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AOTEAROA • NEW ZEALAND

Temperate Pastures – Pergamino

16 October 2014

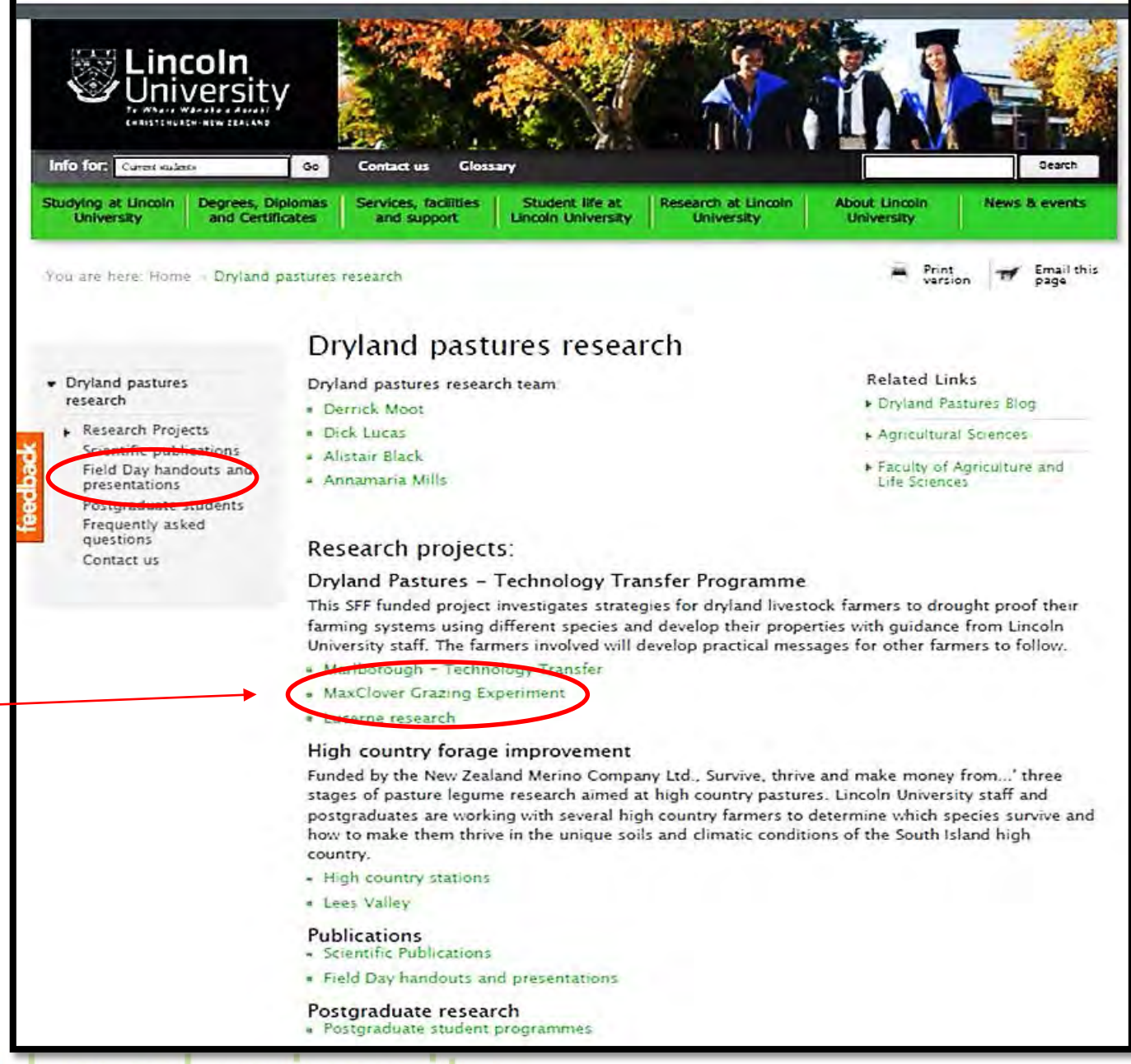
New Zealand's specialist land-based university

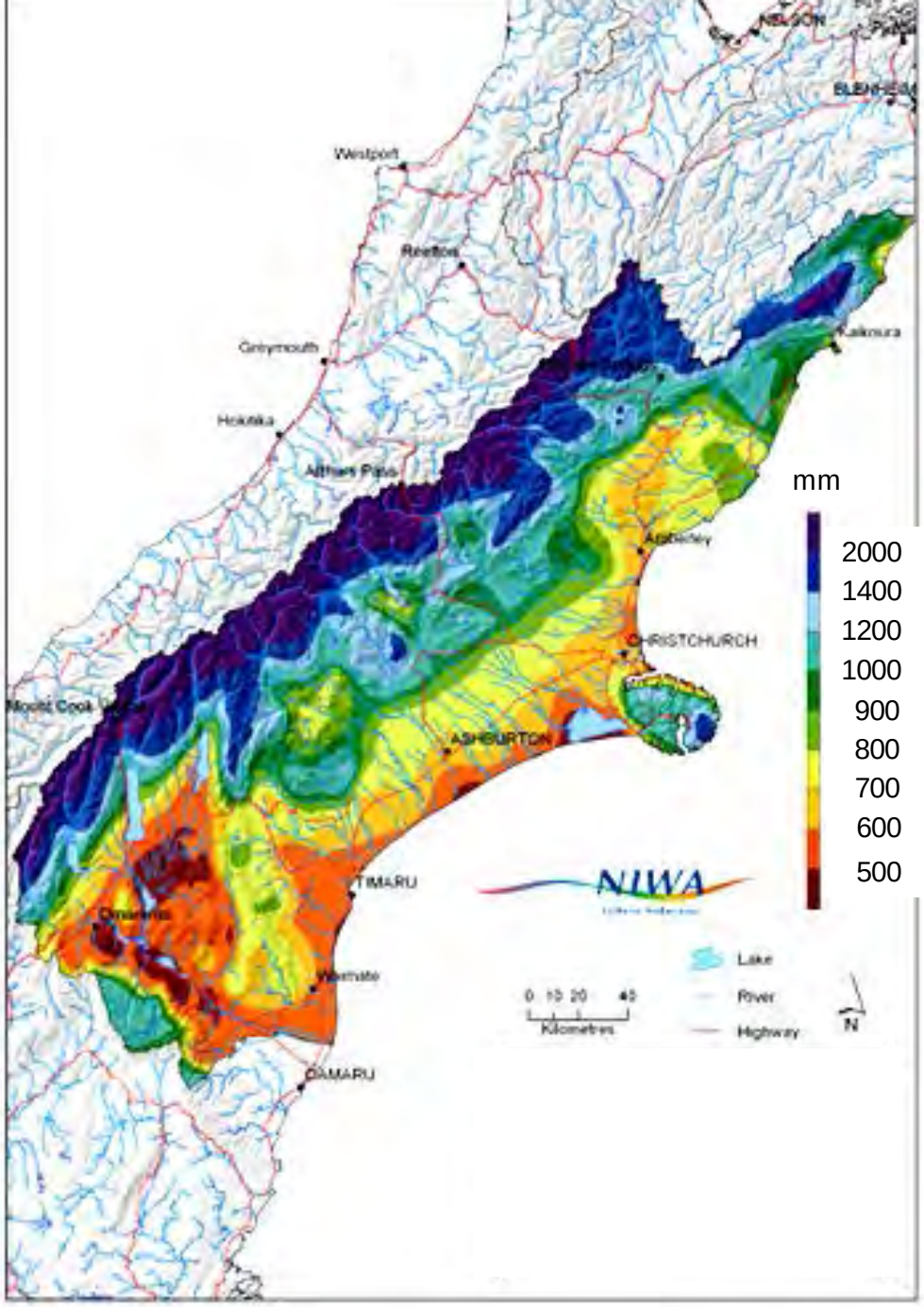
The website…

Info on:

- Current projects
- Field day presentations
- Scientific publications
- FAQs
- Postgraduate study
- Photo Diary
- Direct link to BLOG

www.lincoln.ac.nz/dryland





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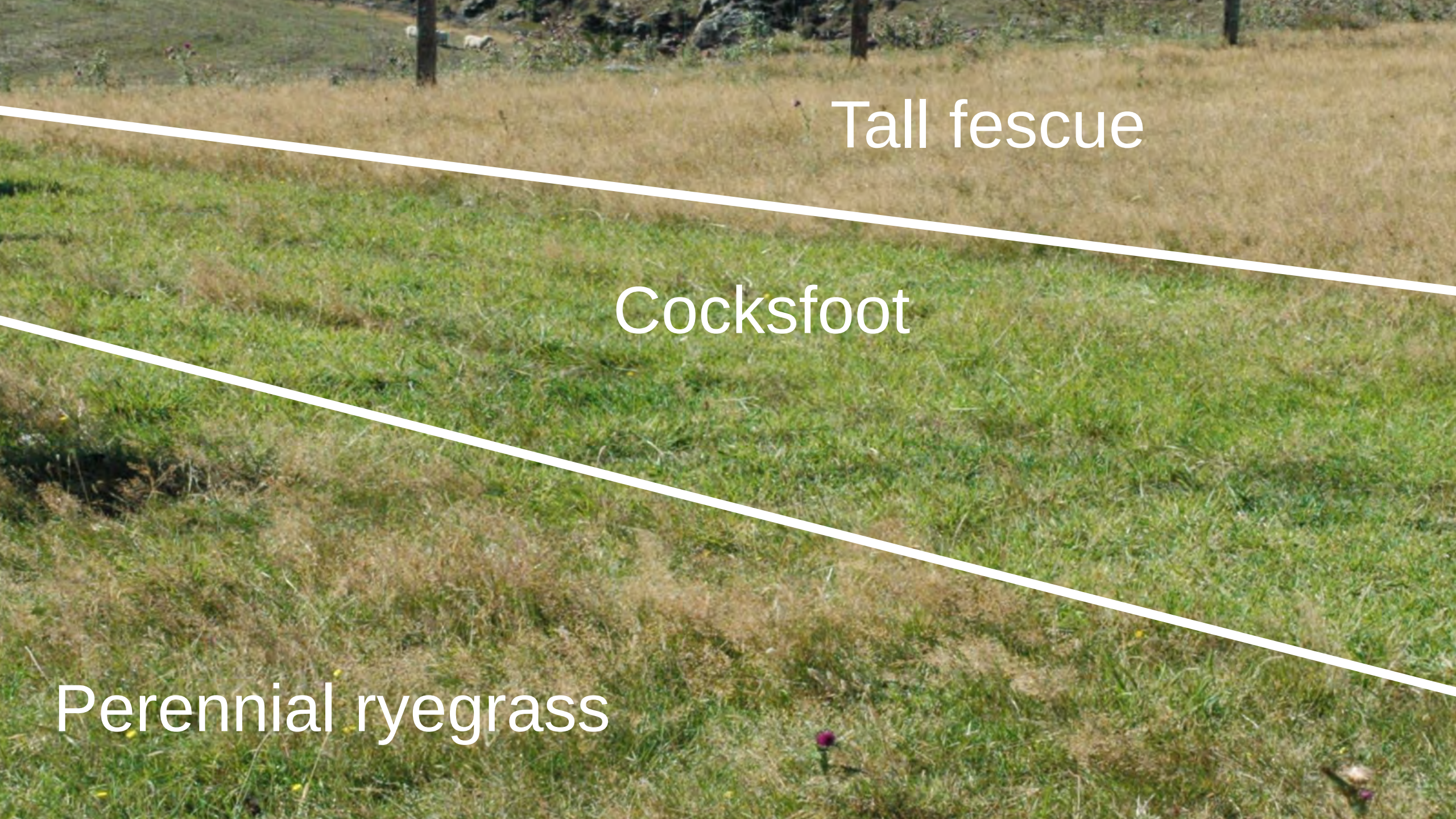
Climate

Median rainfall (mm)
(1971-2000)

Source: Climate Explorer
NIWA, 2010


Tall fescue
Cocksfoot
Perennial ryegrass

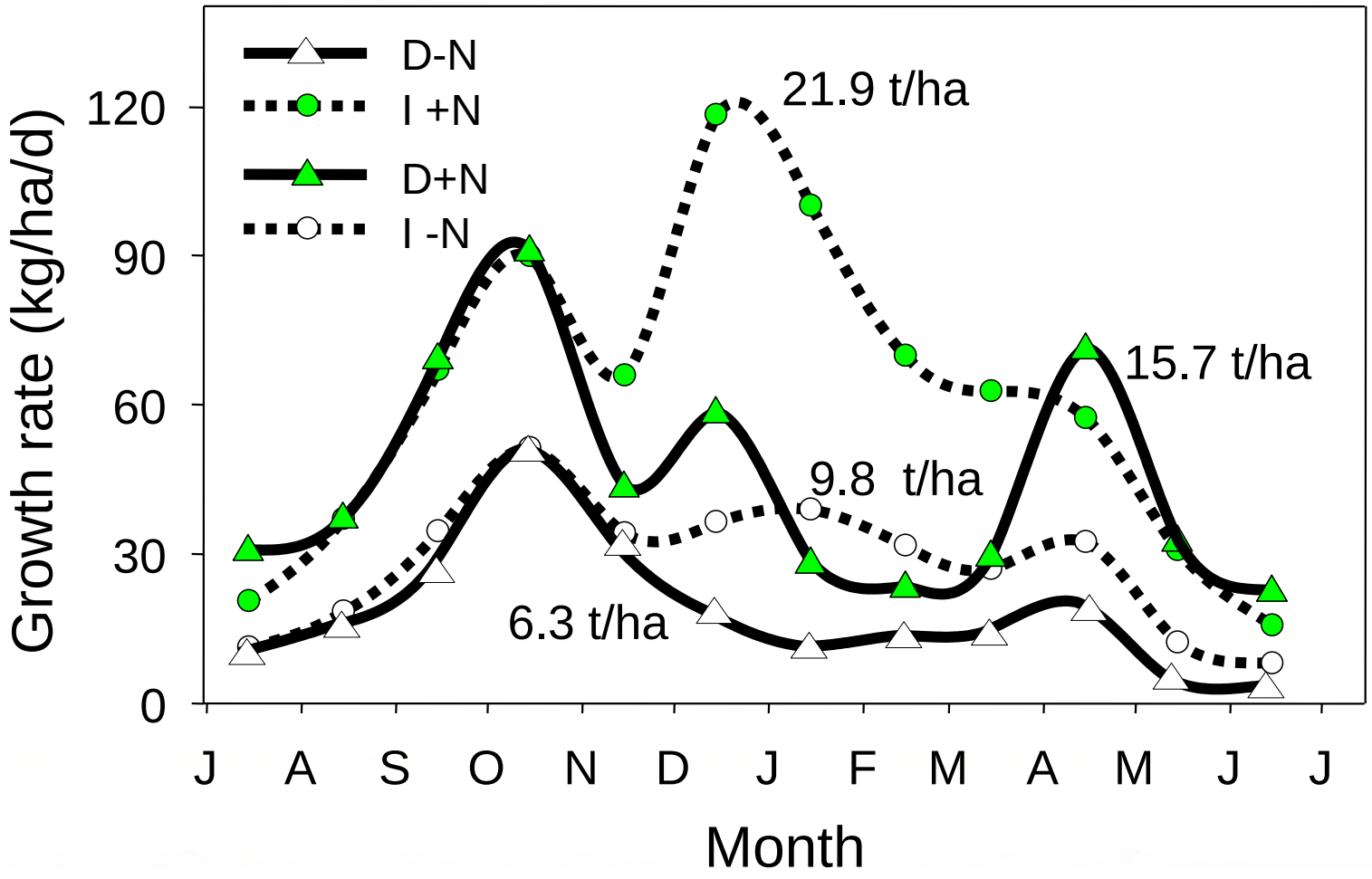
Experiment site

Rep 1

Rep 2

Rep 3

Growth rates (2 year means)



Mills *et al*. 2006

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Winter

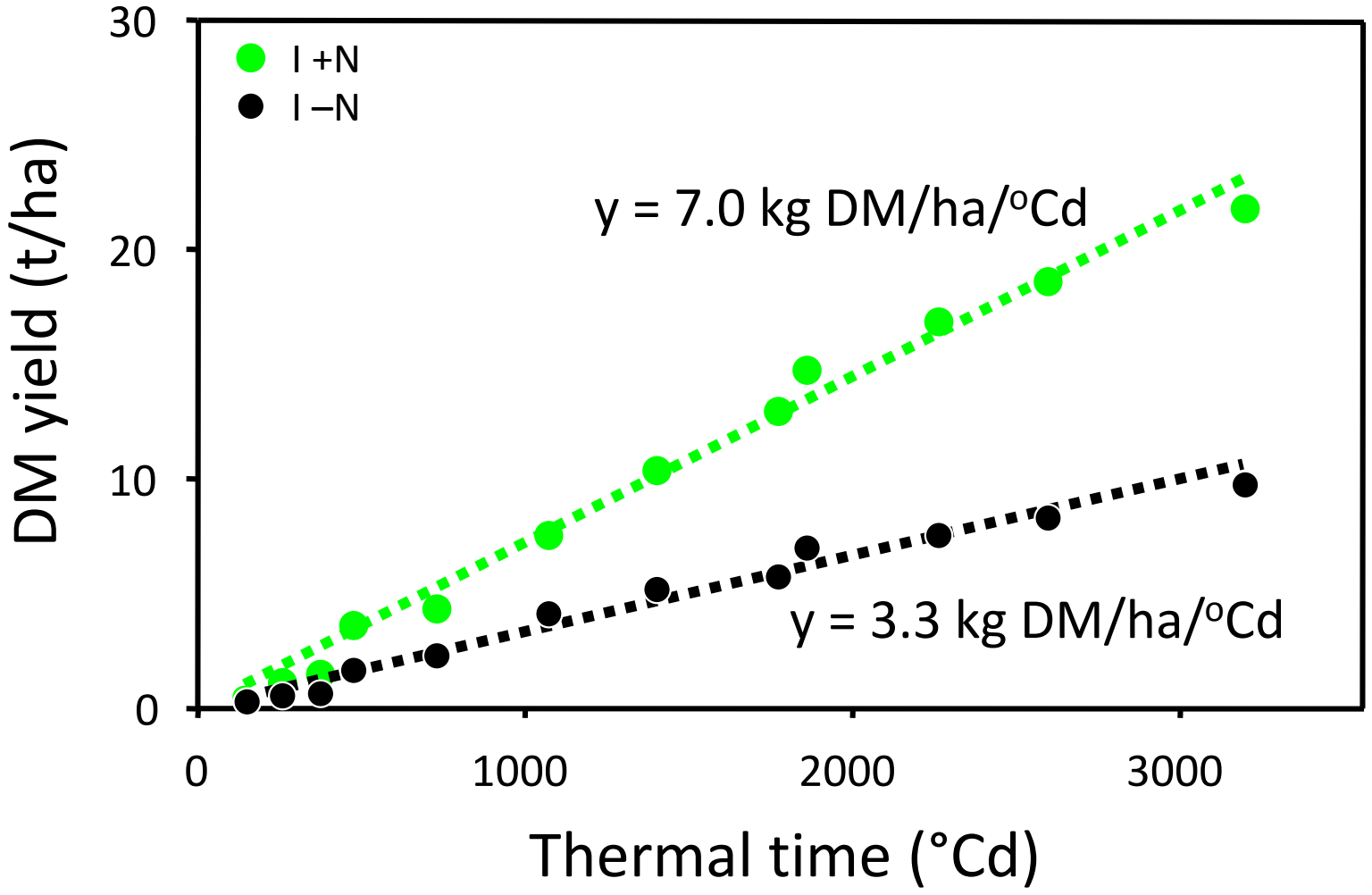
⇒ temperature response

Temperature

- Tt = Thermal time (°Cd)

$$= \frac{Tmax + Tmin}{2} - T_b$$

The Nitrogen gap



21.9 t/ha

9.8 t/ha

Mills *et al*. 2006; 2009

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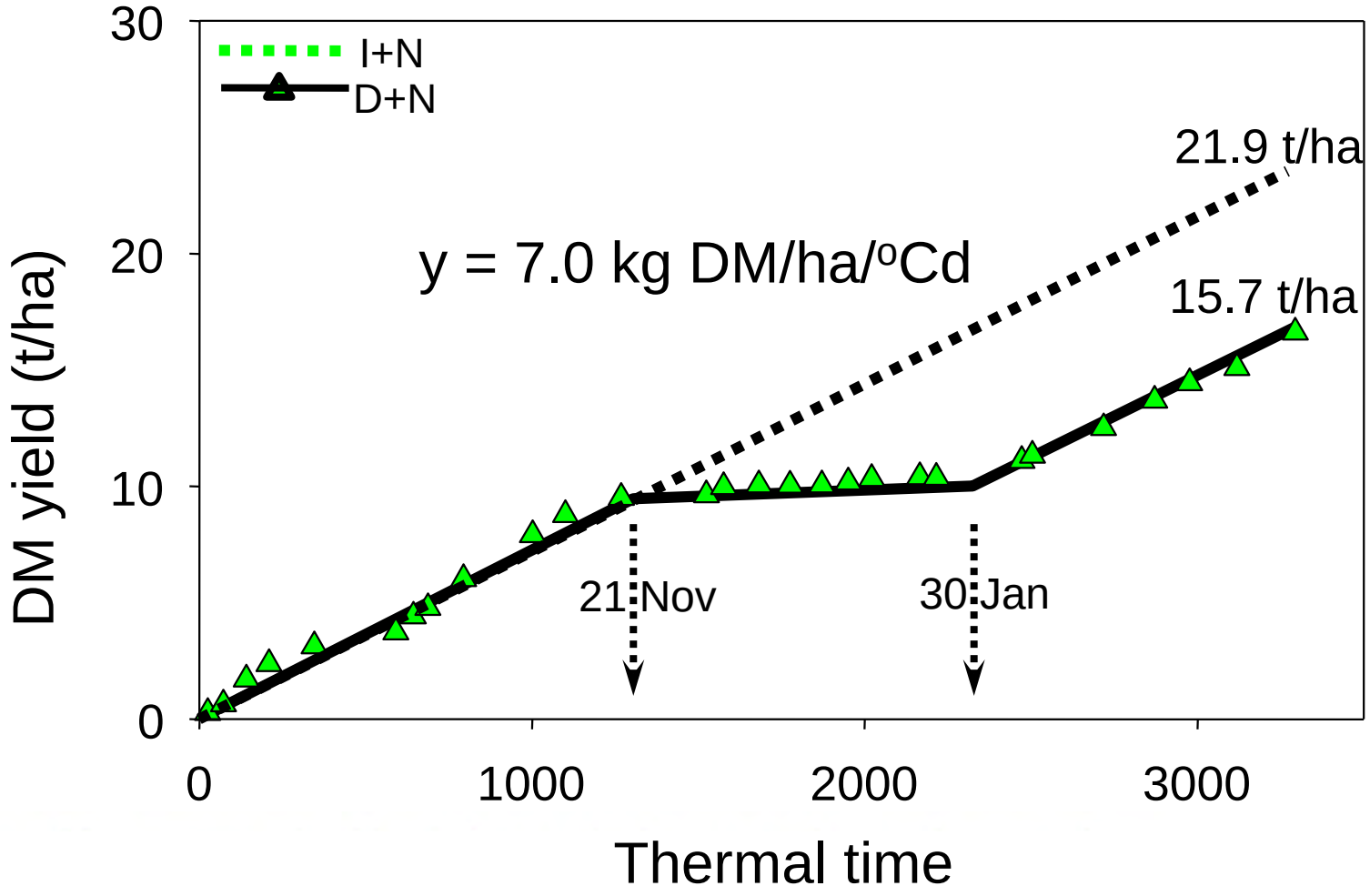
Summer

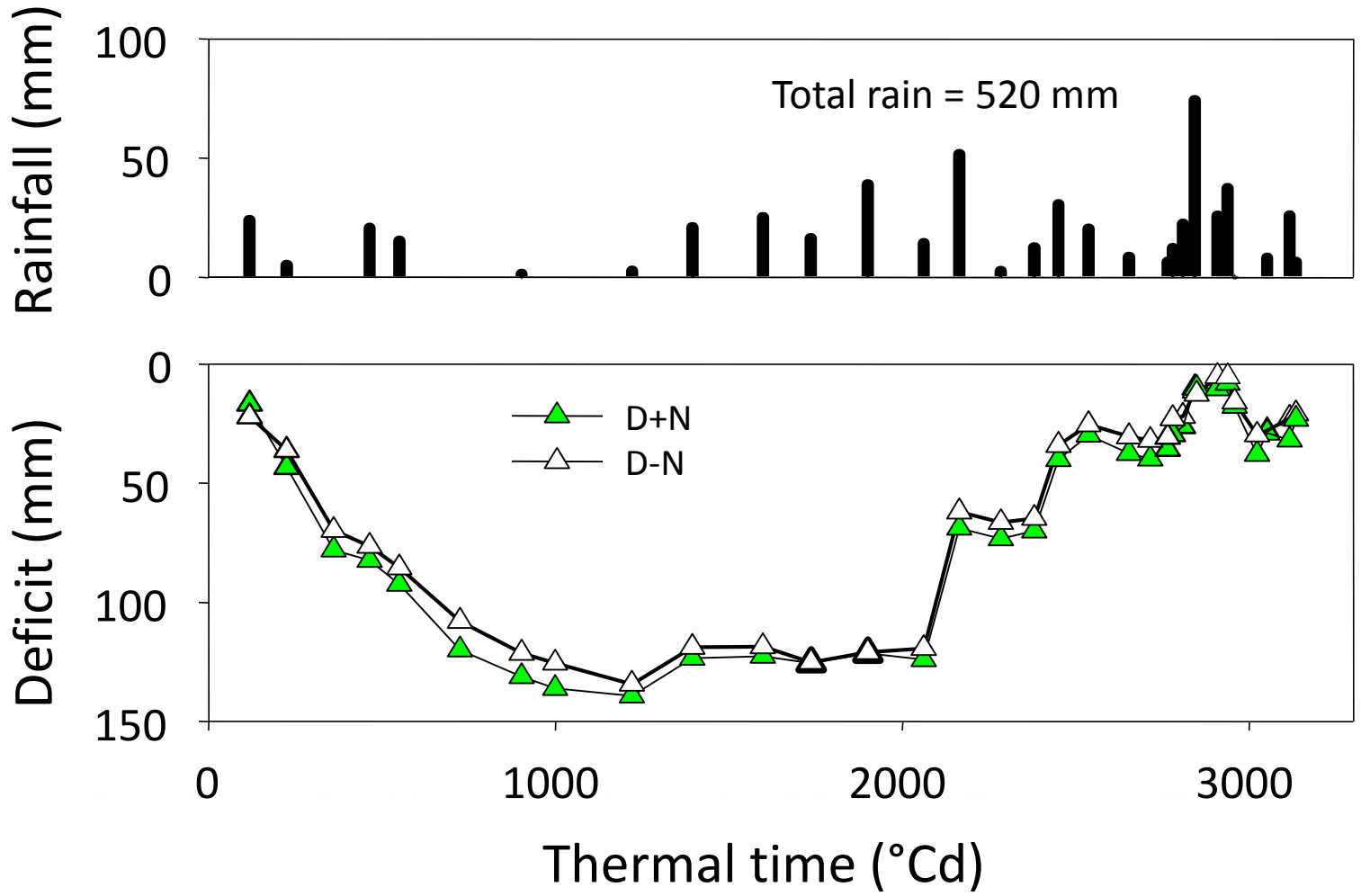
⇒ moisture response

Mills 2007

Water stress effect on yield



Soil moisture deficit 2003/04



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Dry matter yield and botanical composition of the 'MaxClover' grazing experiment at Lincoln University, Canterbury, New Zealand

PHOTO DIARY - 2002/03 to 2010/11

Prepared by: DJ Moot; A Mills; RJ Lucas; KM Pollock; M Smith
Lincoln University DryLAND Pastures Research Team

Funded by:
beef+lamb new zealand

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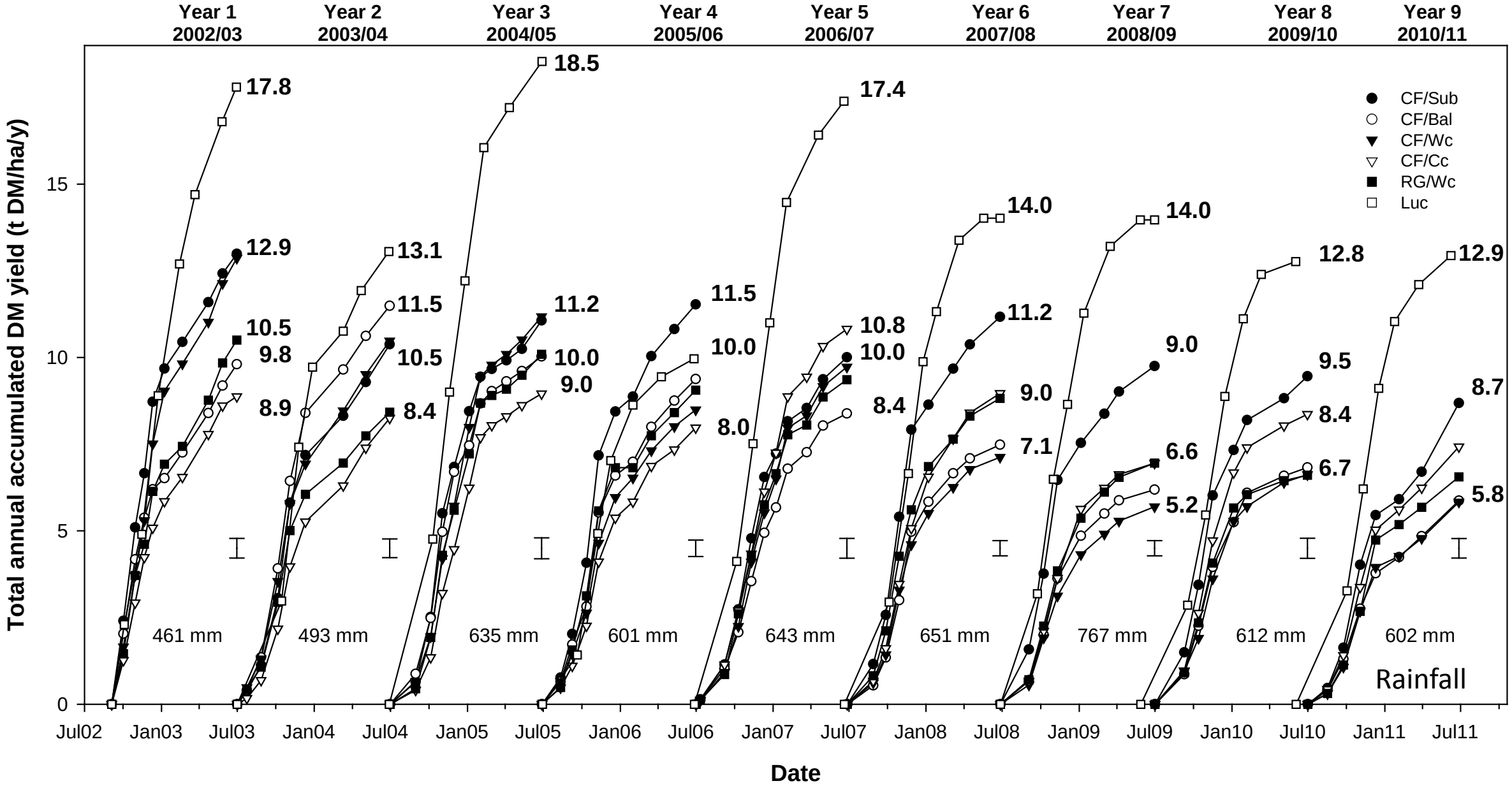
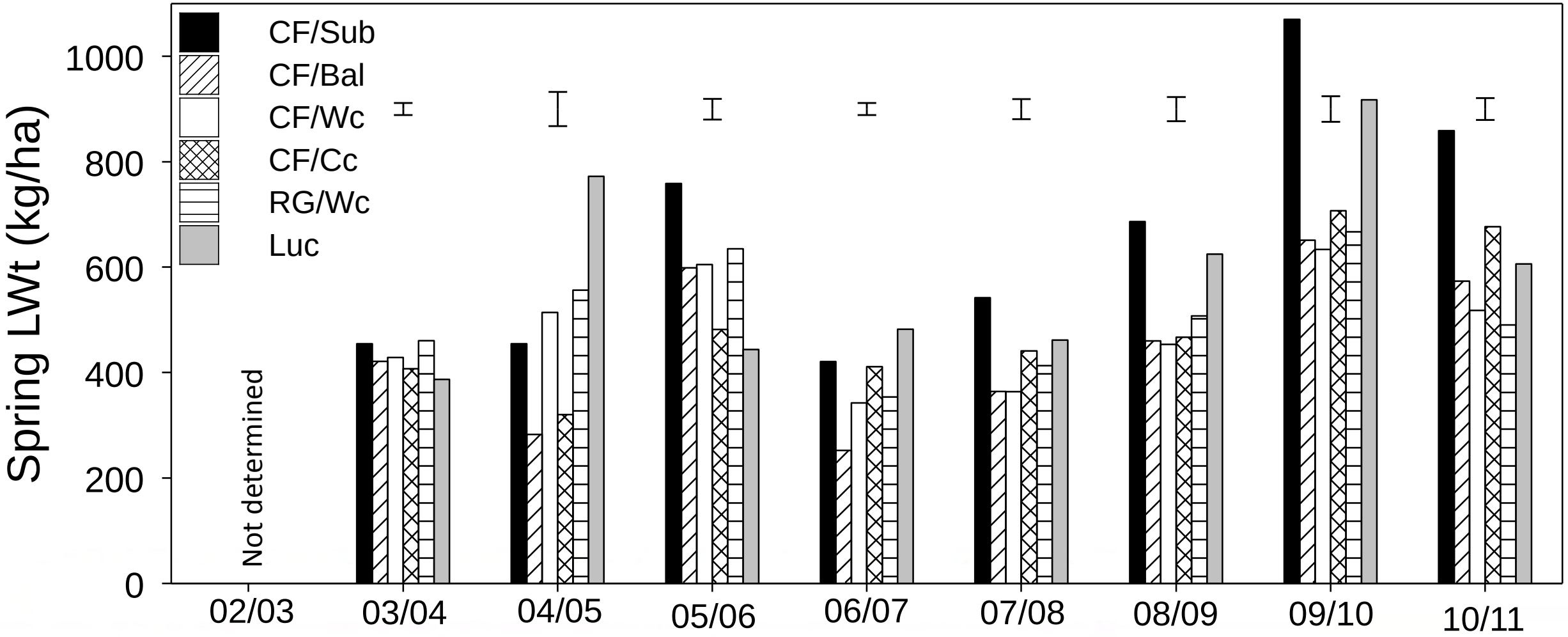
The ‘MaxClover’ Grazing experiment in paddock H19 at Lincoln University

Figure 1. Total annual accumulated dry matter production



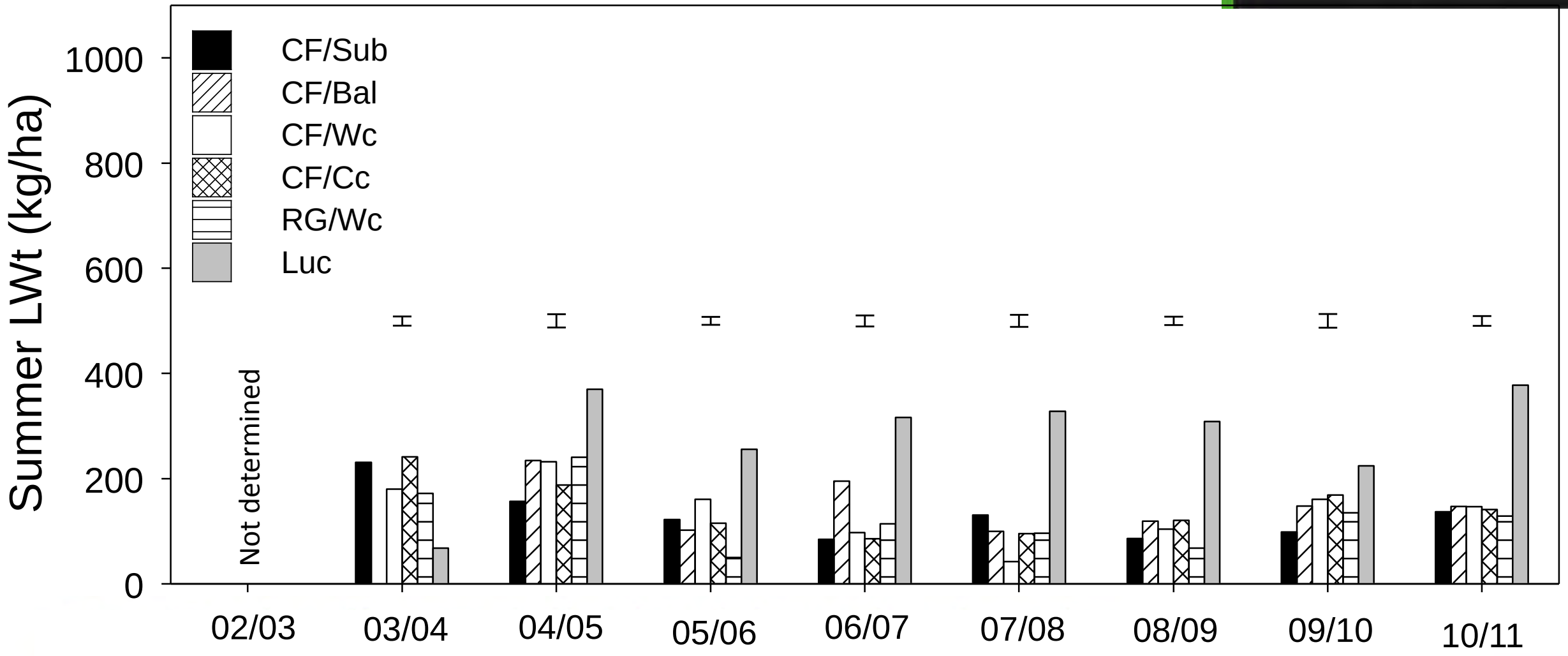
Source: Moot 2012

Total spring LWt production



Mills *et al*. 2014b

Total summer LWt production



Mills *et al*. 2014b

Total autumn LWt production

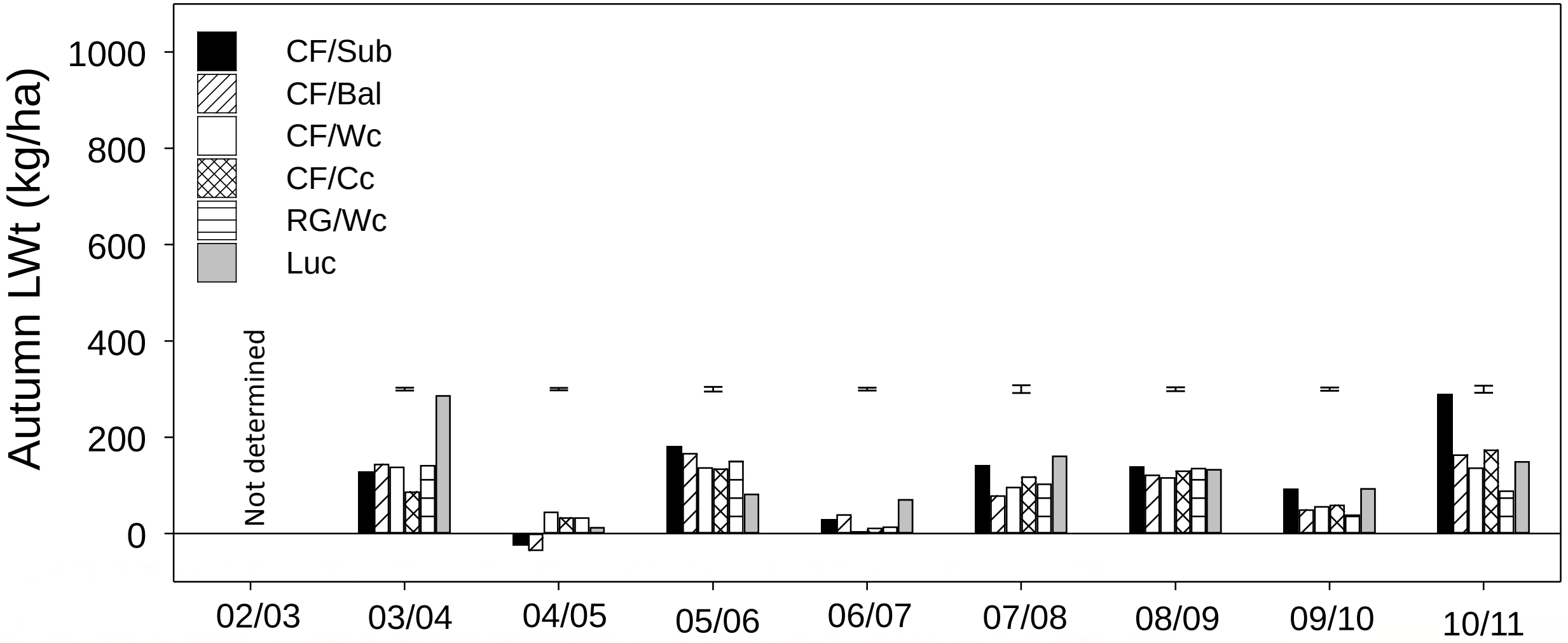
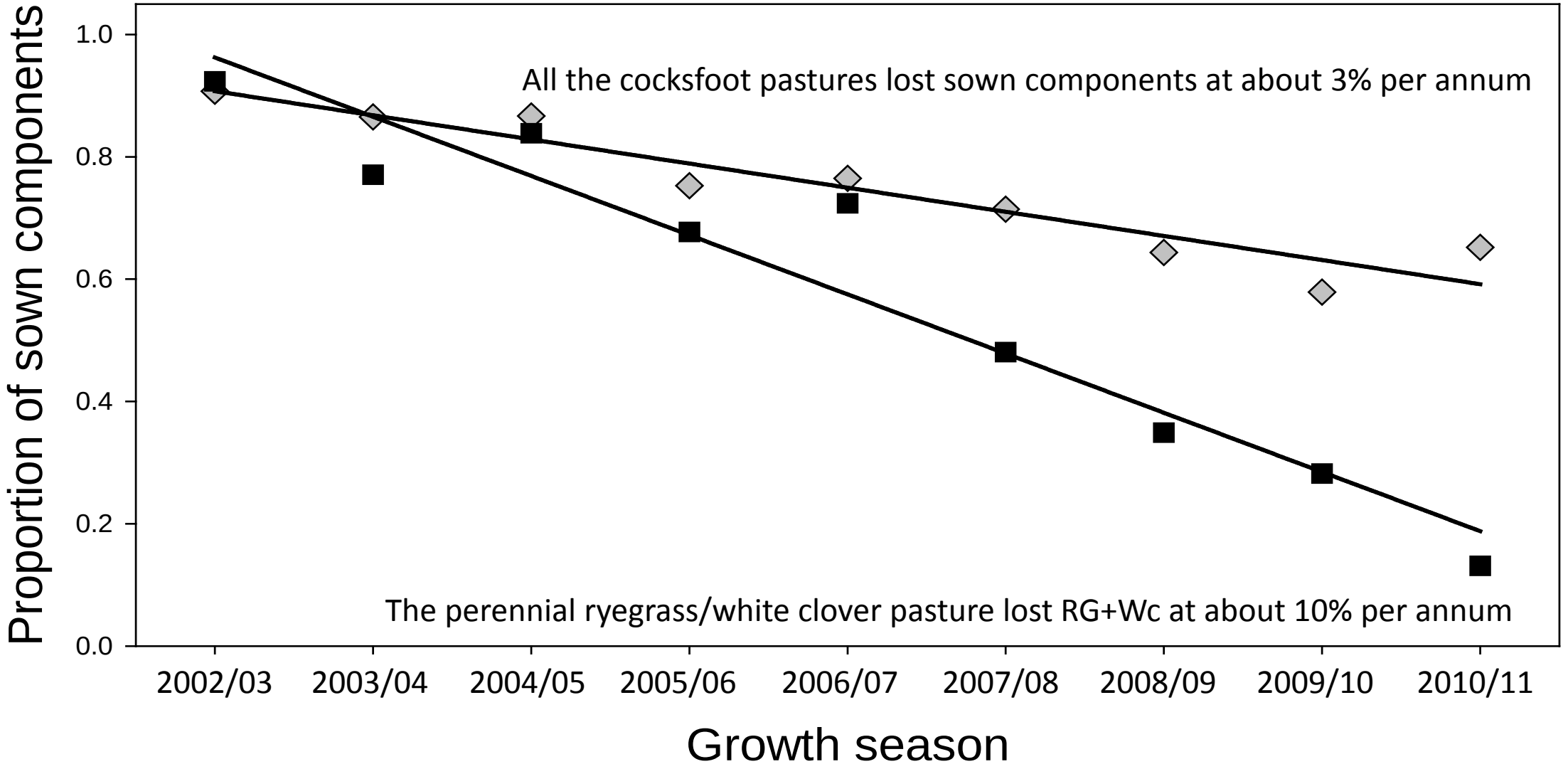
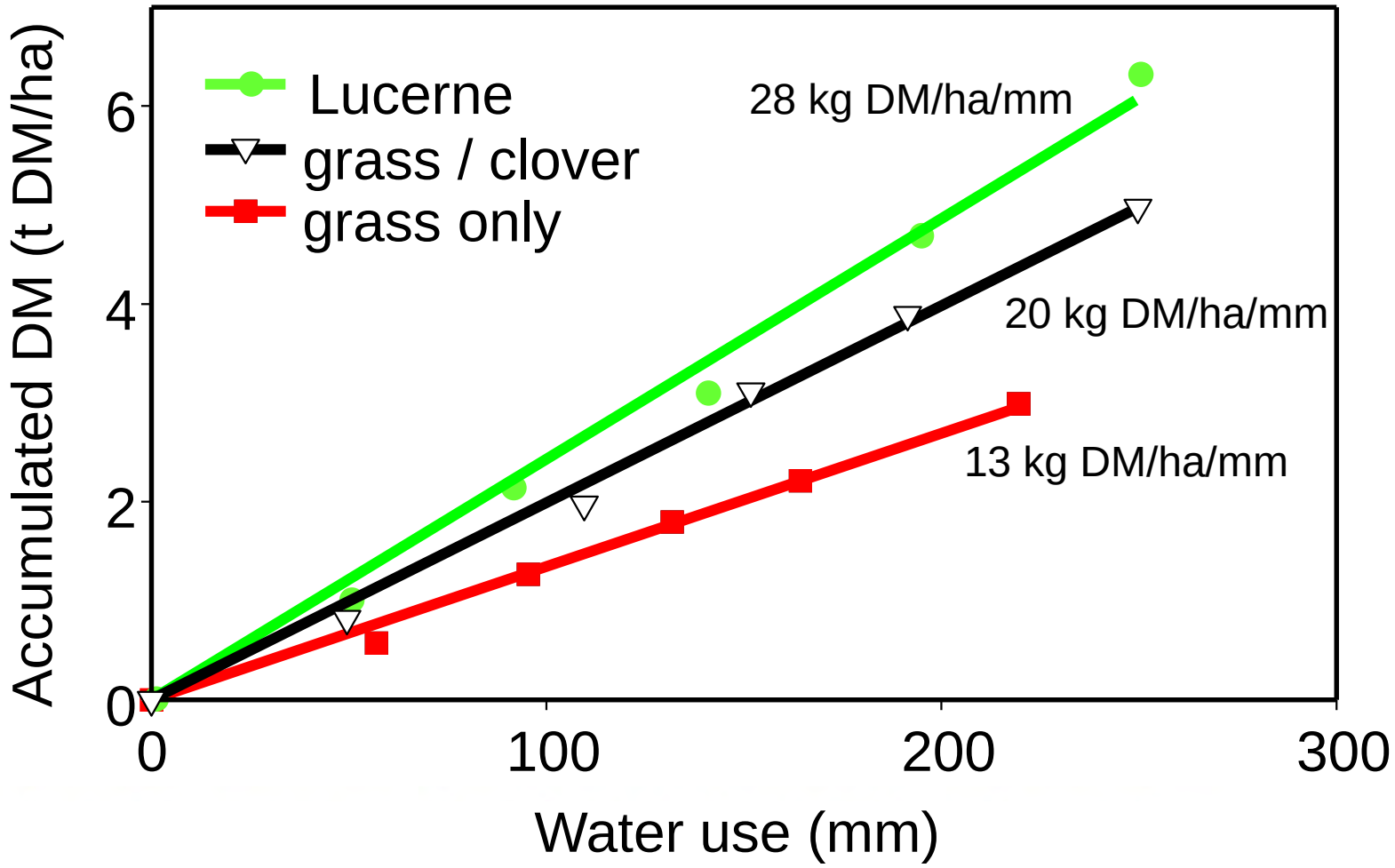


Figure 2. Change in the proportion of originally sown pasture components (grass + clover) over time



Mills *et al.*, 2014a

Spring WUE: legume = (nitrogen)



Moot *et al*. 2008

Conclusions

- Evapotranspiration is independent of N status
- Legumes are seldom N deficient
- In dryland pastures legumes have higher WUE
- Spring is crucial for pasture production
- Long term experiments …….don’t suit funding cycles

How can we increase WUE on-farm?

Cocksfoot/Subterranean clover pastures

(*Dactylis glomerata/Trifolium subterraneum*)

- Total yields ranged from 13.0 t/ha (Year 1) to 8.7 t/ha (Year 9).
- By Year 9, 67% of the total yield was from the originally sown species.
- In four of the nine years the sub clover yield was >3.0 t/ha.

Mills *et al.*, 2014a

Yr 2 Summer (Jan 2004) CF/Sub

In the driest summer, a bit of cocksfoot remains green in the CF/Sub pasture compared with the RG/Wc pasture where only a bit of white clover remained green at this time of year.
The quadrat is 0.1 m^2.

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Yr 6 Spring (Nov 2007) CF/Sub

A close up of the pasture.

Yr 8 Spring (Sept 2009) CF/Sub

CF/Sub pasture in Plot 5.

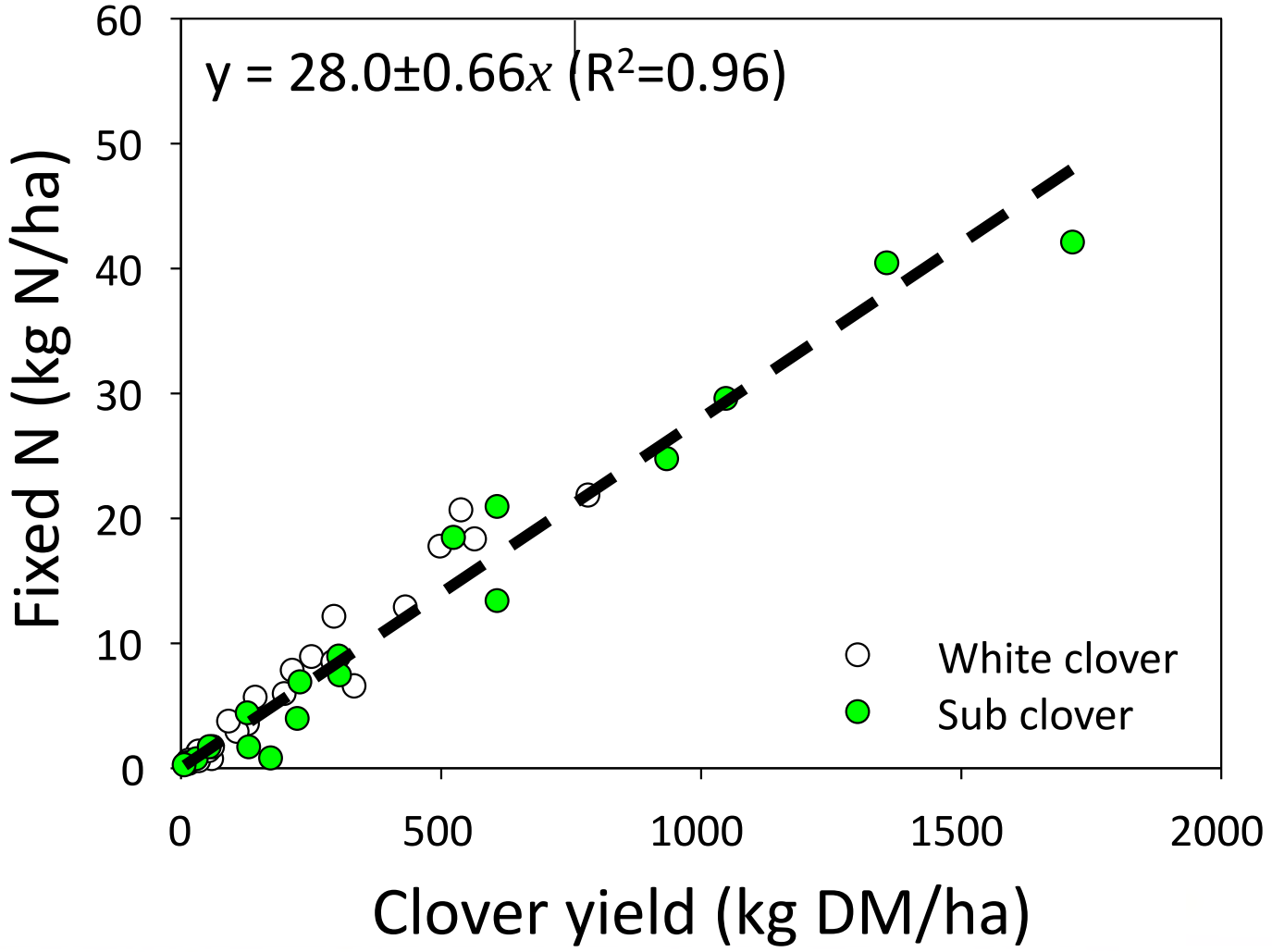
In Yr 8 the 2.4 t/ha of yield contributed by sub clover was more than double the clover yield produced from any other grass based pasture.

For the spring period (to 16 Nov 2009) about 40% of the DM yield on offer was sub clover.

Nitrogen fixation
25 kg N/t DM

Lucas *et al.* 2010

Biological N fixation



Lucas *et al.* 2010

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Pasture (legume) management

Dr Derrick Moot
Professor of Plant Science

Water and nitrogen = ryegrass

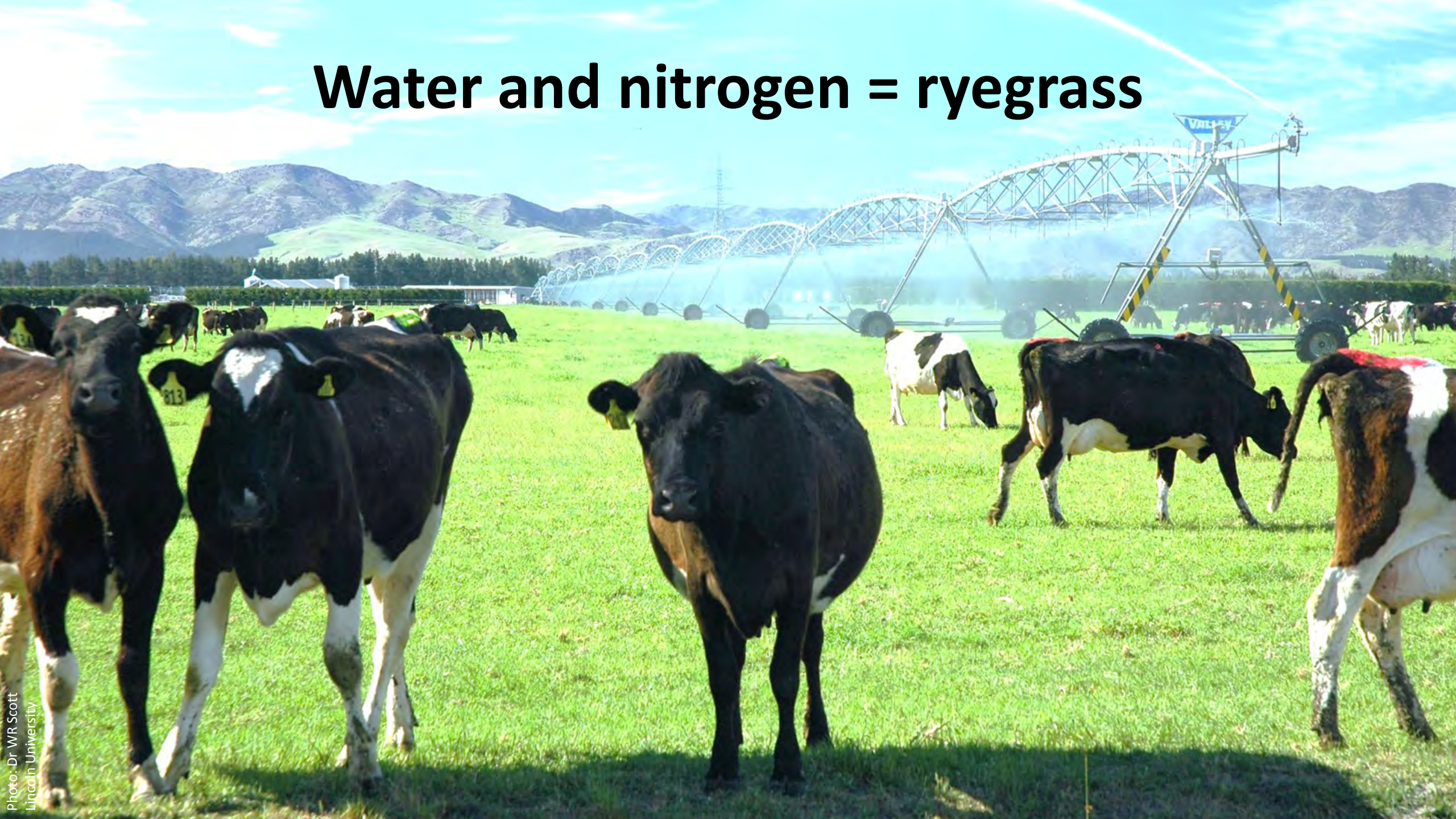
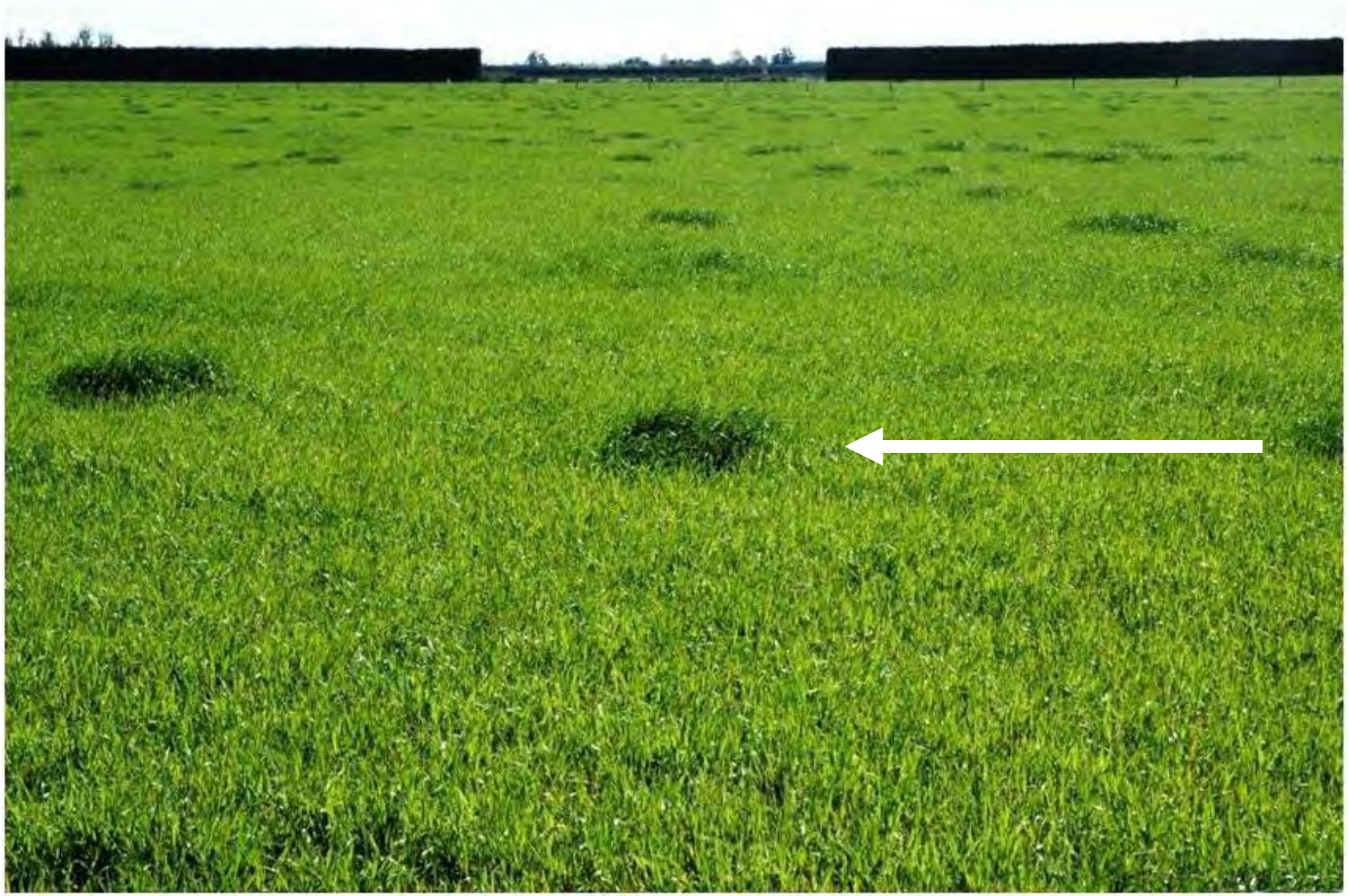


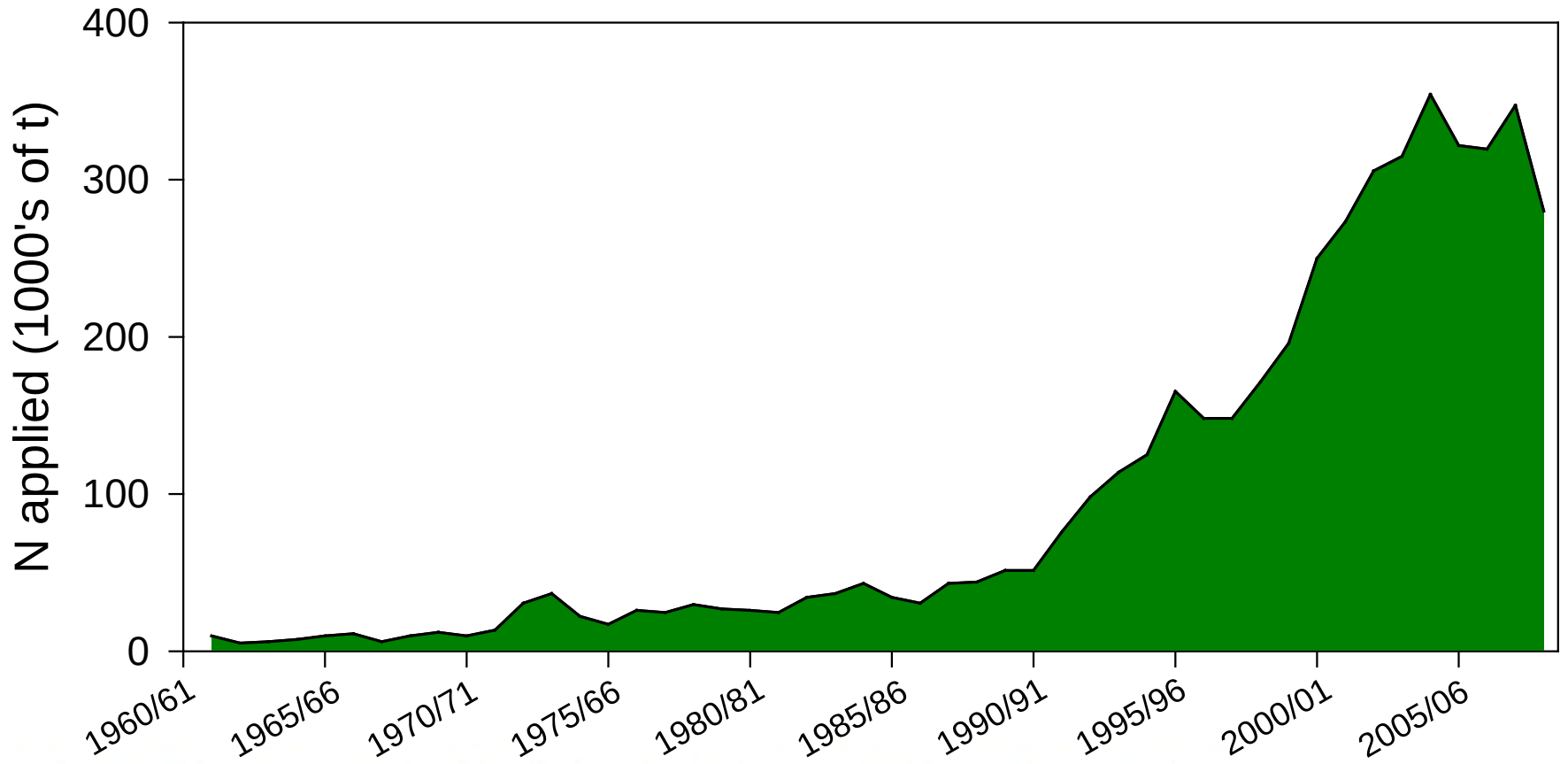
Photo: Dr WR Scott
Lincoln University

Nitrogen deficient pasture

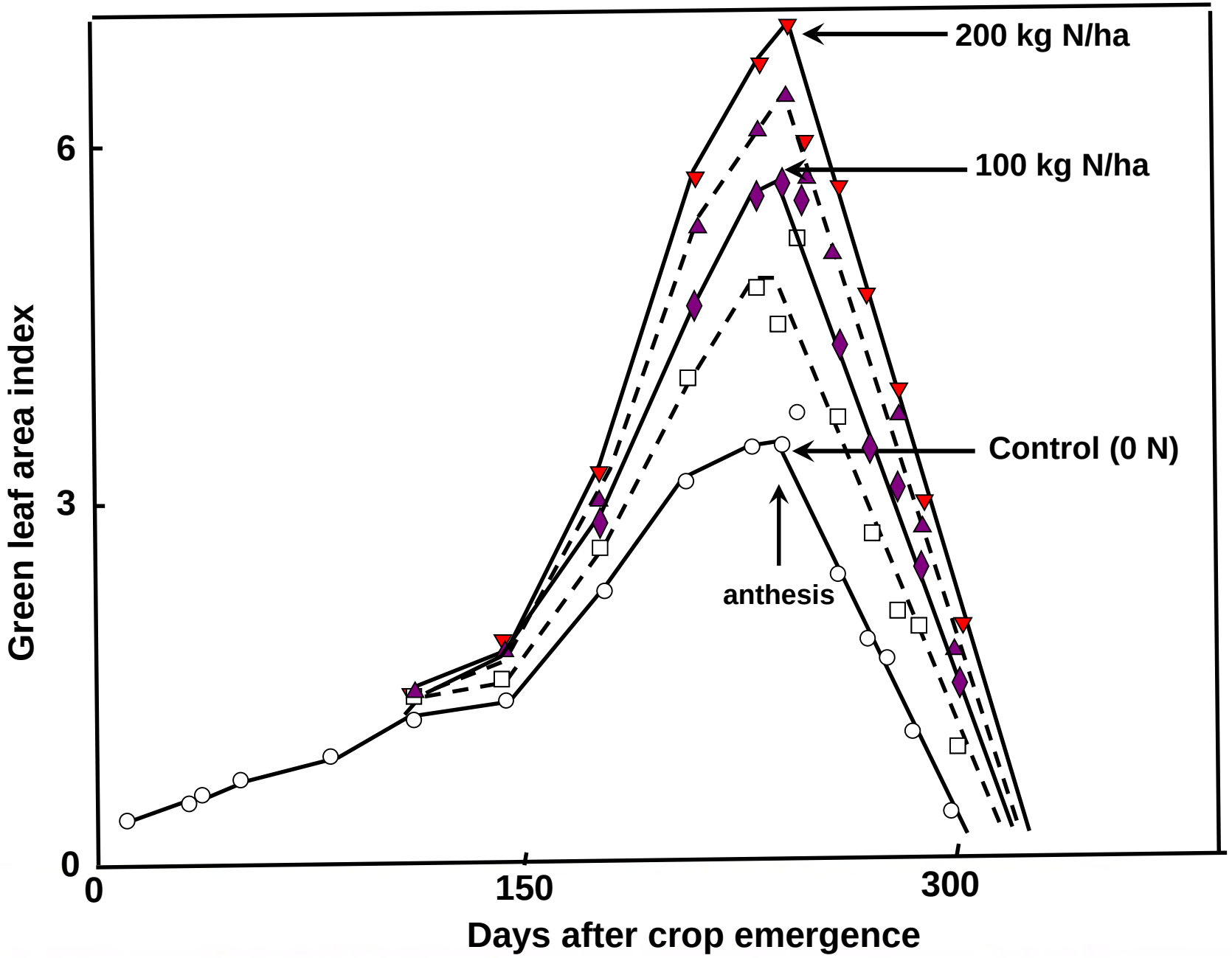


1000 kg N/ha

Nitrogen fertiliser use

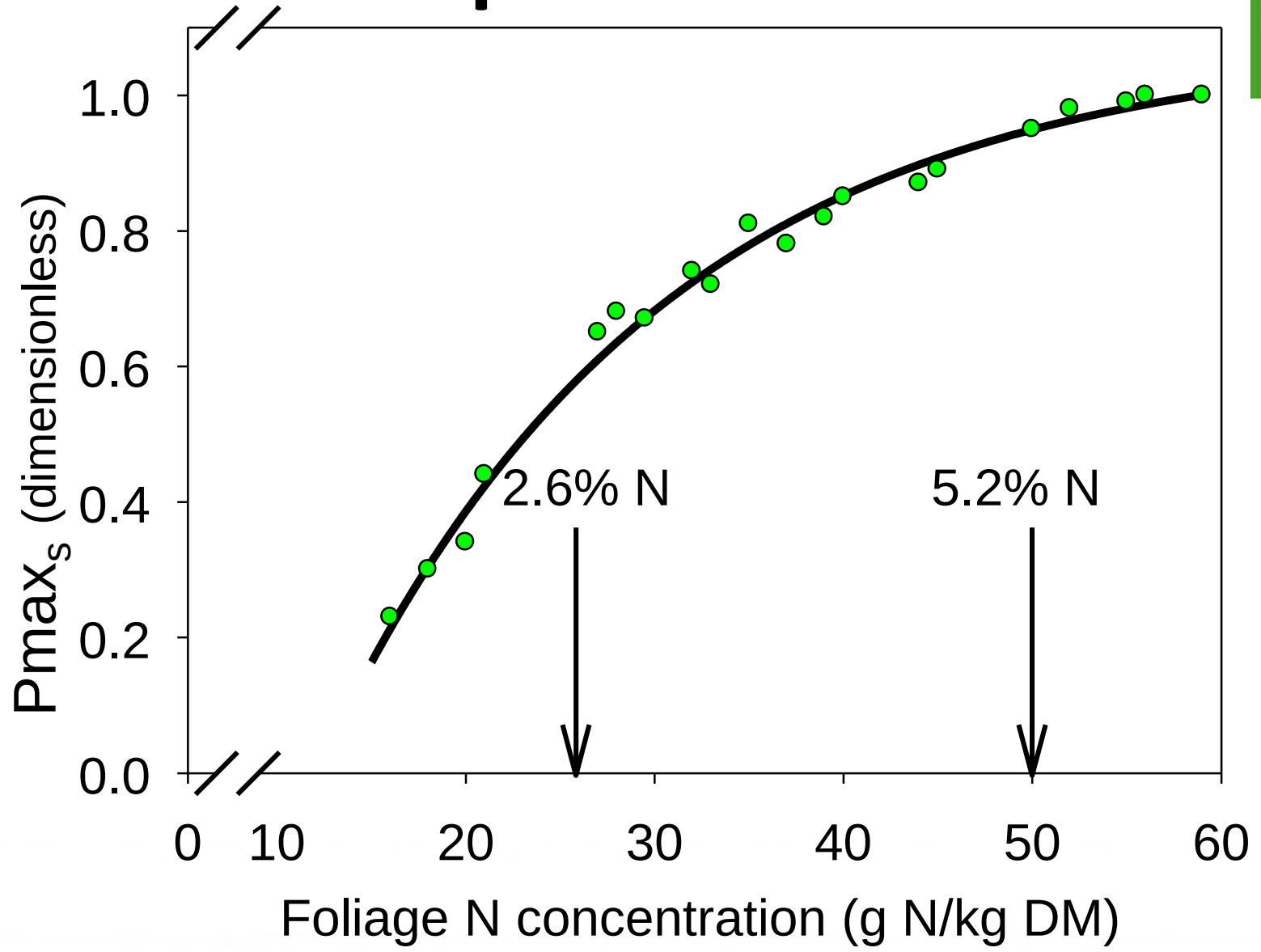


Source: New Zealand Fertiliser Manufacturers' Research Association


200 kg N/ha
100 kg N/ha
Control (0 N)
anthesis
Green leaf area index
Days after crop emergence
0
3
6
0
150
300

Green 1987

Plant vs. animal requirements



Peri *et al*. 2002

Photo: A Black

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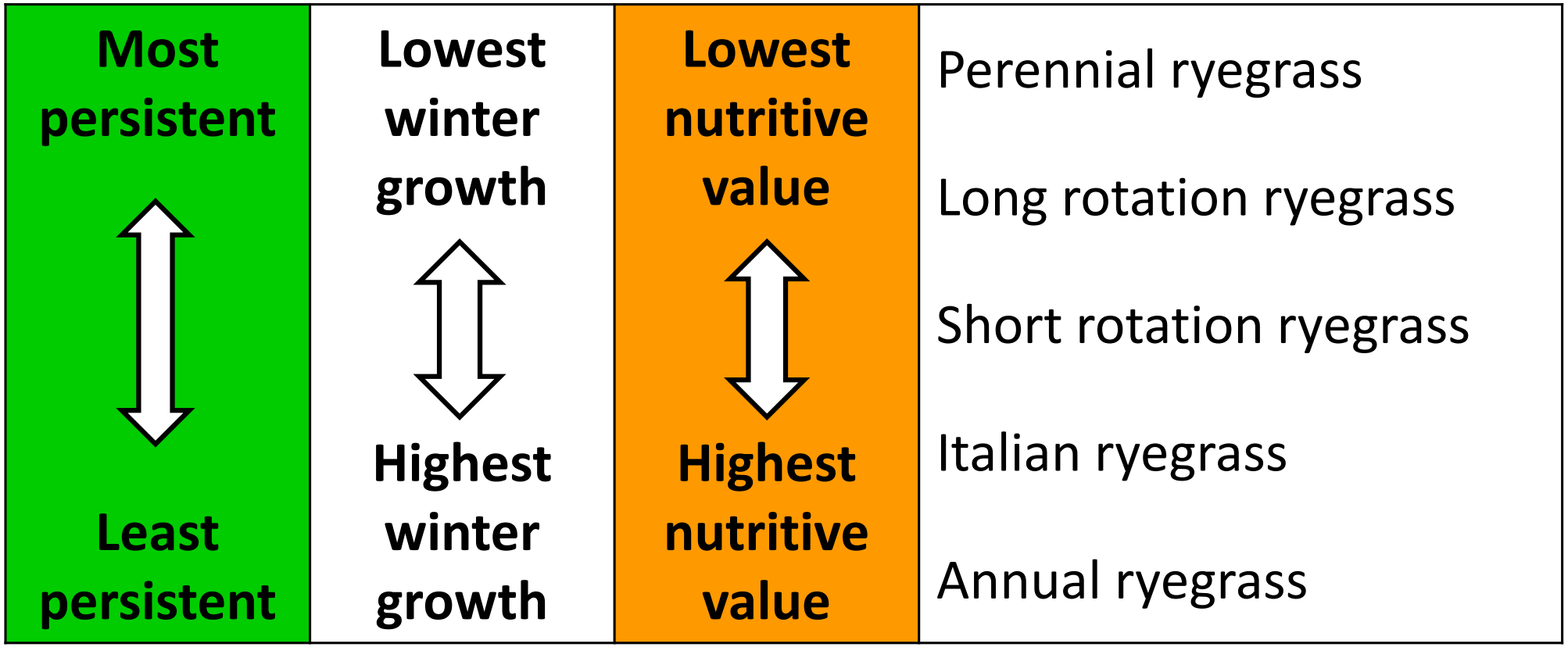
The ryegrass continuum



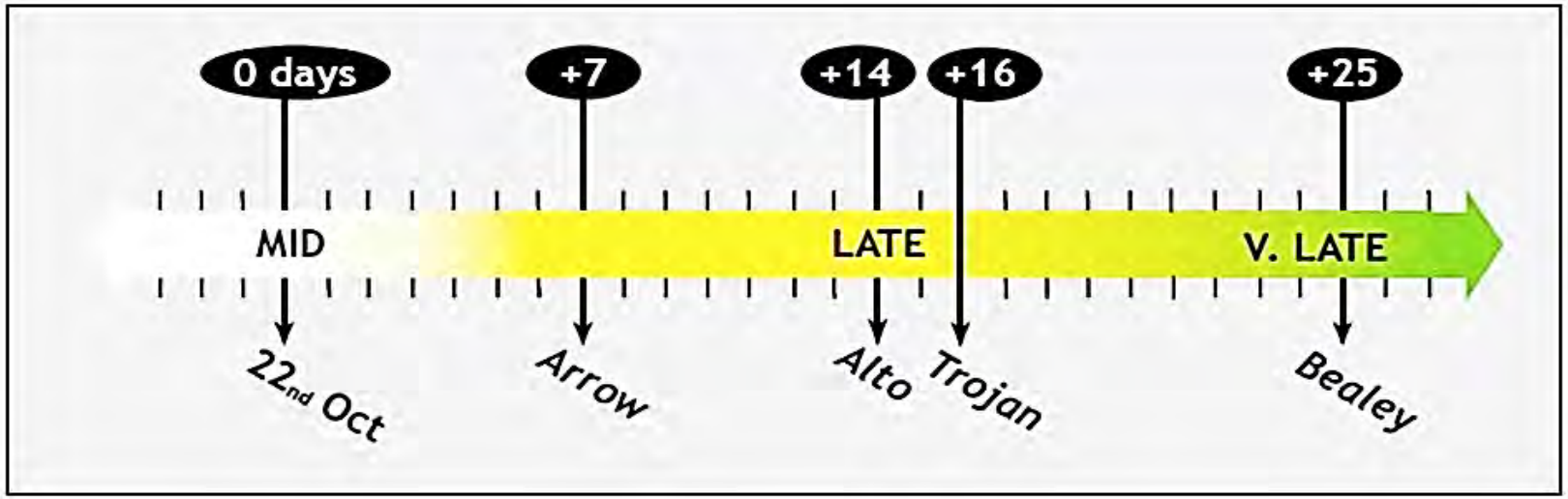
Ryegrass endophyte strains

Endophyte strain	Peramine	Lolitrem B	Ergovaline	Janthitrems
Standard	High	High	High	-
Without	-	-	-	-
Endo5	High	-	Low	-
AR1	High	-	-	-
NEA2 or NEA	Low	Low*	Low-medium*	-
AR37	-	-	-	High

- = none produced; * depends on the specific endophyte strain(s), and ratio of strains, in the mix

Heading date

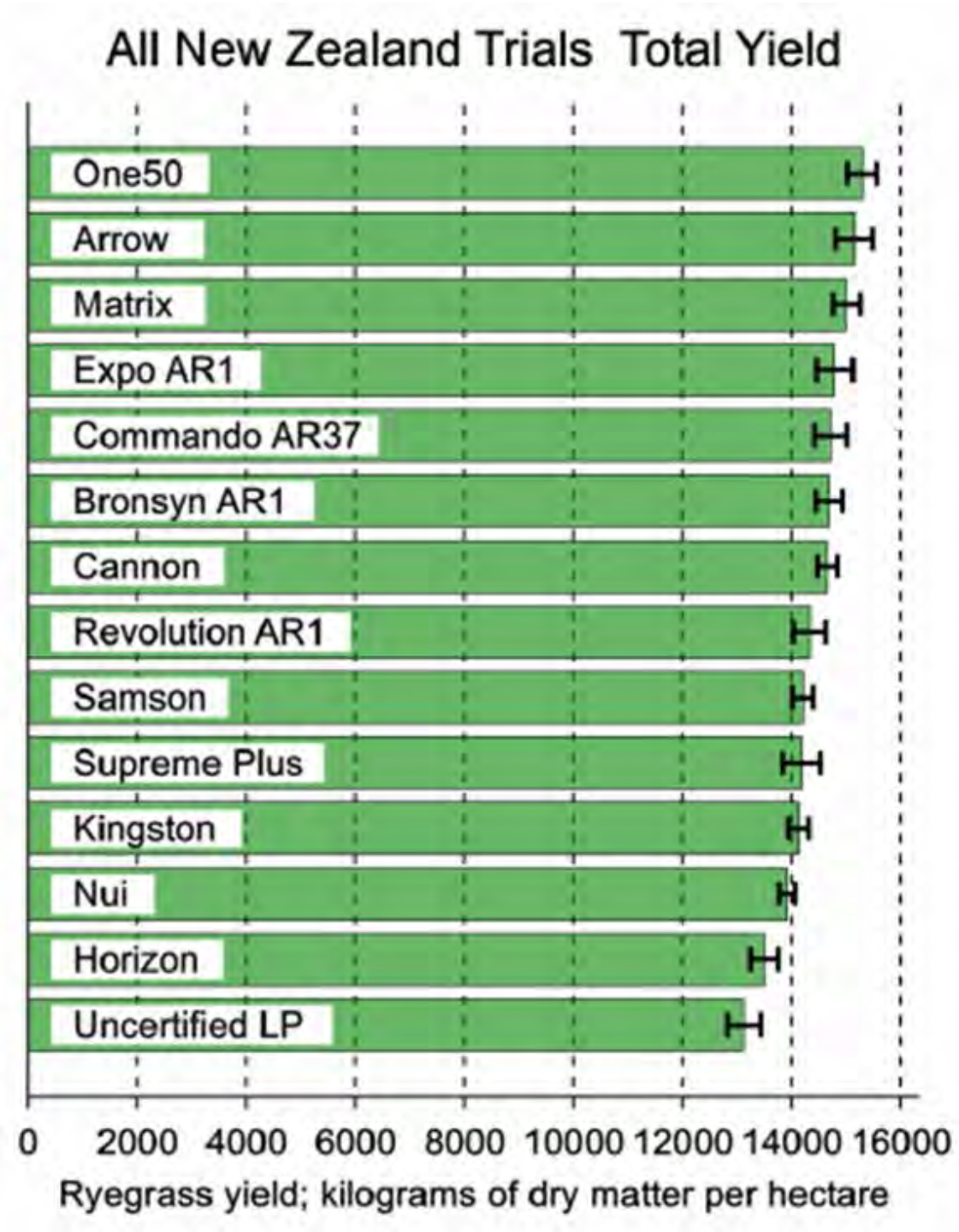
- Heading = flowering time in spring.
- Early heading - higher early spring growth.
- Late heading - late spring quality.



Source: www.agriseeds.co.nz

Forage variety trials

Photo: A Black



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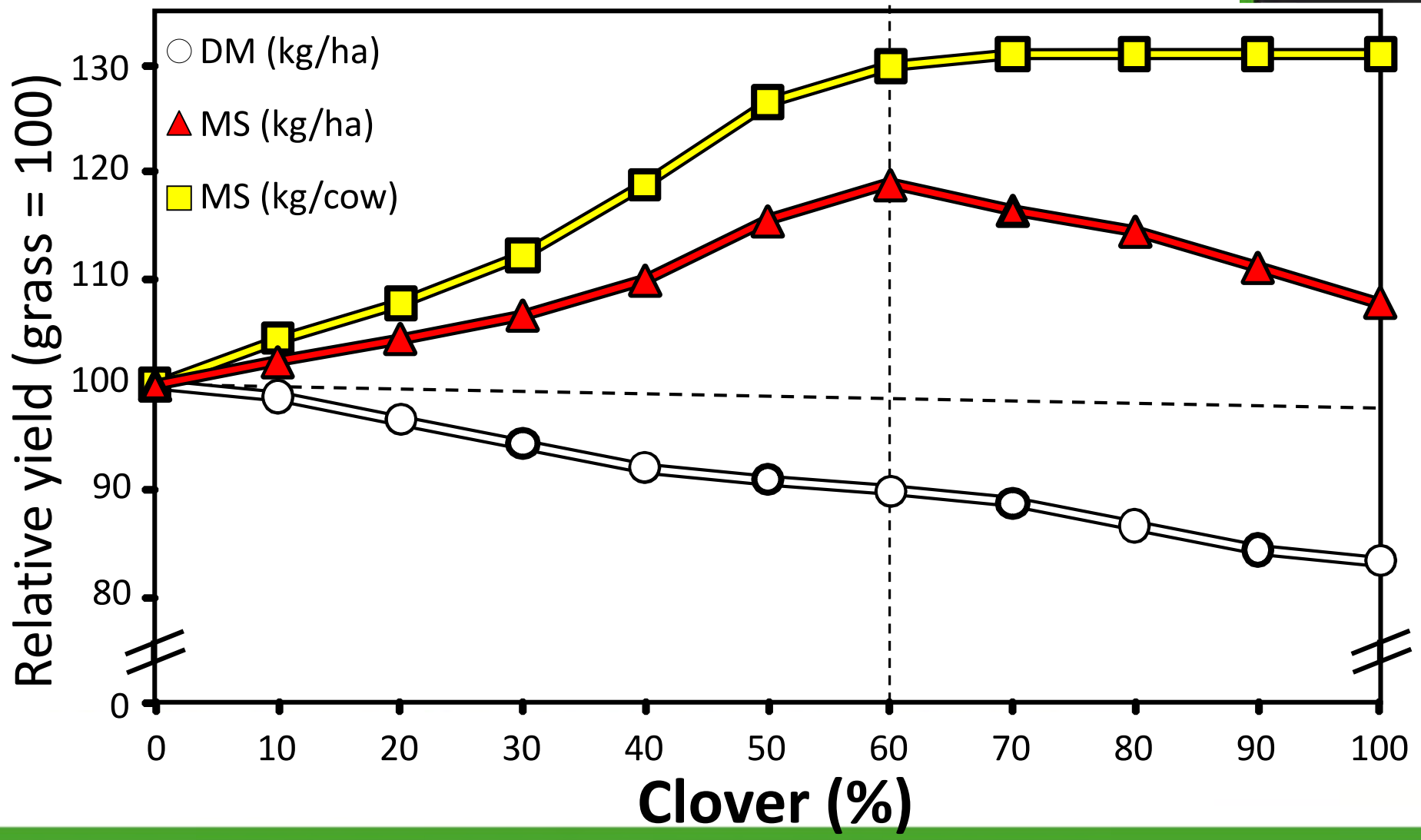
Perennial ryegrass cultivars

Source: National Forage Variety Trials (www.nzpbra.org)

Cows & sheep prefer 70% legume, 30% grass

Photo: Jo Grigg
'Tempello' Marlborough

Clover content & milksolids production



Cosgrove 2005

High feeding value pastures have;

- **high legume content**
- **high leaf content**
- **low stem content**
- **young herbage age**

INTERNATIONAL SHEEP RESEARCH CENTRE

Daily lamb live weight gains in summer/autumn when intake was maximised in experiments using ryegrass & white clover pastures as the control.

Forage	g/day	Range (No. expts)
Ryegrasses/ white clover	154	56 – 226 (10)
Herb/legume	246	246 – 247 (2)
Chicory	254	192 – 290 (3)
Plantain	214	207 – 222 (2)
Red clover	298	292 – 305 (2)
White clover	259	226 – 282 (3)
Lucerne	230	210 – 243 (3)
Birdsfoot trefoil	258	258 (1)
Leaf turnips	245	245 (1)
Mean	251	

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Adapted from Kemp *et al*. 2010


40% white clover

How to get more legume??

- Grass is a WEED!!!!! (in the eyes of clover)
- Understand competition: - Grass vs. Legume
  - Grazing preference
  - N, P, S, K – grass has more roots
  - Water – deep rooted perennials
  - Light – taller legumes?
- Management: -
  - Sow legume friendly grasses at low seeding rates
  - Grow legumes alone, overdrill grasses later?
  - Use a range of legume species & cultivars
  - Avoid N fertiliser on actively growing legume pastures

Conclusions

- Pasture yield is dictated by your biophysical environment – quantify it!
- Nitrogen limits leaf expansion and P/S
- Legumes are always under pressure!
- **Identify appropriate pasture legume before your companion grass**
- **Without controlled grazing systems legumes will not survive in pasture**

References and Links

Part 1: Temperate Pastures

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Part 2: Pasture (legume) management

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