicators as often as needed to suit each treatment
Defoliation is through grazing at the Ellinbank site and through cutting at the Hamilton site.

Perennial ryegrass (Control)	Even mix (12 species mix)	Herb Heavy (HH) (12 species mix)	Grass Heavy (GH) (12 species mix)	Legume Heavy (LH) (12 species mix)*
				
+ 200 kg N/ha/yr	+ 100 kg N/ha/yr	+ 150 kg N/ha/yr	+ 150 kg N/ha/yr	+ 0 kg N/ha/yr

Urea bill per year (using $600/T Urea (46% N) spot price):

$261/ha	$130/ha	$196/ha	$196/ha	$0/ha

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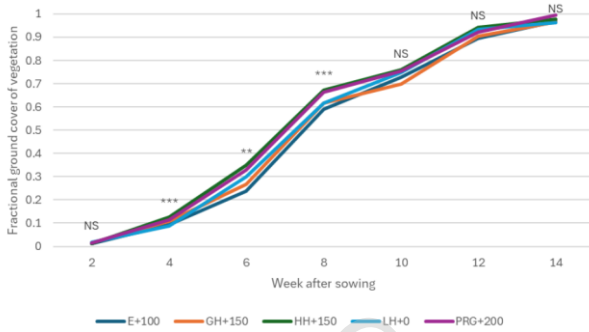
Autumn establishment observations

- Time from sowing to first graze was 12-14 weeks for all treatments
- Herb-Heavy and PRG growth rates fastest between 4-8 weeks.
- Weed burden a challenge – weeds colonising any bare ground from week 8 onwards.
  - Chemical control impossible but repeated cutting proved successful eventually. Annual weeds usually outcompeted by sown species in time.



Source: Thomson, A. (2025), Interim Milestone Report: Project 2 Resilient Forages Milestone 9

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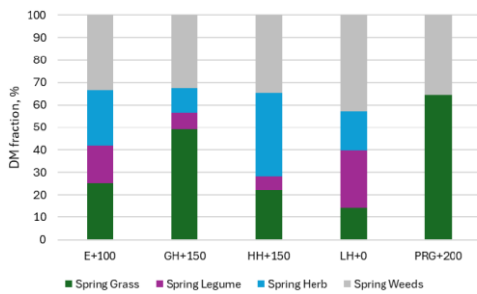
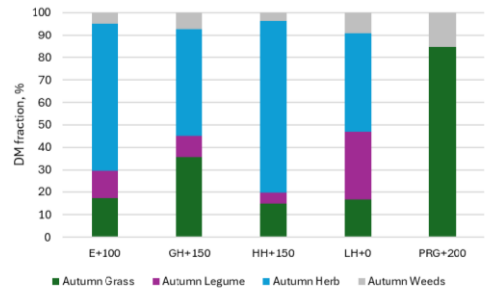
Botanical composition in year 1

Spring 2023



Autumn 2024



P value (treatment * season): Grass < 0.001; Legume = 0.04, Herb < 0.001; Weeds = 0.04

Source: Thomson, A. (2025), Interim Milestone Report: Project 2 Resilient Forages Milestone 9

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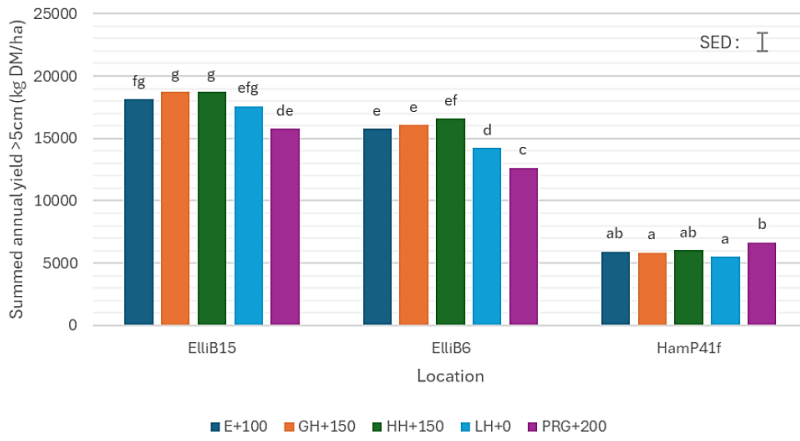
Year 1 Summed harvestable DM yield including establishment period



Source: Thomson, A. (2025), Interim Milestone Report: Project 2 Resilient Forages Milestone 9

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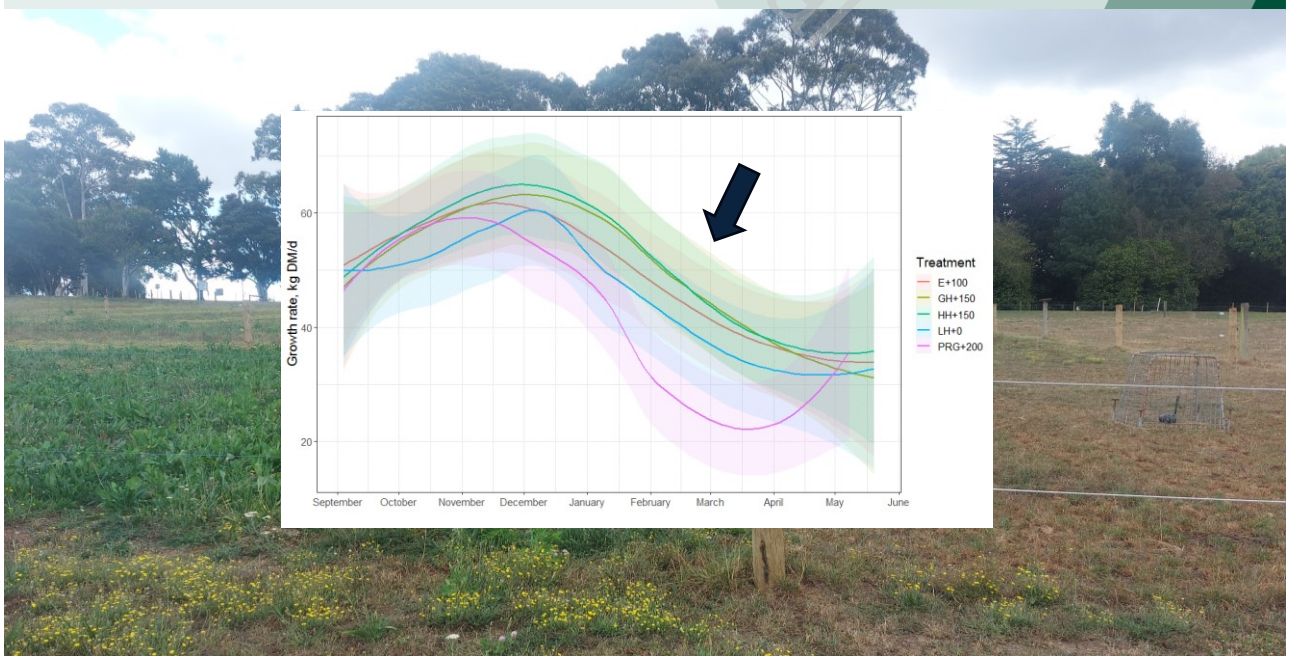
Seasonal growth rates (Year 1)



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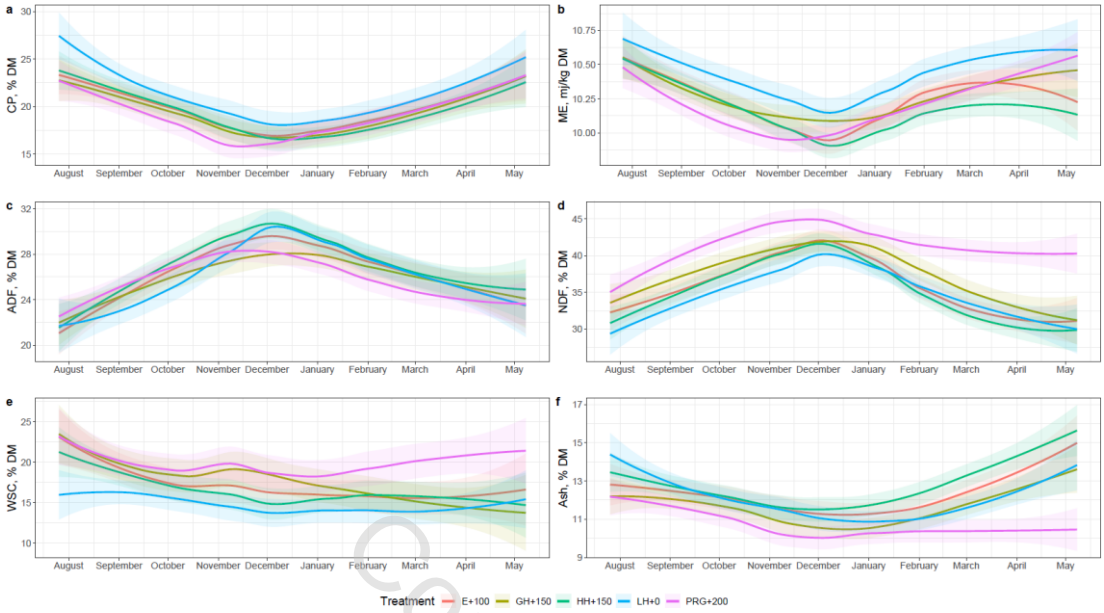
Seasonal nutritional concentrations



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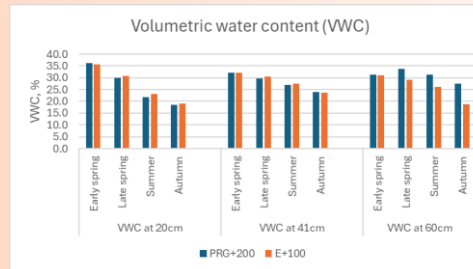
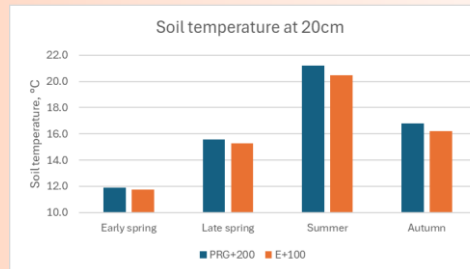
Using the latest technologies in research

CropX soil moisture sensors

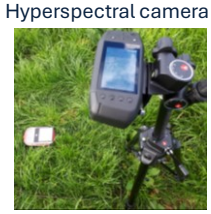




In situ root Scanner

UAV Imagery

Hyperspectral camera



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Source: Thomson, A. (2025), Interim Milestone Report: Project 2 Resilient Forages Milestone 9

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Introducing 'Pasture 365'

Australian Government
Department of Agriculture, Water and the Environment

Future Drought Fund

This program received funding from the Australian Government's Future Drought Fund

Provides funding for:

- Testing of multispecies forages
- Across multiple states and rainfall zones
- Across multiple farming system types
- Allows for establishment of **9 focal sites** and **up to 5 satellite sites per focal site**
- Wellbeing assessments for participating farmers
- Traditional owner engagement

Research question:

- Taking into account local climate and conditions, how can a multispecies feedbase be designed to provide all-year round feed both now and into the future?

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Take home messages: Agronomy

- Dominant functional group makes a difference! Design your initial seed mix with use-case and environment in mind and adjust N rates to suit legume proportion
- Expect seasonal shifts in dominant fractions as certain functional groups experience summer dormancy
- Our Year 1 results demonstrate yield benefits of combining productive grass, legume, and herb cultivars with reduced N fertiliser rates
- Our Year 1 results also support claims that multispecies swards (especially the deep rooting herb components) can elongate the growing season in times of moderate water deficiency
- Weed control is a key challenge (explore selective options such as Thistrol gold)

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Spring grazing study design: Conducted Aug – Nov 2024

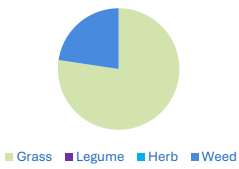
1 Perennial ryegrass (Control)

2 Grass Heavy (GH) (12 species mix)

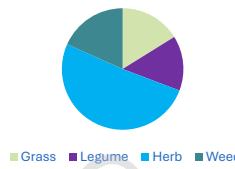
3 Even mix (12 species mix)

4 Herb Heavy (HH) (12 species mix)

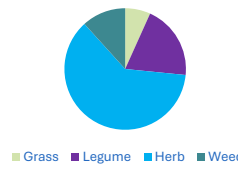
PRG



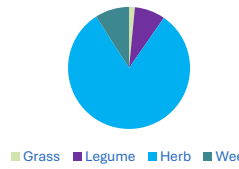
GRASS HEAVY



EVEN



HERB HEAVY



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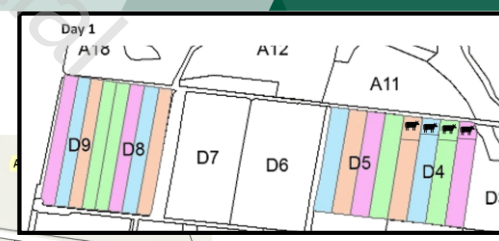
Paddock management



Observations:

- Multispecies regrowth rate slightly faster than PRG but both able to be grazed on similar round length
- Regrowth time allowed was ~24 days for all mixture types
- Multispecies pastures could have been grazed on a slightly short round length than PRG

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Proposed timeline of animal experimentation

	2023		2024				2025				2026				2027			
Activity	W	Sp	S	A	W	Sp	S	A	W	Sp	S	A	W	Sp	S	A	W	Sp
Establish platform	■	■																
Spring Cohort 1						■												
Summer Cohort 2											■							
Autumn Cohort 3																■		

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Take Home Messages: Grazing and Animal Performance

- Multispecies pastures can be managed on the same grazing round length as PRG in Spring (even slightly shorter round length to optimise nutritive value)
- It is recommended that multispecies swards for grazing purposes should still contain at least 1/3rd grasses by proportion to obtain milk yield similar to monoculture PRG
- Herb-dominant multispecies swards are low fibre forages
    - expect fast rumen degradation rate, beware of issues such as low rumen pH or bloating due to high intake.
    - Also has benefits such as high mineral content and methane reduction potential
- Watch this space for final spring results and future Summer/Autumn studies

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Thanks to:

- The Resilient Forages project team (see right), and technical staff (Dani Stayches, Krystel Alcazar and Rahul Malik)
- The Dairy Feedbase 23-28 funders for their support (Dairy Australia, Agriculture Victoria and the Gardiner Foundation)

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