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For the latest in red meat research and development

Cooma, NSW – 13 May 2026

Managing [illegible]dbase on the [illegible]

Jim Virgona, Graminus Consulting

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Legumes in pastures on the Monaro – worth the trouble

Jim Virgona, Graminus Consulting

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Today

- Revision - Basics on Nitrogen in grazing systems
- Legumes – Nitrogen and other benefits
- Life is tough for legumes on the Monaro
- Giving legumes an even chance
  - Soil Conditions
  - Legume Selection
  - Grazing Management
  - Weed Control

Nitrogen in grazing systems

- Basics
  - Around 2-4% of plant dry matter
  - Critical for photosynthesis (half of leaf N is tied up in one photosynthetic enzyme)
  - Taken up as ammonium or nitrate
  - Mostly comes from “mineralisation” of soil organic matter
- Increasing N supply:
  - Increases leaf size
  - Increases tillering (in grasses)
  - Increases rate of photsynthesis
- More nitrogen, More grass.

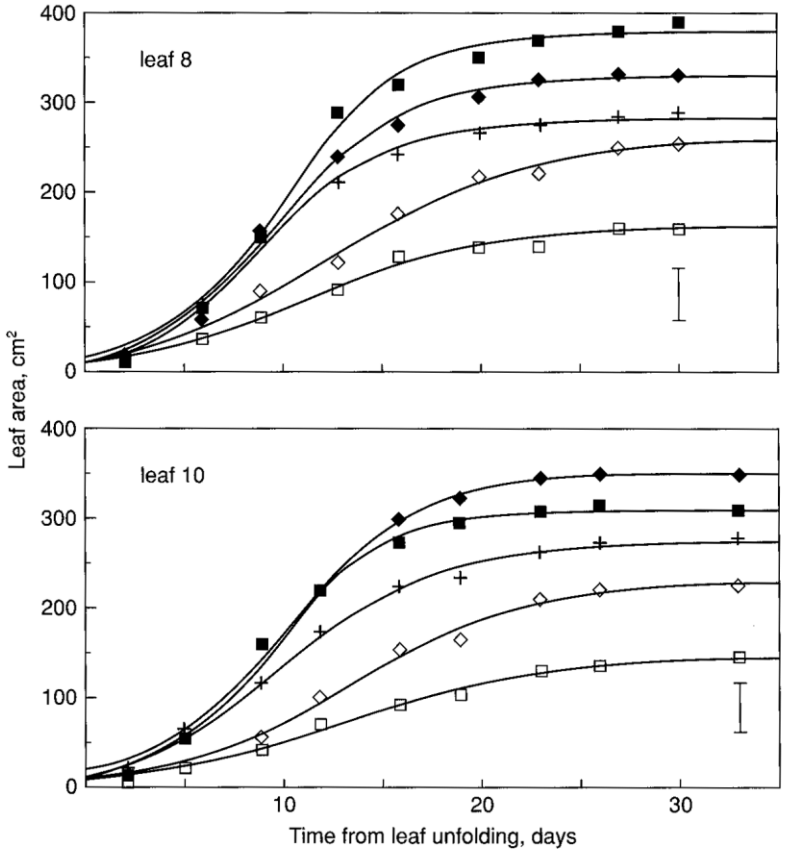
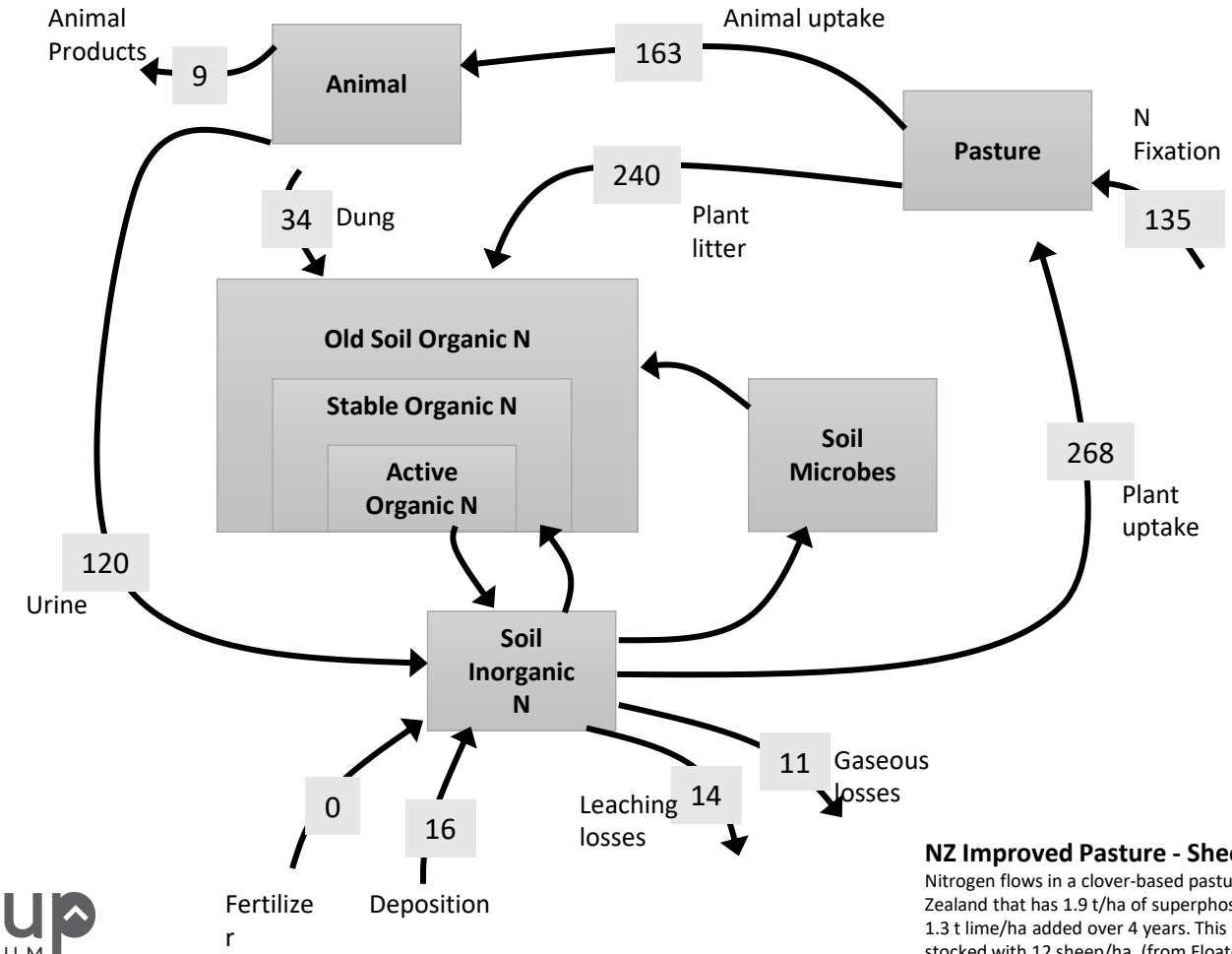


Figure 3.9 Time courses of expansion of leaves 8 and 10 of potato plants cv. Vebeca grown in pots in a glasshouse at five levels of nitogen supply (□ 250; ◇ 500; + 1000; ◆ 1500; ■ 2000 mg N plant^{-1} week^{-1}). Vertical bars represent LSD for treatment means at $P = 0.05$ (from Vos and van der Putten 1998).



NZ Improved Pasture - Sheep

Nitrogen flows in a clover-based pasture in New Zealand that has 1.9 t/ha of superphosphate and 1.3 t lime/ha added over 4 years. This pasture was stocked with 12 sheep/ha. (from Floate 1987 via Pearson and Ison 1997). Numbers represent kg of N/ha

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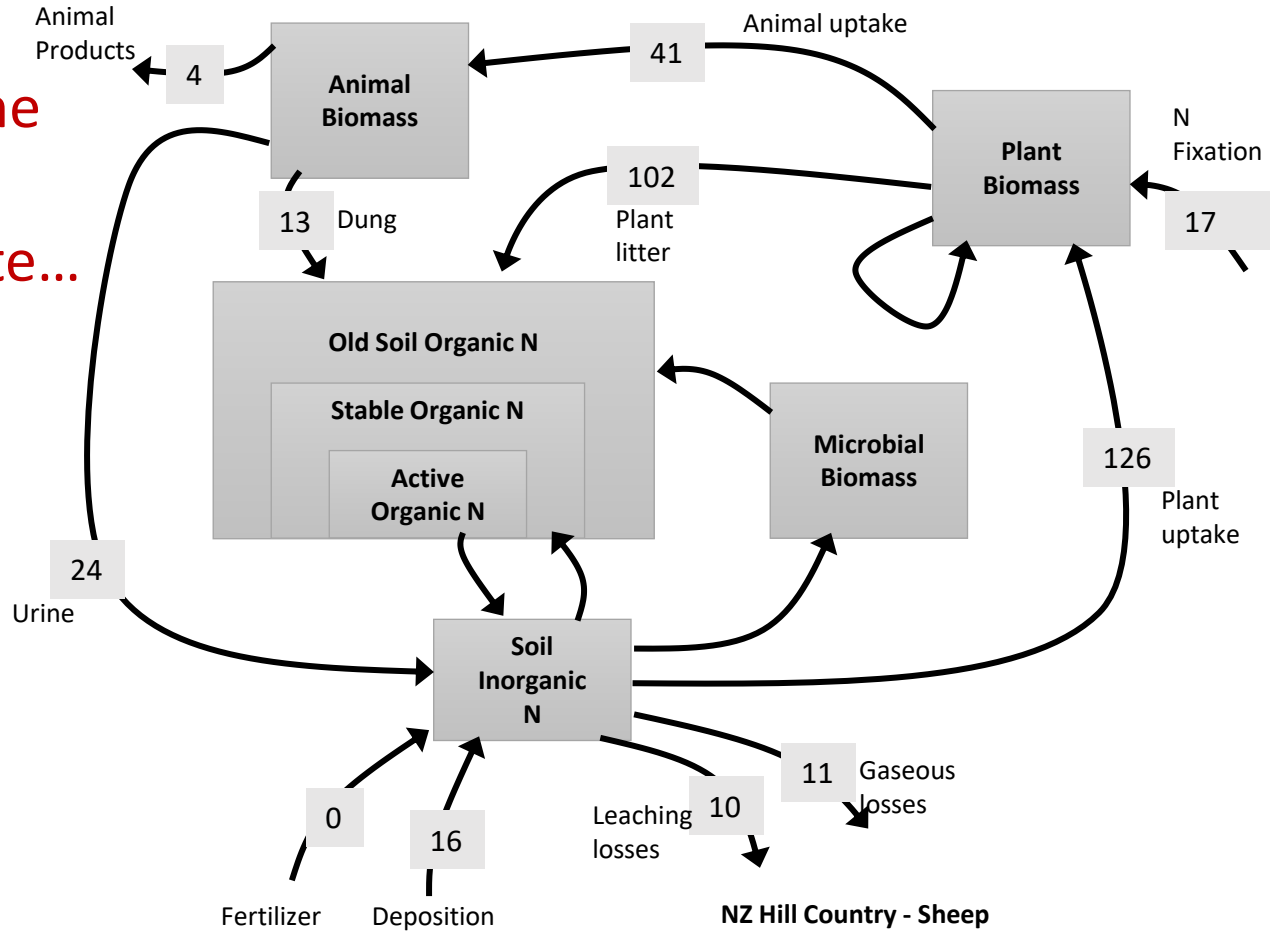
More like the Monaro -
But not quite…



NZ Hill Country - Sheep

Nitrogen flows in an unfertilised pasture in unimproved hill country in New Zealand. This pasture was stocked with 6 sheep/ha. (from Floate 1987 via Pearson and Ison 1997). Numbers represent kg of N/ha.

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Nitrogen Sources

- Mostly either FERTILIZER or Nitrogen Fixation
- Fertiliser (Urea, usually) – short term boost to pasture availability
- Nitrogen Fixation – by legumes provides most N (??)
- Nitrogen Fixation
  - Legumes
  - Consumes energy
  - Relationship with bacteria (Rhizobium..etc.)

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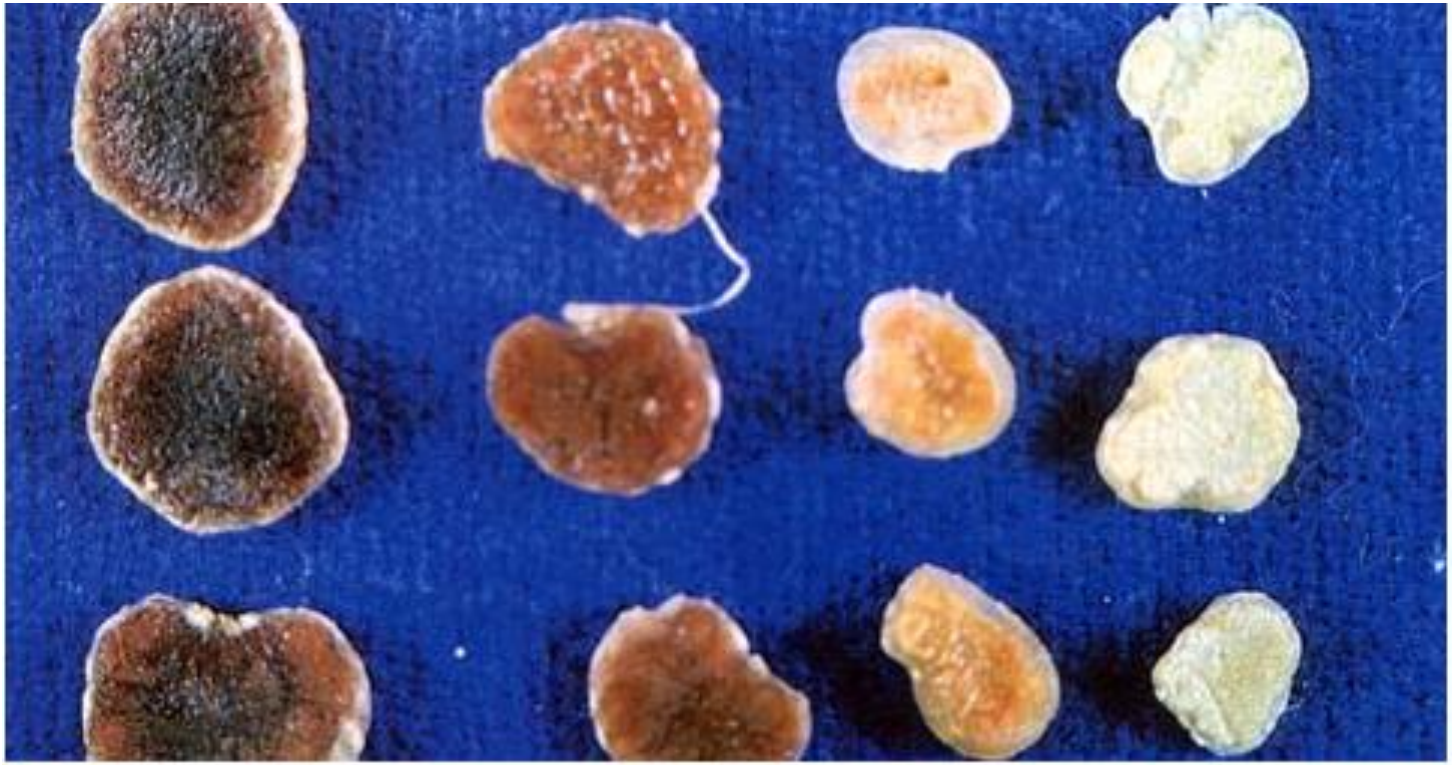


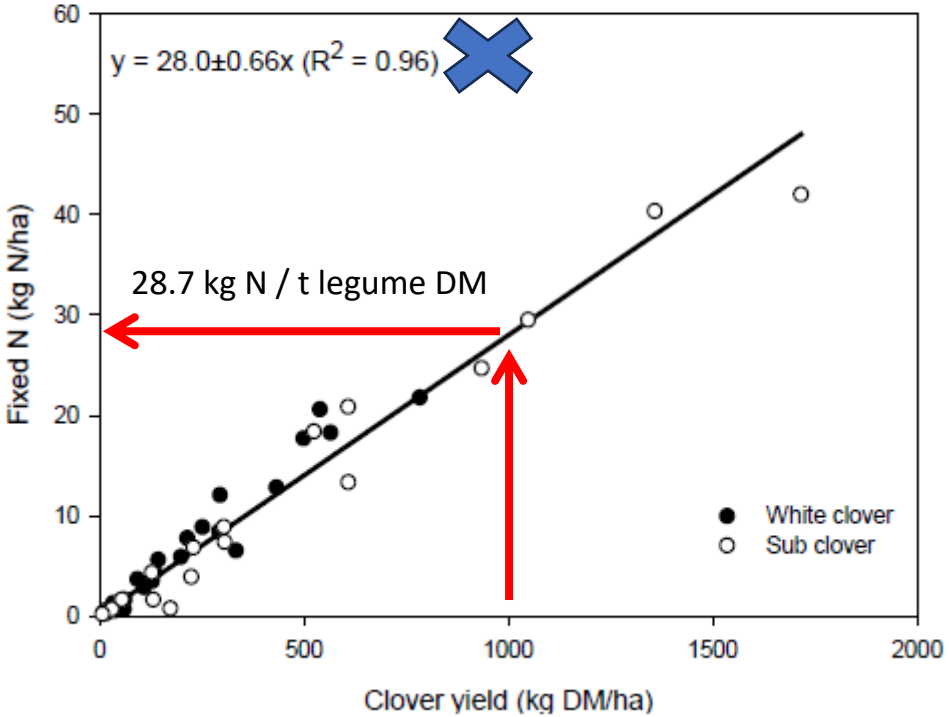
Figure 3. Nodules sliced in half. The ineffective nodules on the right-hand side are small and white. Pigmented pink nodules are effective, while the nodules on the far left are old and breaking down.

Nitrogen fixation cont'd

- The key point….
- Nitrogen fixation in legumes is directly related to legume dry matter production.
- Provisos and nuances BUT above statement is generally accurate
- How much Nitrogen per amount of legume growth?

Figure 3 Fixed nitrogen (kg N/ha) against clover yield (kg DM/ha) for white (n=27) and subterranean (n=17) clovers grown in dryland cocksfoot based pastures in the 'MaxClover' grazing experiment at Lincoln University, New Zealand from 2002 to 2005.

Kiwis again….bro



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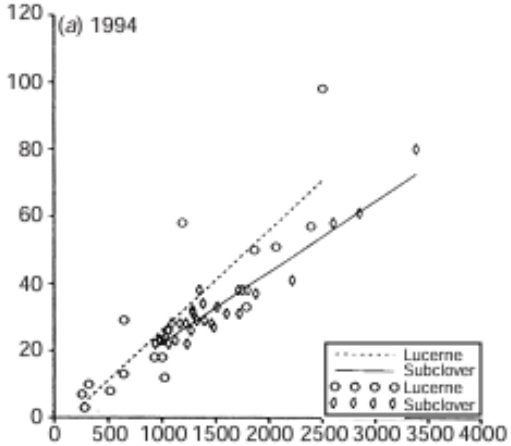

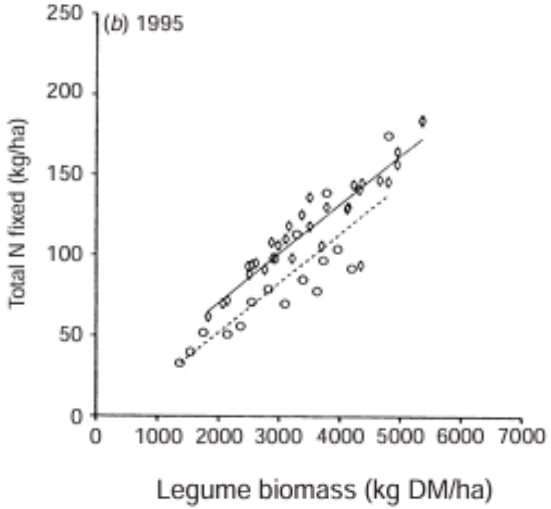

Year	N fixed/t dry matter	
	Sub Clover	Lucerne
1994	24	24
1995	34	29

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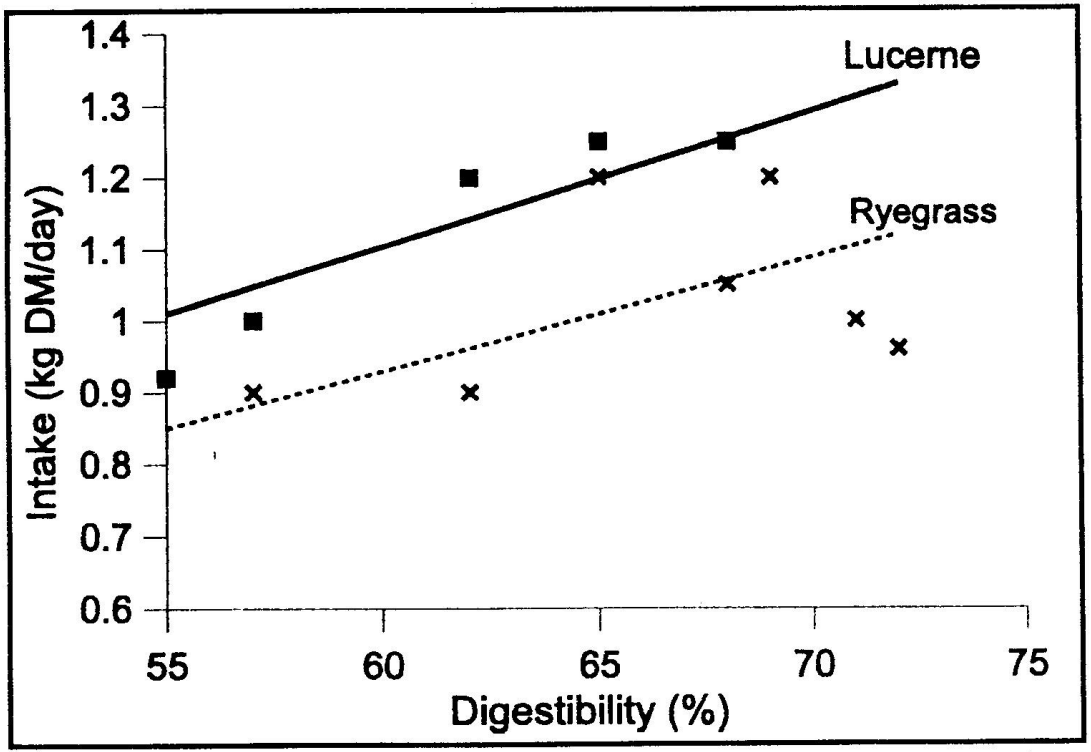
But wait….there's more

- As soil nitrogen levels increase, nitrogen fixation will decrease – the Monaro??
- Also…we forgot the roots….values could be 30-70% higher than reported above!
- Safe to say an average might be around 32 kg N/t DM

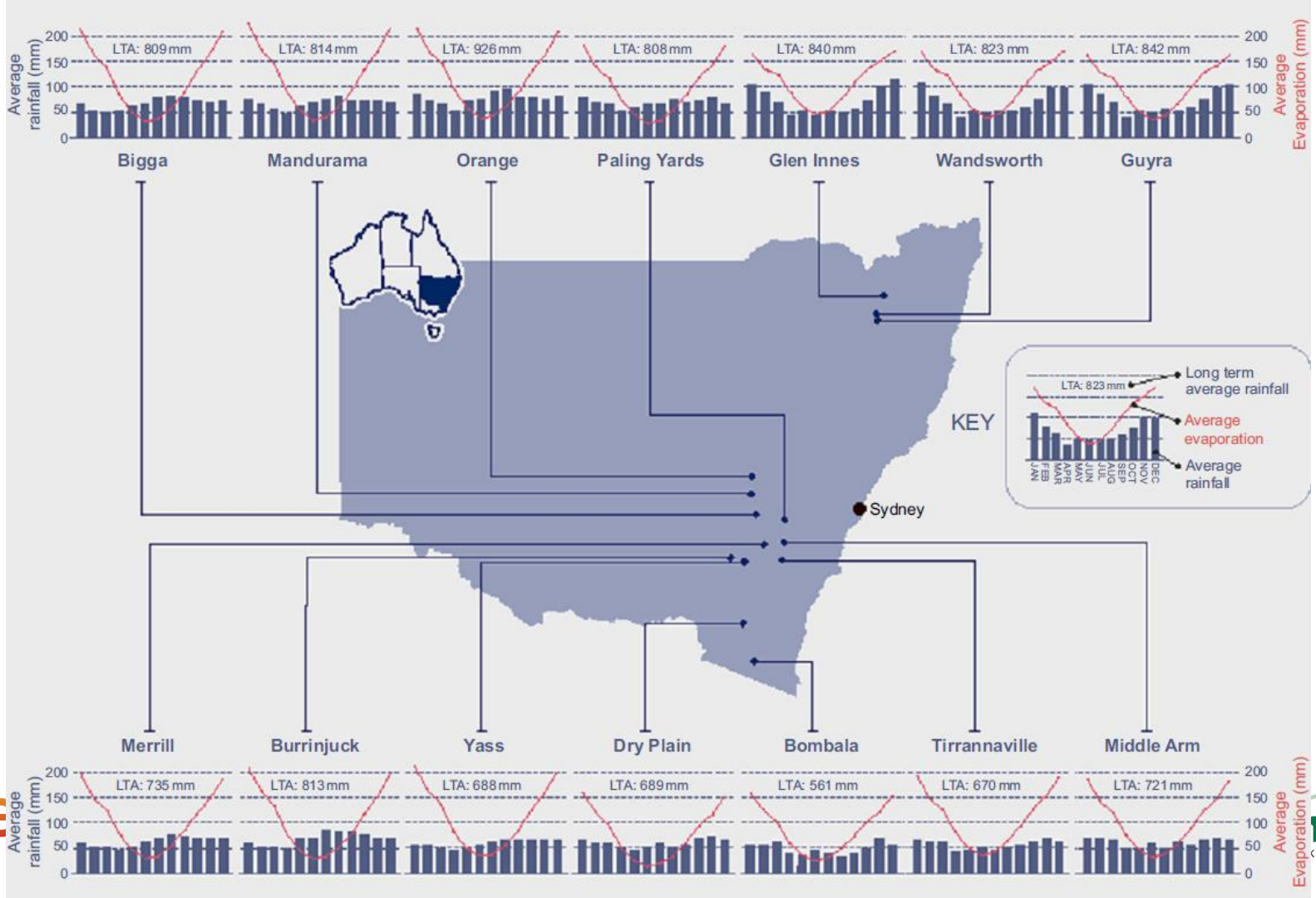


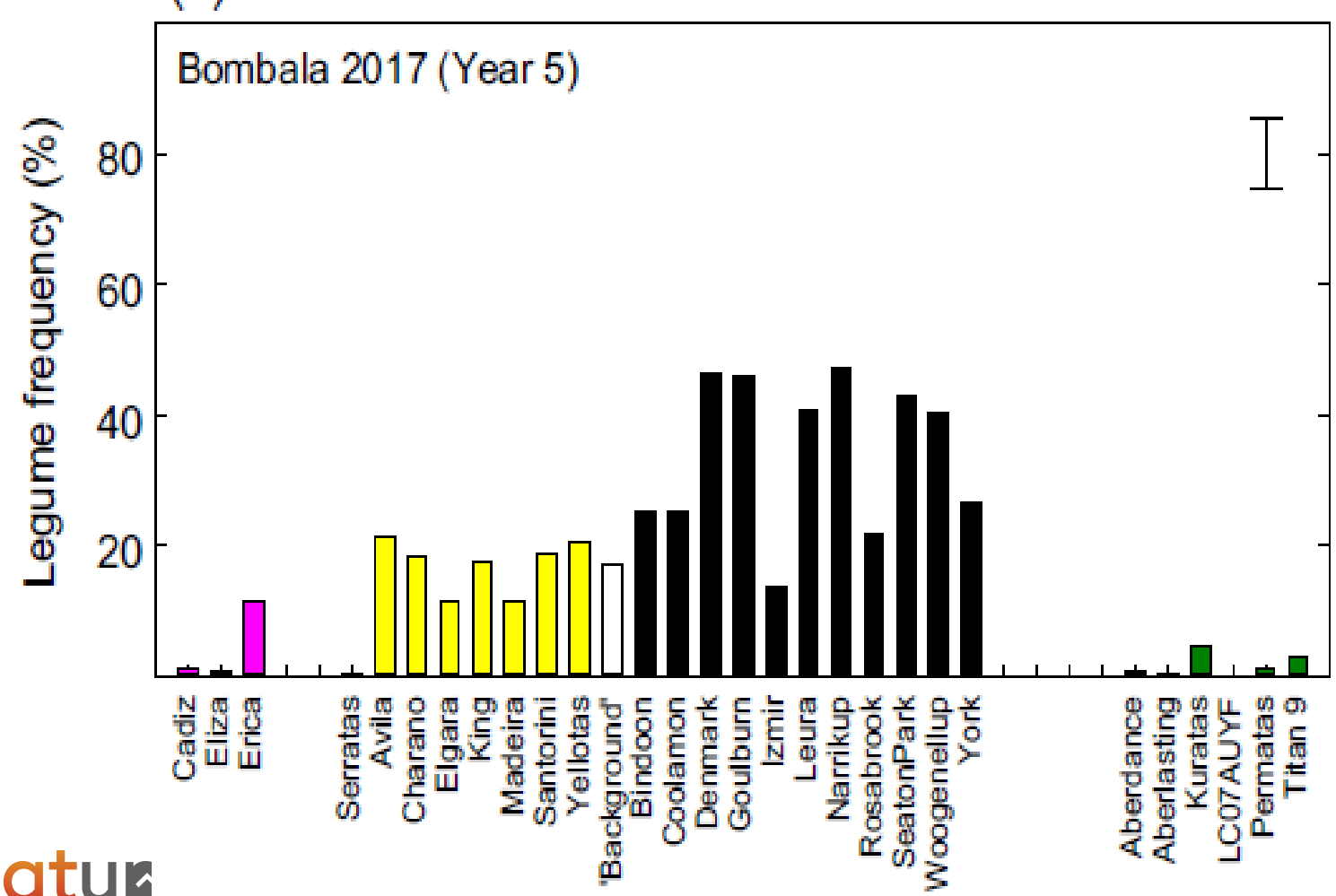
From Greenhalgh (1979), *The management and diseases of sheep*. Commonwealth Agricultural Bureaux; pp. 201-12.

Its not just Nitrogen….

The Monaro and Legumes

- Long history of problems – many searches for the right species…e.g. Caucasian clover
- Recent data – Hayes and Co-workers…


Average rainfall (mm)
200
150
100
50
0
LTA: 809 mm
LTA: 814 mm
LTA: 926 mm
LTA: 808 mm
LTA: 840 mm
LTA: 823 mm
LTA: 842 mm
Average Evaporation (mm)
Bigga
Mandurama
Orange
Paling Yards
Glen Innes
Wandsworth
Guyra
Sydney
KEY
LTA: 823 mm
Long term average rainfall
Average evaporation
Average rainfall
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Merrill
Burrinjuck
Yass
Dry Plain
Bombala
Tirrannaville
Middle Arm
LTA: 735 mm
LTA: 813 mm
LTA: 688 mm
LTA: 689 mm
LTA: 561 mm
LTA: 670 mm
LTA: 721 mm



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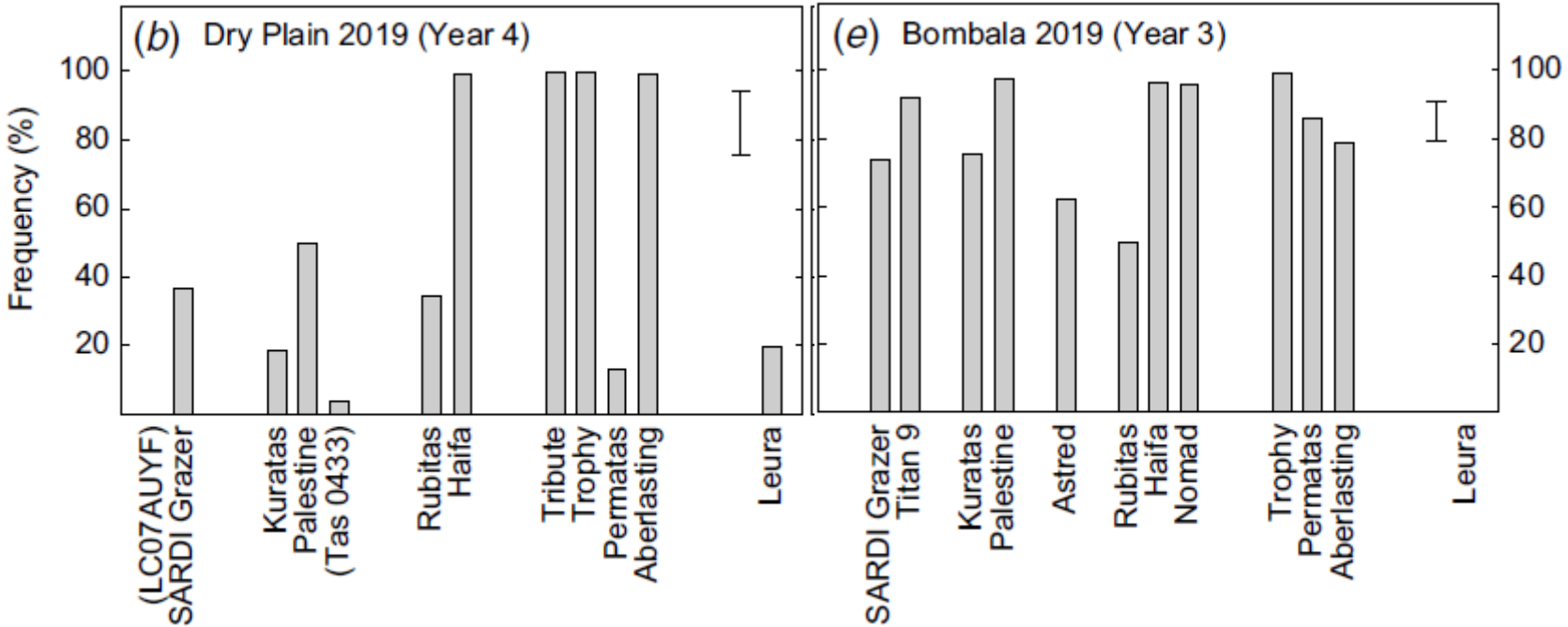

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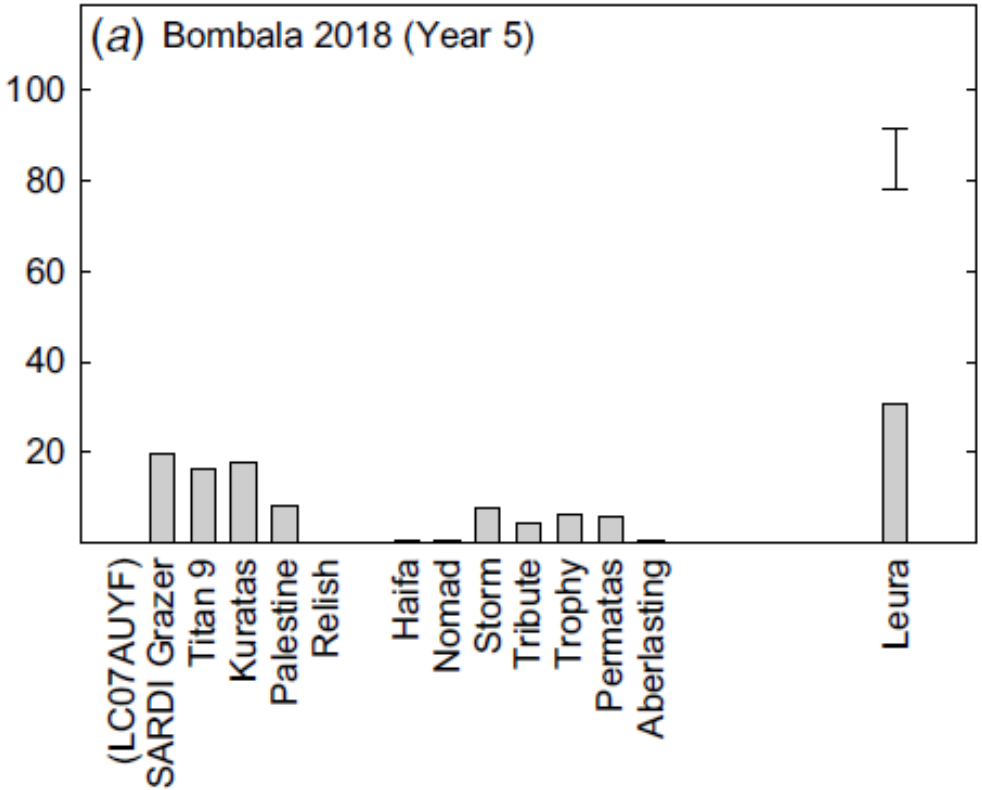
Lower fertility site - Bombala



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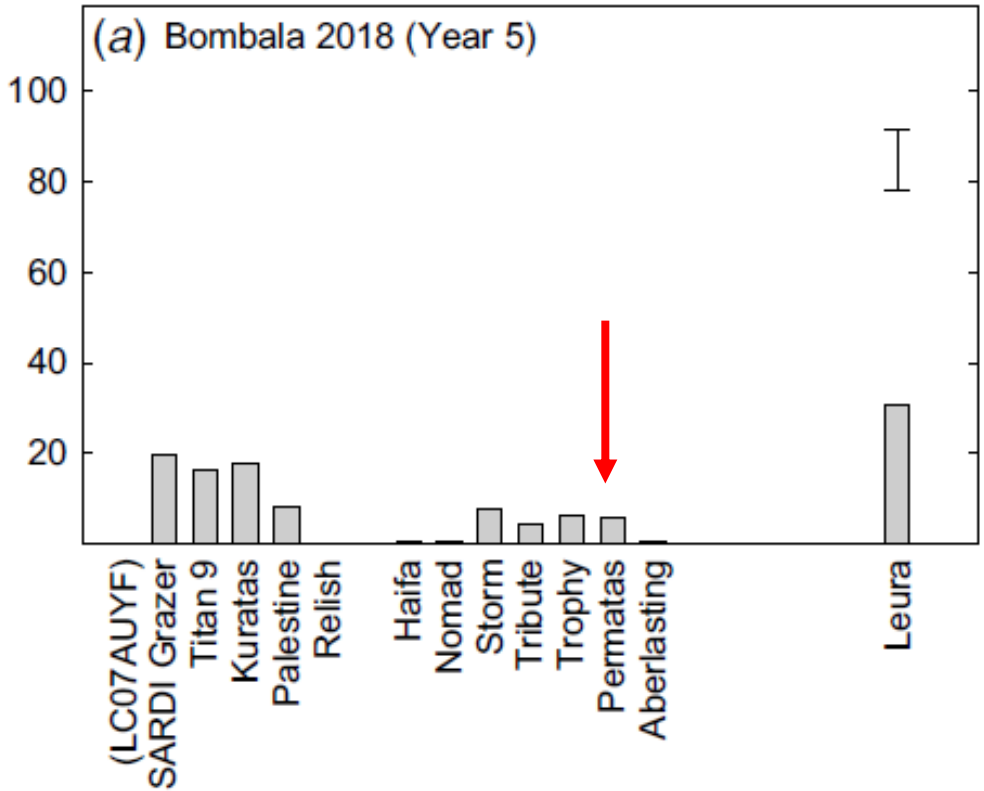
Summary – Hayes et al.

- In high fertility – its Lucerne (but not shallow, infertile or acid)
- White Clover better than lucerne on acidic infertile soils
- Some sub clovers and serradellas best adapted of the annuals
- In short – there are options…but not many
- (Stop Press…..re-visit Bombala site and it's the Caucasian that lasted)

Lower fertility site - Bombala



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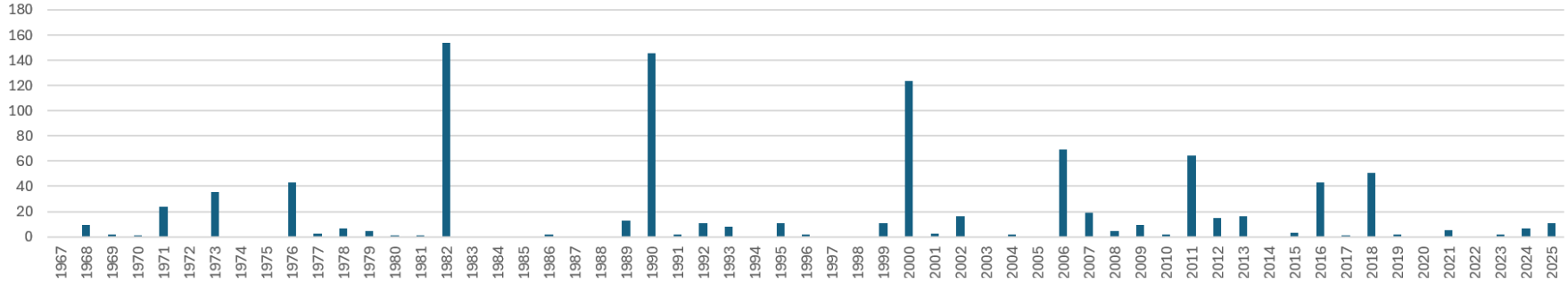
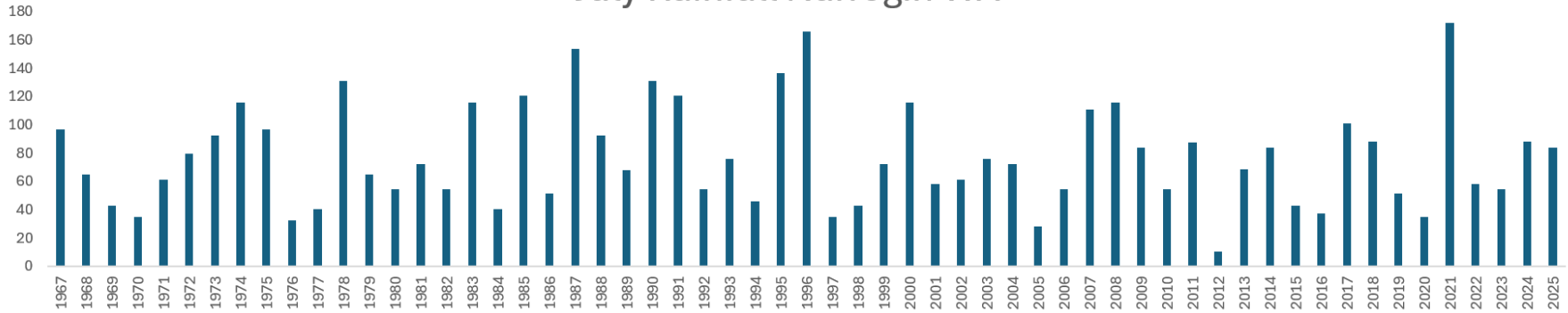
The Monaro Environment

- Its not just the cold of winter – or the seasonal pattern of rainfall
- Look at winter variability
- First….how to measure variability

January Rainfall Narrogin WA



July Rainfall Narrogin WA



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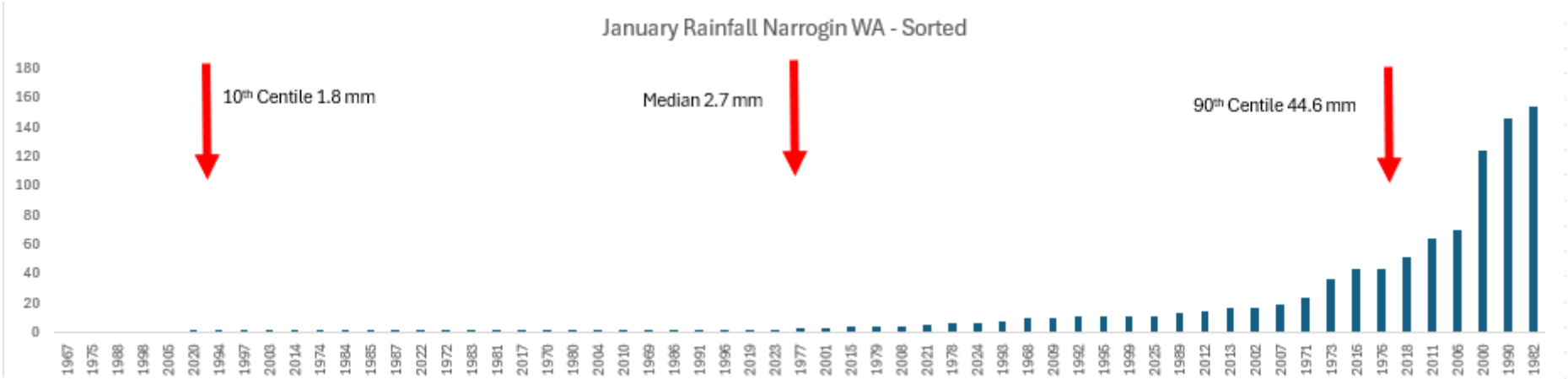
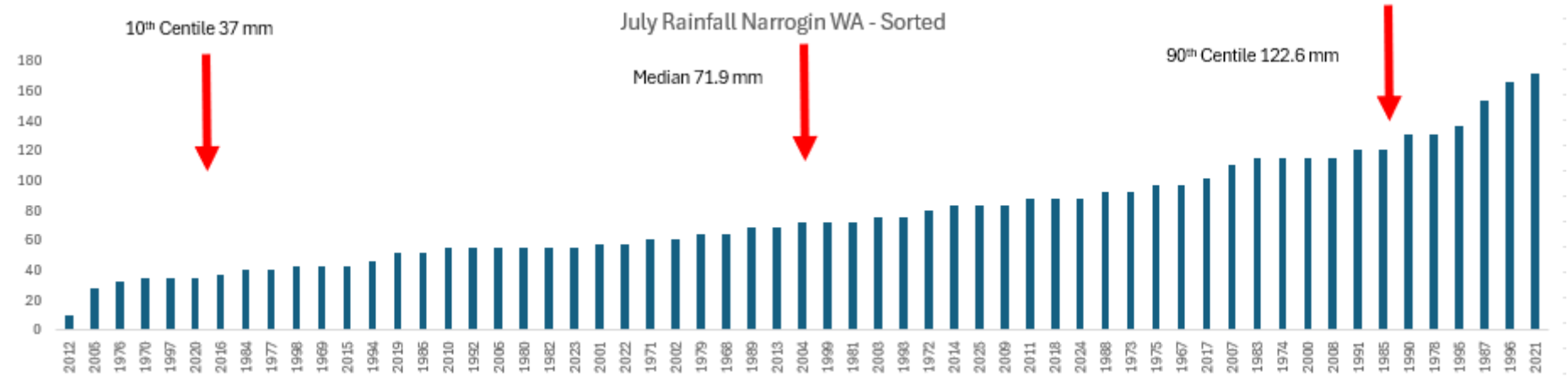
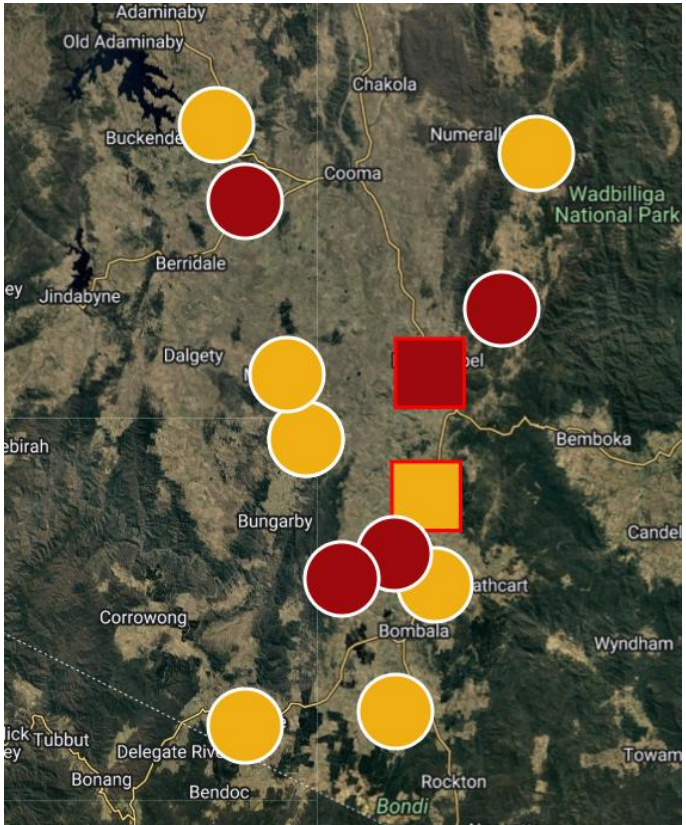

January Rainfall Narrogin WA - Sorted
10th Centile 1.8 mm
Median 2.7 mm
90th Centile 44.6 mm
180
160
140
120
100
80
60
40
20
0
1967 1975 1988 1998 2005 2020 1994 1997 2003 2014 1974 1984 1985 1987 2022 1972 1983 1981 2017 1970 1980 2004 2010 1969 1986 1991 1996 2019 2023 1977 2001 2015 1979 2008 2021 1978 2024 1993 1968 2009 1992 1995 1999 2025 1989 2012 2013 2002 2007 1971 1973 2016 1976 2018 2011 2006 2000 1990 1982


July Rainfall Narrogin WA - Sorted
10th Centile 37 mm
Median 71.9 mm
90th Centile 122.6 mm
180
160
140
120
100
80
60
40
20
0
2012 2005 1976 1970 1997 2020 2016 1984 1977 1998 1969 2015 1994 2019 1985 2010 1992 2006 1980 1982 2023 2001 2022 1971 2002 1979 1968 1989 2013 2004 1999 1981 2003 1993 1972 2014 2025 2009 2011 2018 2024 1988 1973 1975 1967 2017 2007 1983 1974 2000 2008 1991 1985 1990 1978 1995 1987 1996 2021

Relative Variability

- $\text{Variability} = \frac{90th\ Centile - 10th\ Centile}{50th\ Centile}$
- January Variability = 15.85
- July Variability = 1.19

Some Monaro data



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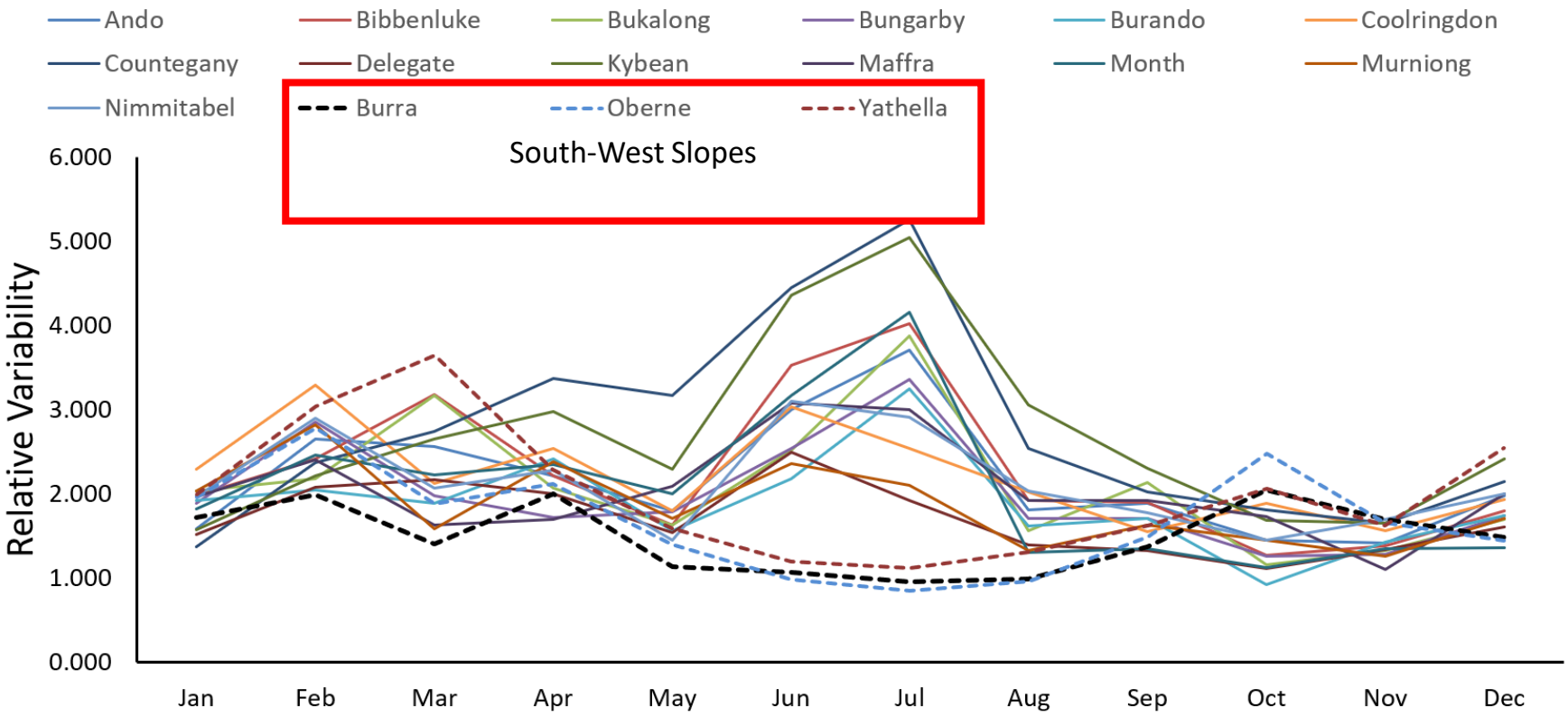

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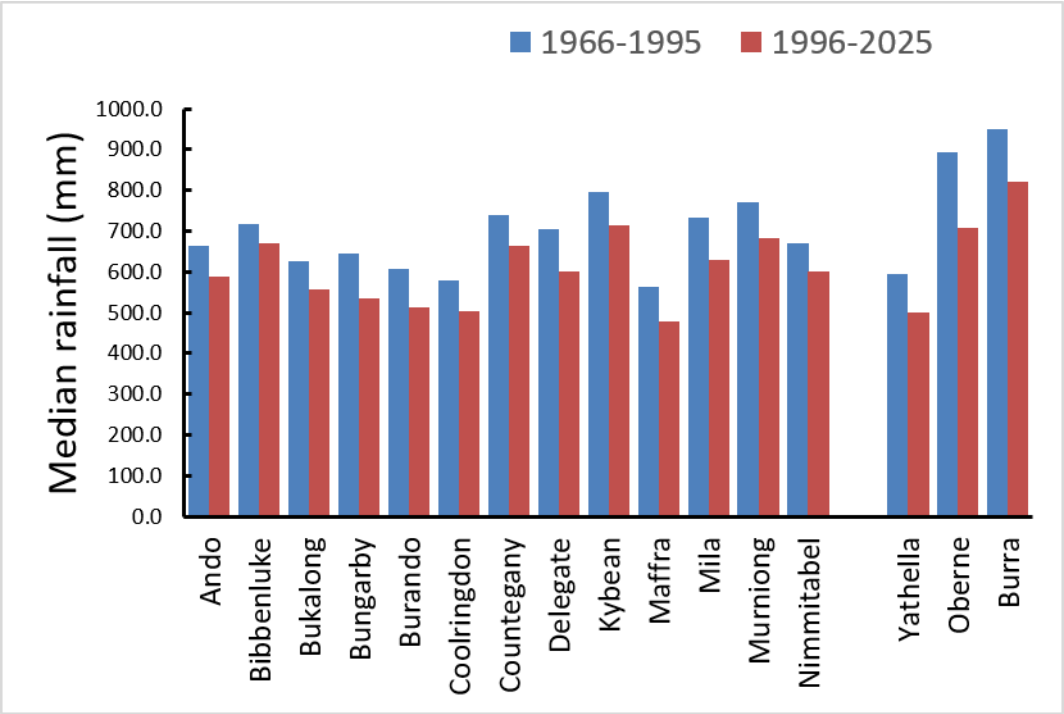
- Based on 1996-2025 data – but heck this out….



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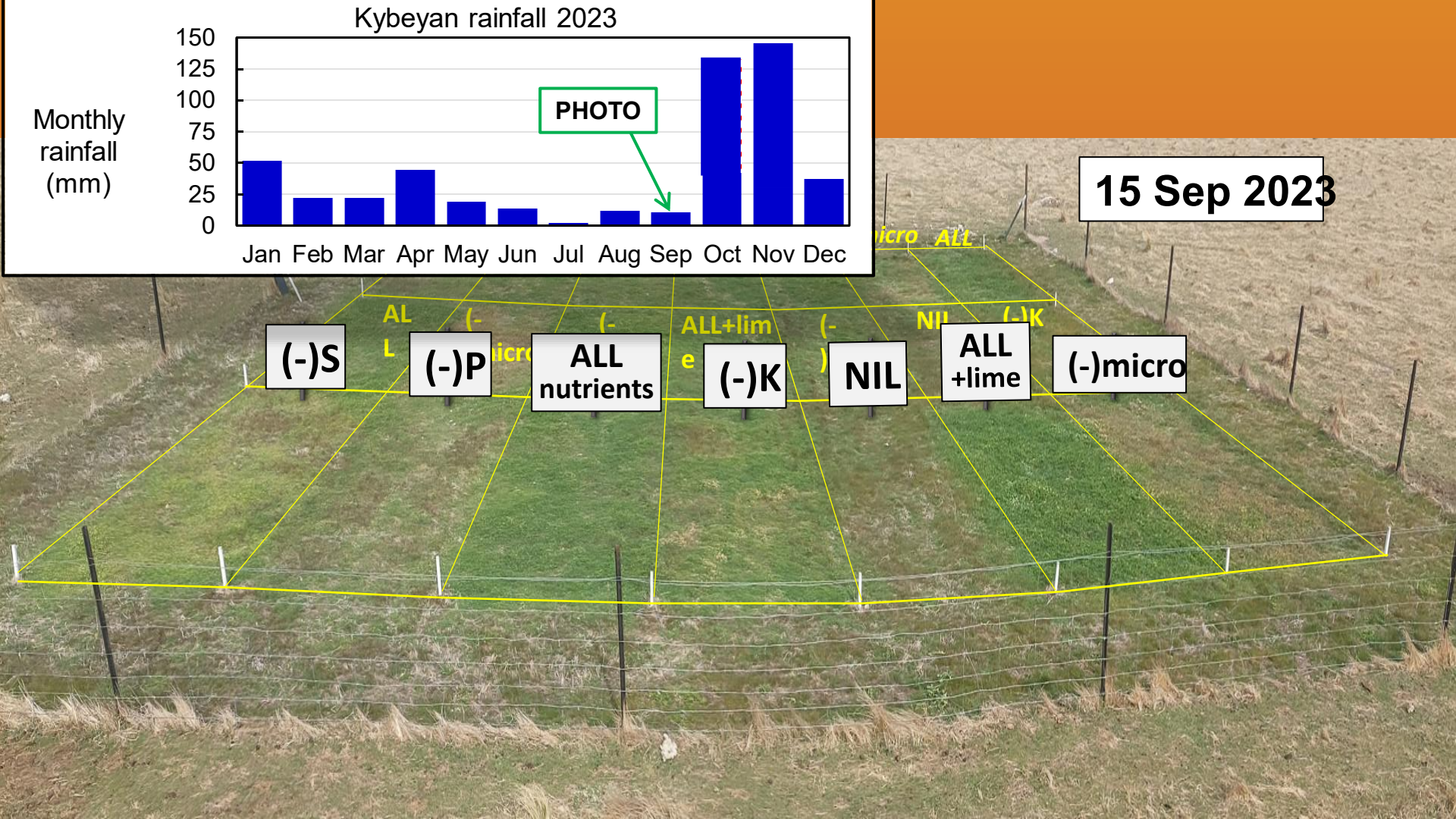
Legume Production and Monaro

- Episodic!!
- Dryish and variable winters for sub clover (less seed softening in summer)
- Variable spring/summer for white clover
- But every so often it happens and when the “stars align” then system has to be right…..

Giving the legumes a chance

1) Monaro Soils Club – nutritional limitations must be minimised – and it takes a bit to work it out


Kybeyan rainfall 2023
Monthly rainfall (mm)
150
125
100
75
50
25
0
PHOTO
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
15 Sep 2023
(-)S
(-)P
ALL nutrients
(-)K
NIL
ALL +lime
(-)micro

Giving the legumes a chance

1) Monaro Soils Club – nutritional limitations must be minimised – and it takes a bit to work it out BUT THIS IS A MUST.
2) Liming? Later talk
3) Also…beware of the sub soil – sample it.
4) Legume selection and management
    1) When sowing sub clover sow at least two cultivars (e.g. Goulburn and Leura?)
    2) Try to obtain bare seed and inoculate yourself
    3) Role for Lucerne (where possible) and White clover (mixed with sub)

Giving the legumes a chance

5. Grazing Management
    1) Utilise the feed so that legumes not outcompeted
    2) Increases seed softening of hard seeded legume species/cultivars where there is less trash
    3) Can be used tactically

Take home messages

- Legumes are your nitrogen lifeline – Low N…no grass
- The Monaro is a tough environment for legumes but control what you can
- N inputs in this system will be episodic

MLA and relevant tools and resources

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Closing slide

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