Pasture responses to environment

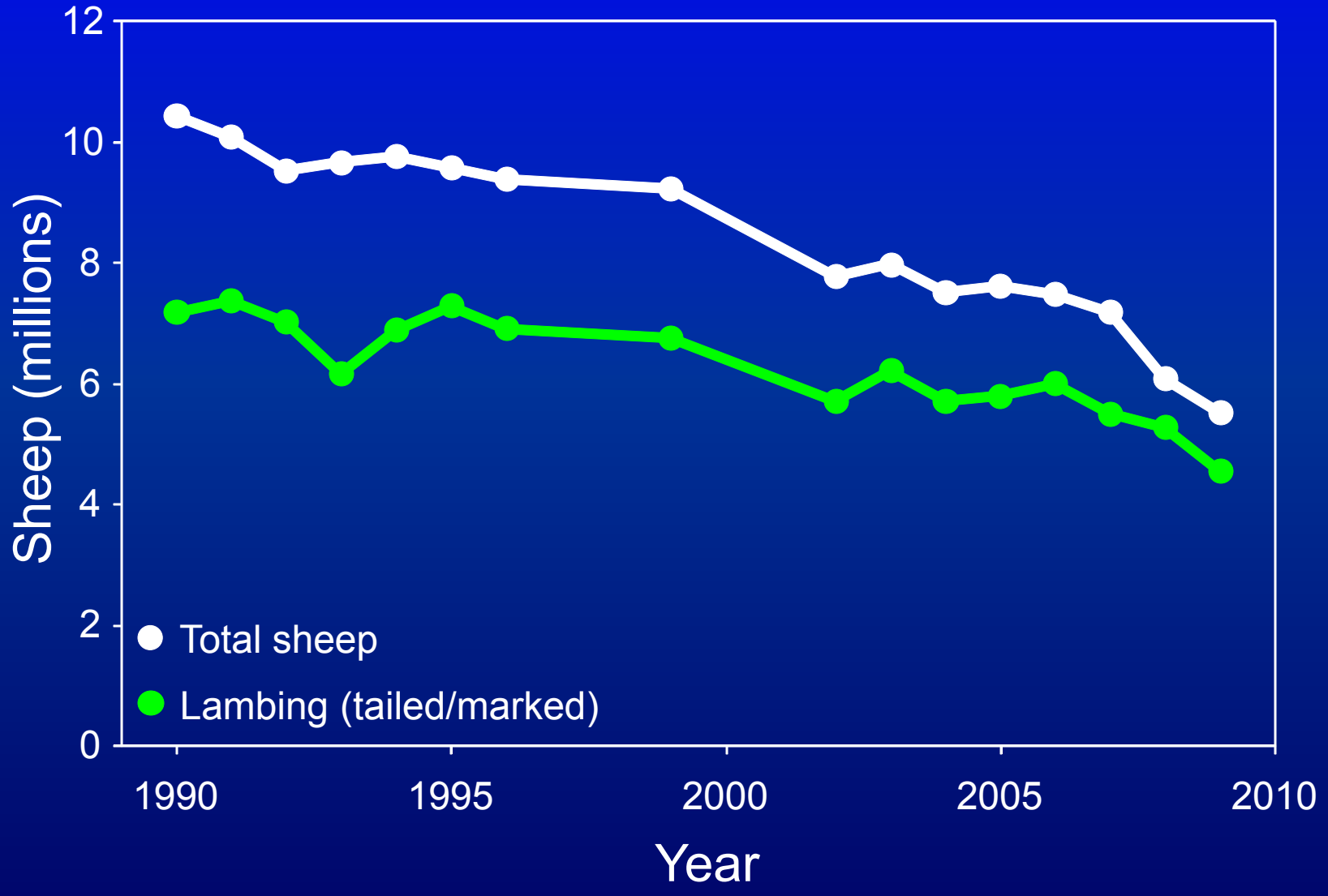
Professor Derrick Moot

Photo: WR Scott
Lincoln University

Lincoln University Dairy Farm

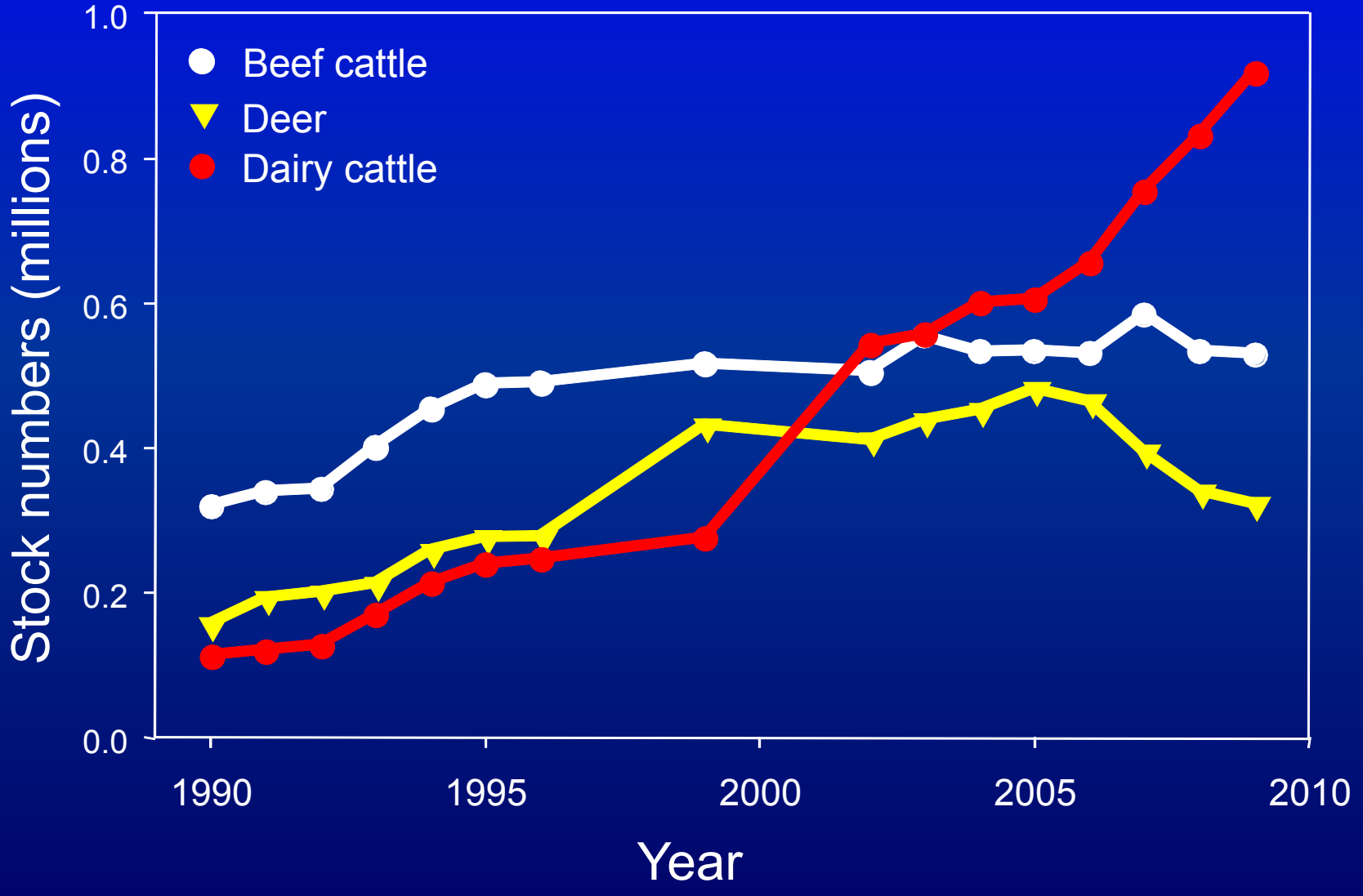
Forest conversion 100 000 ha

Canterbury.....sheep numbers

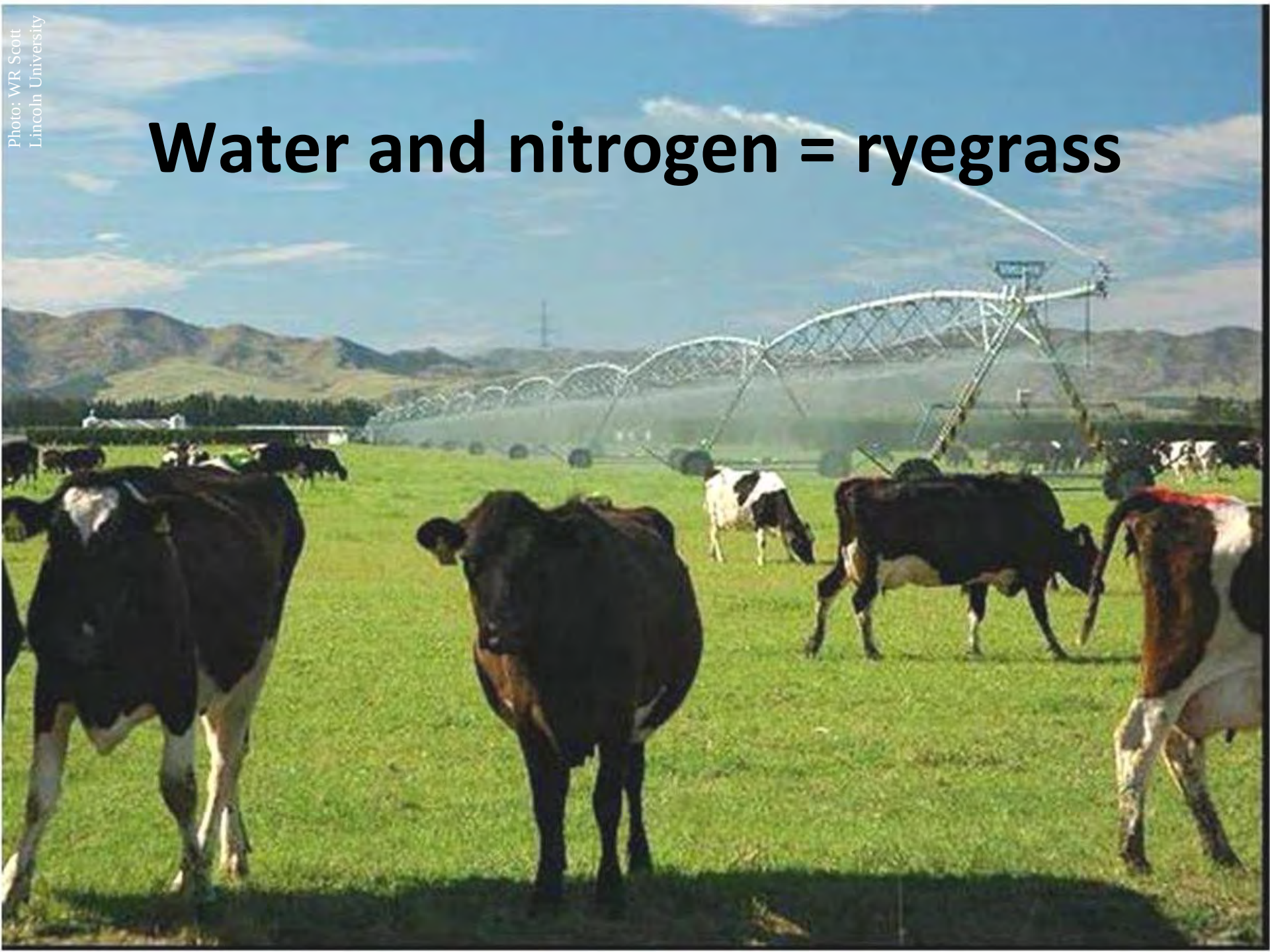


Source: Department of Statistics

Canterbury...deer & cattle numbers

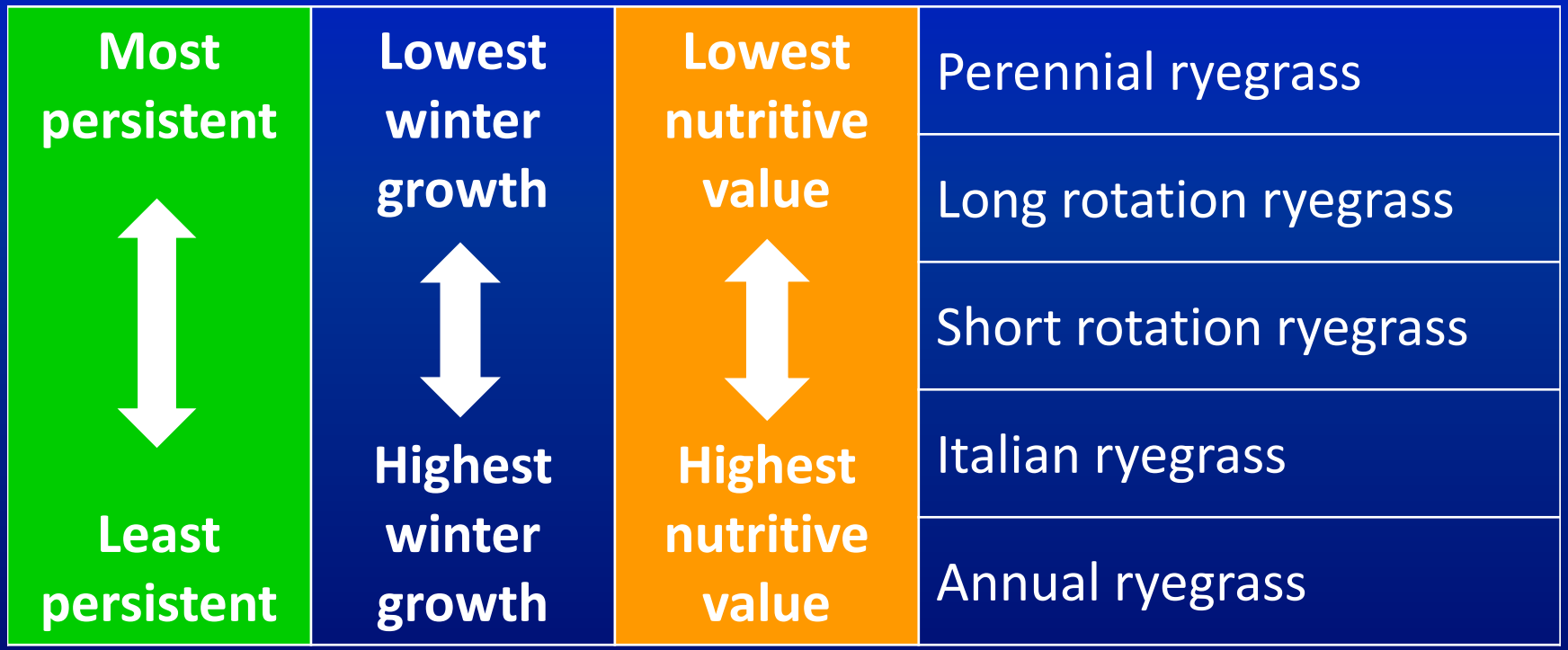


Source: Department of Statistics



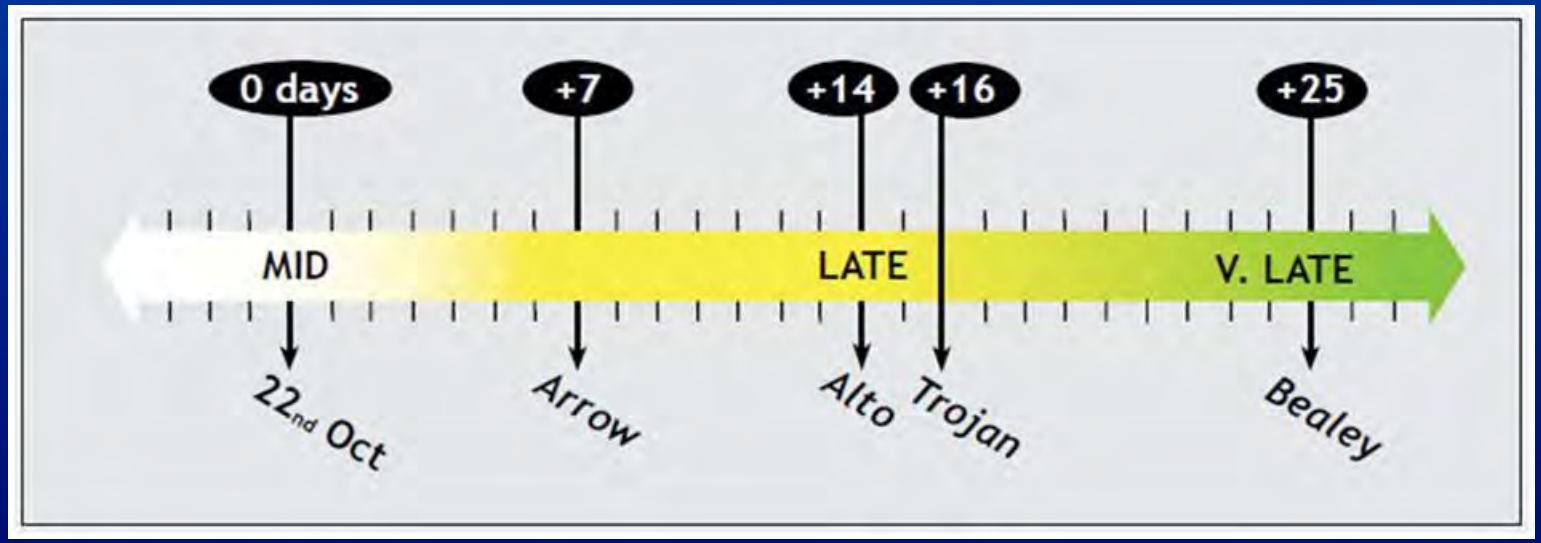
Water and nitrogen = ryegrass

The ryegrass continuum



Heading date

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

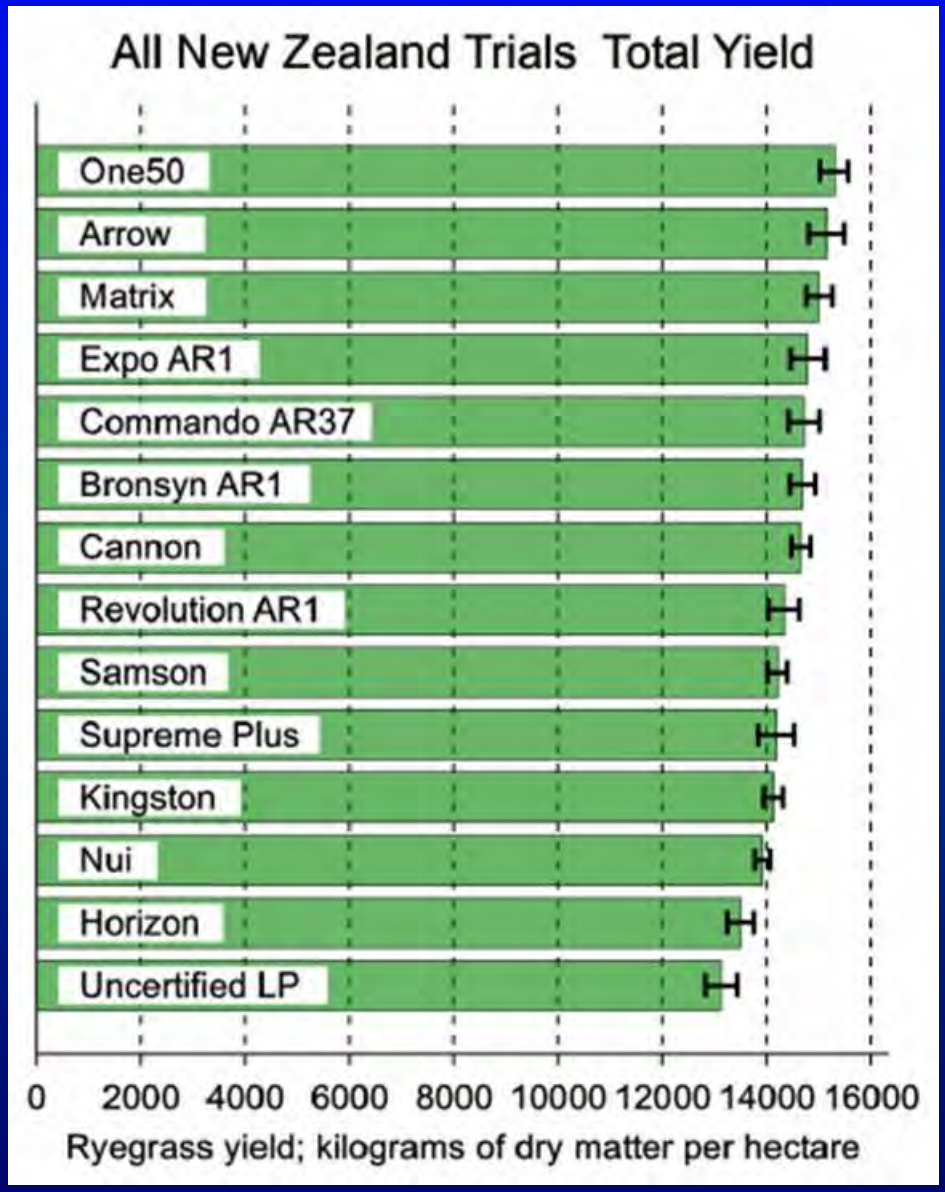


Source: www.agriseeds.co.nz

Forage variety trials

Photo: A Black
Lincoln University

Perennial ryegrass cultivars



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

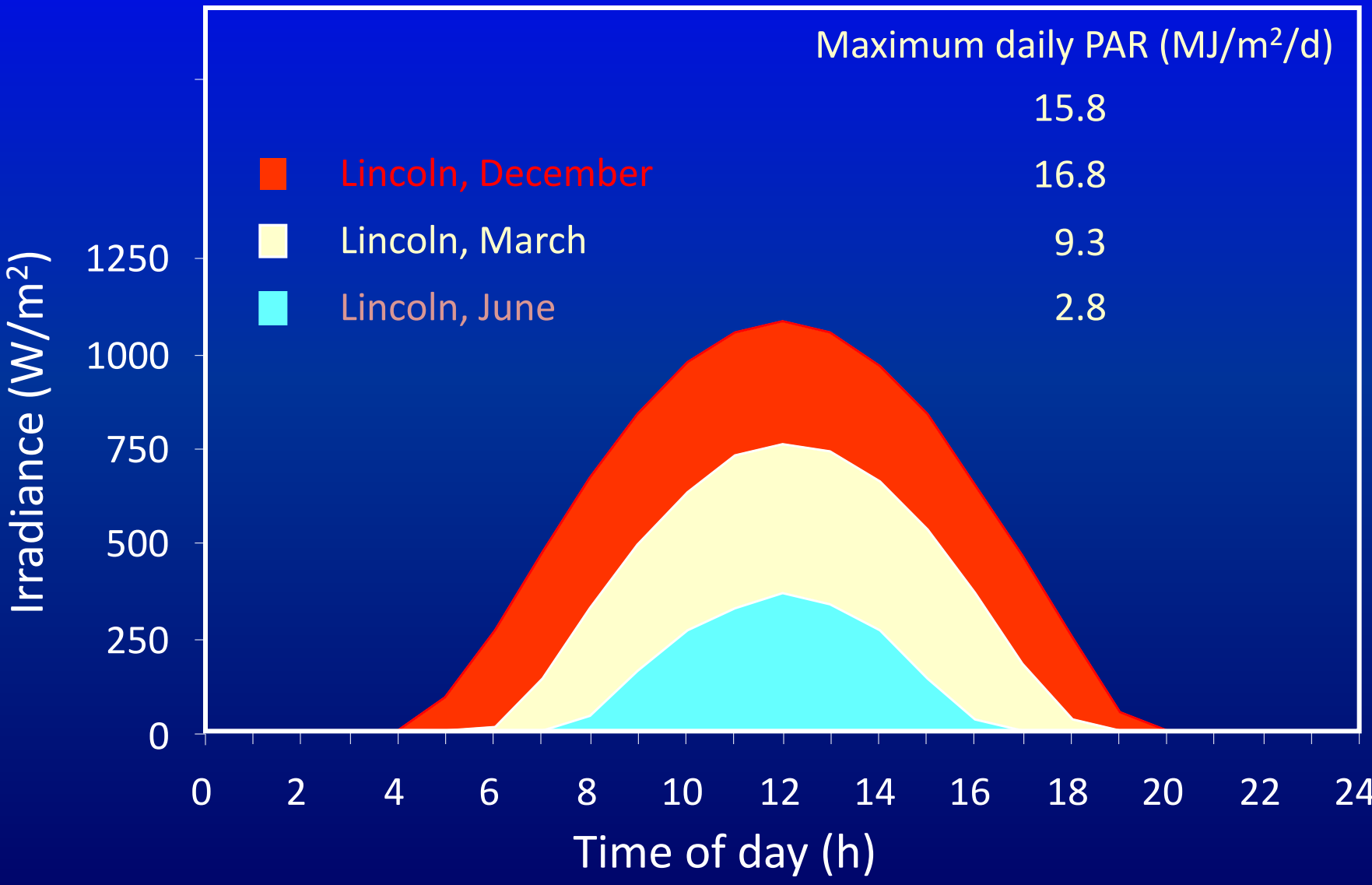
Light

- Photosynthetically active radiation (PAR) is in the visible range (400-700nm).

- Conversion of PAR to DM

~2.5 g DM/MJ/m^2 for C3 plants
~3.8 g DM/MJ/m^2 for C4 plants

Clear sky global irradiance (W/m^2)



Pasture production in Canterbury

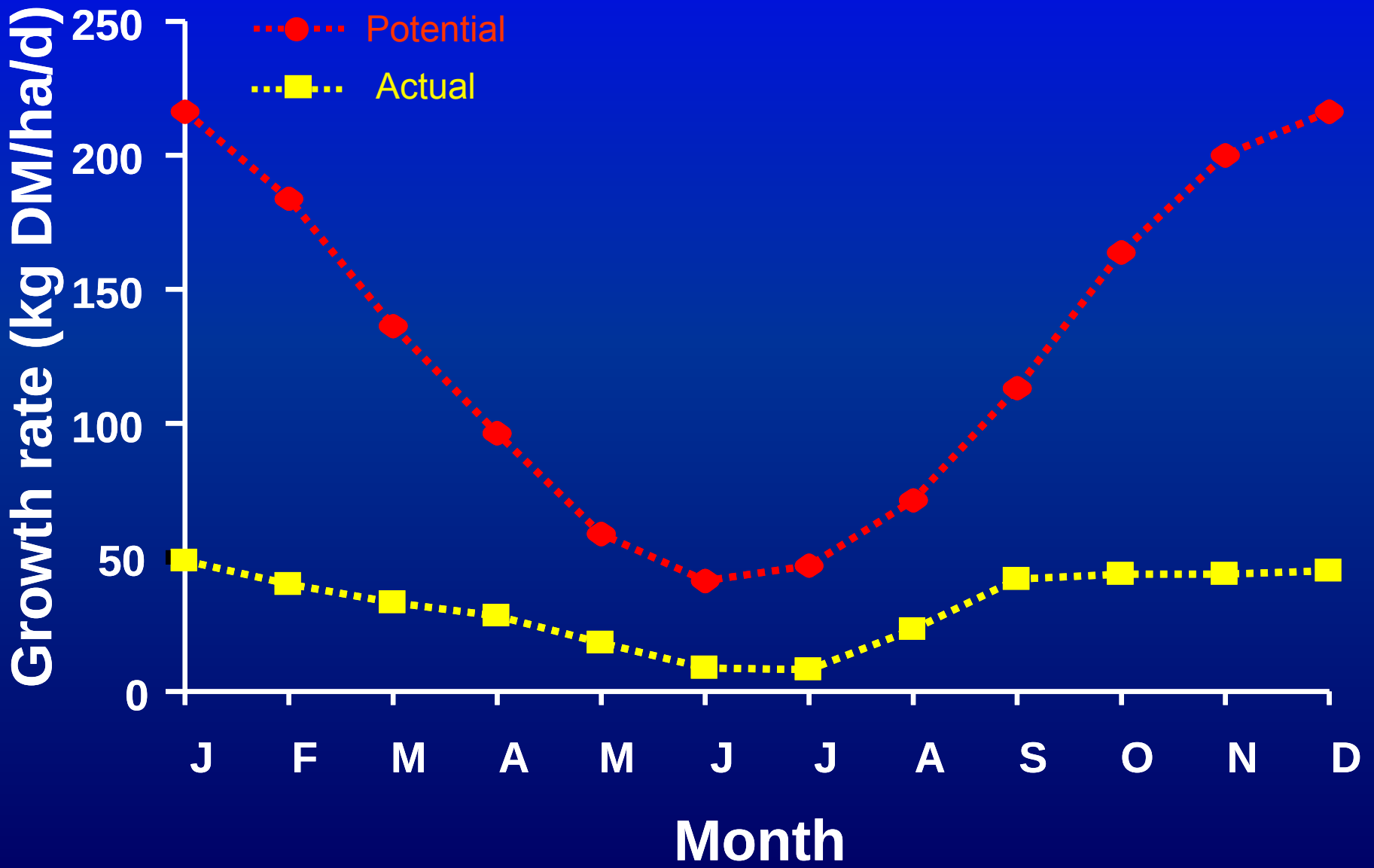
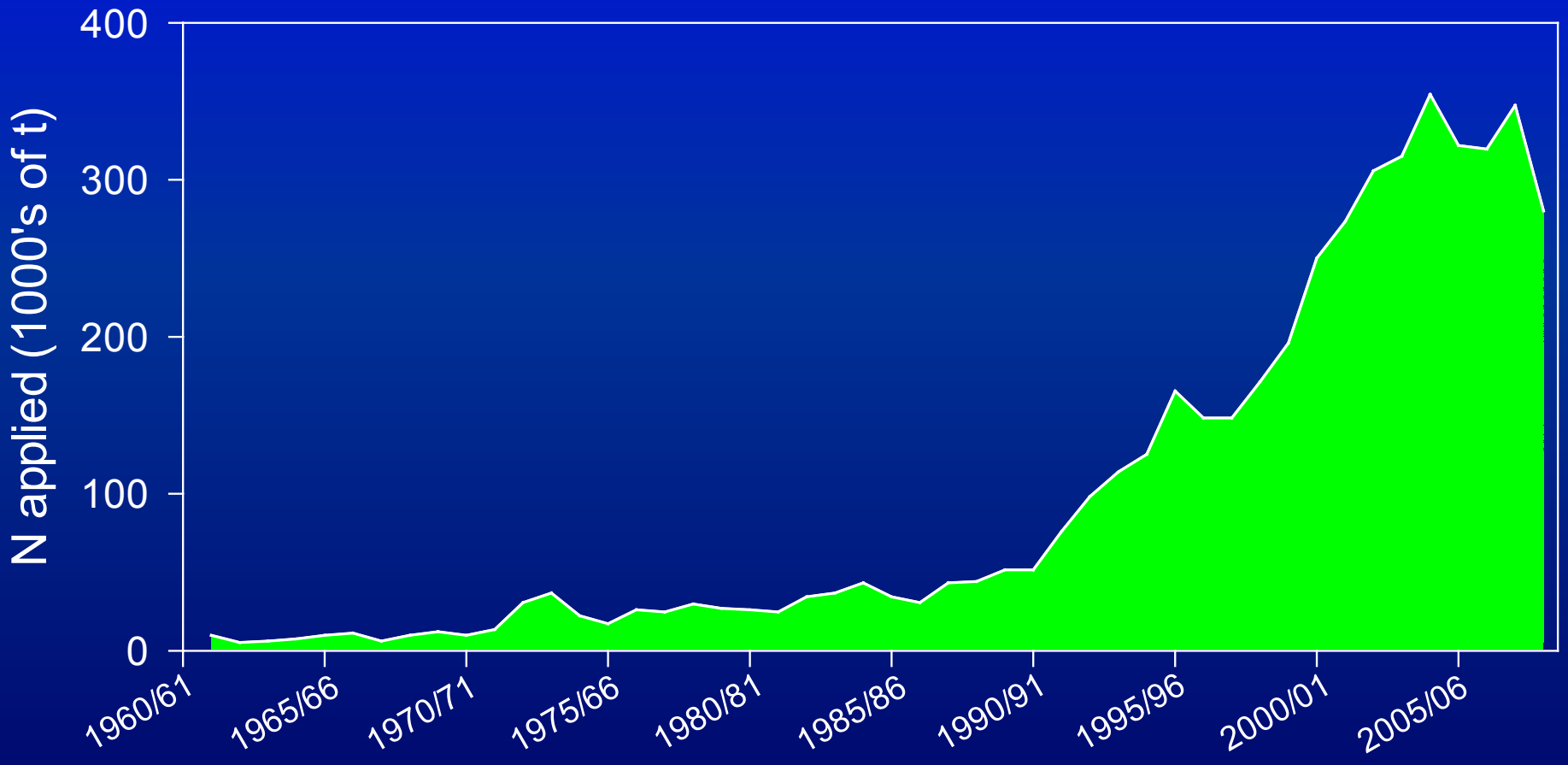


Photo: A Black
Lincoln University

Nitrogen deficient pasture

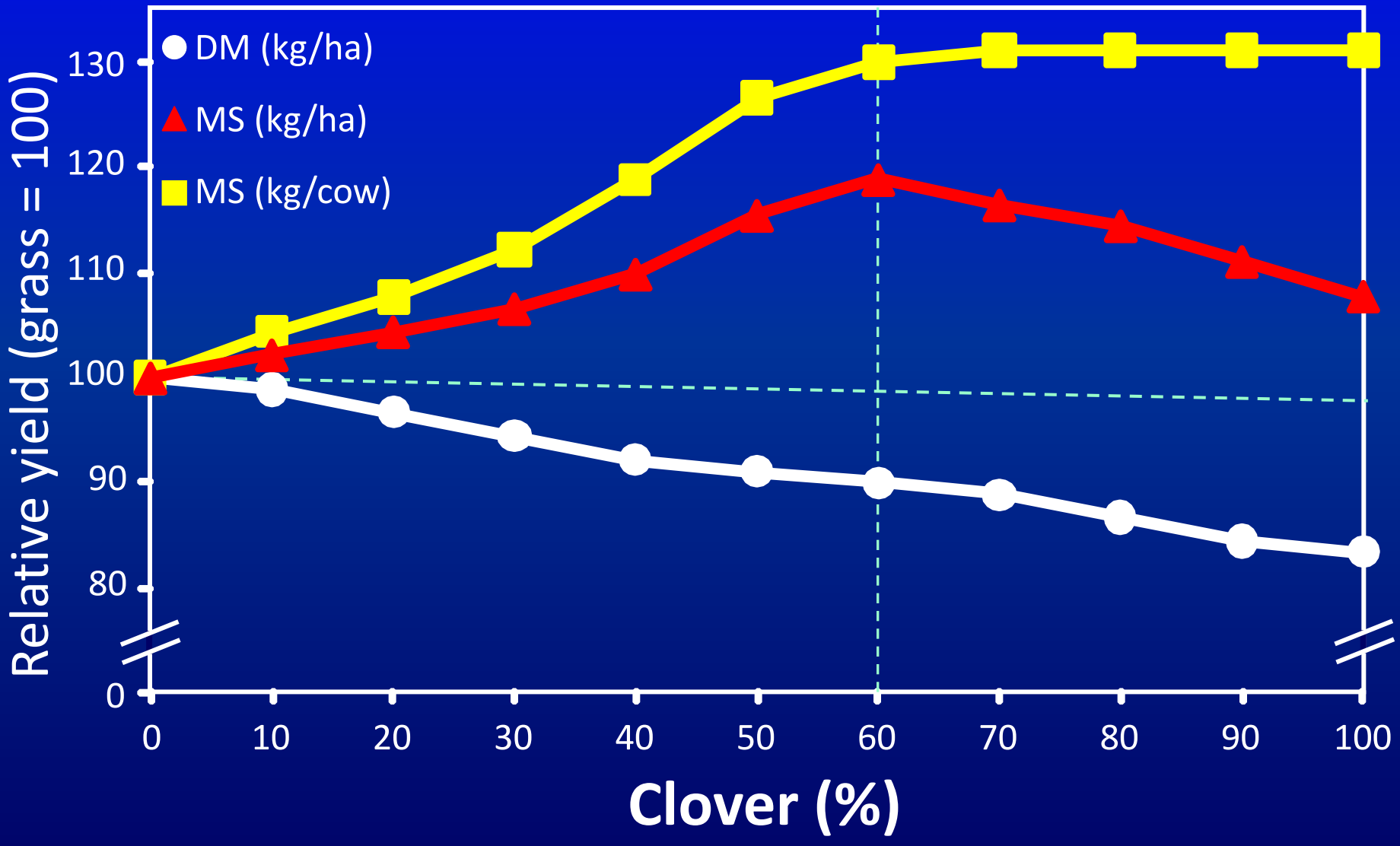
1000 kg N/ha

Nitrogen fertiliser use



Source: New Zealand Fertiliser Manufacturers' Research Association

Clover content & milksolids production



Source: Cosgrove 2005

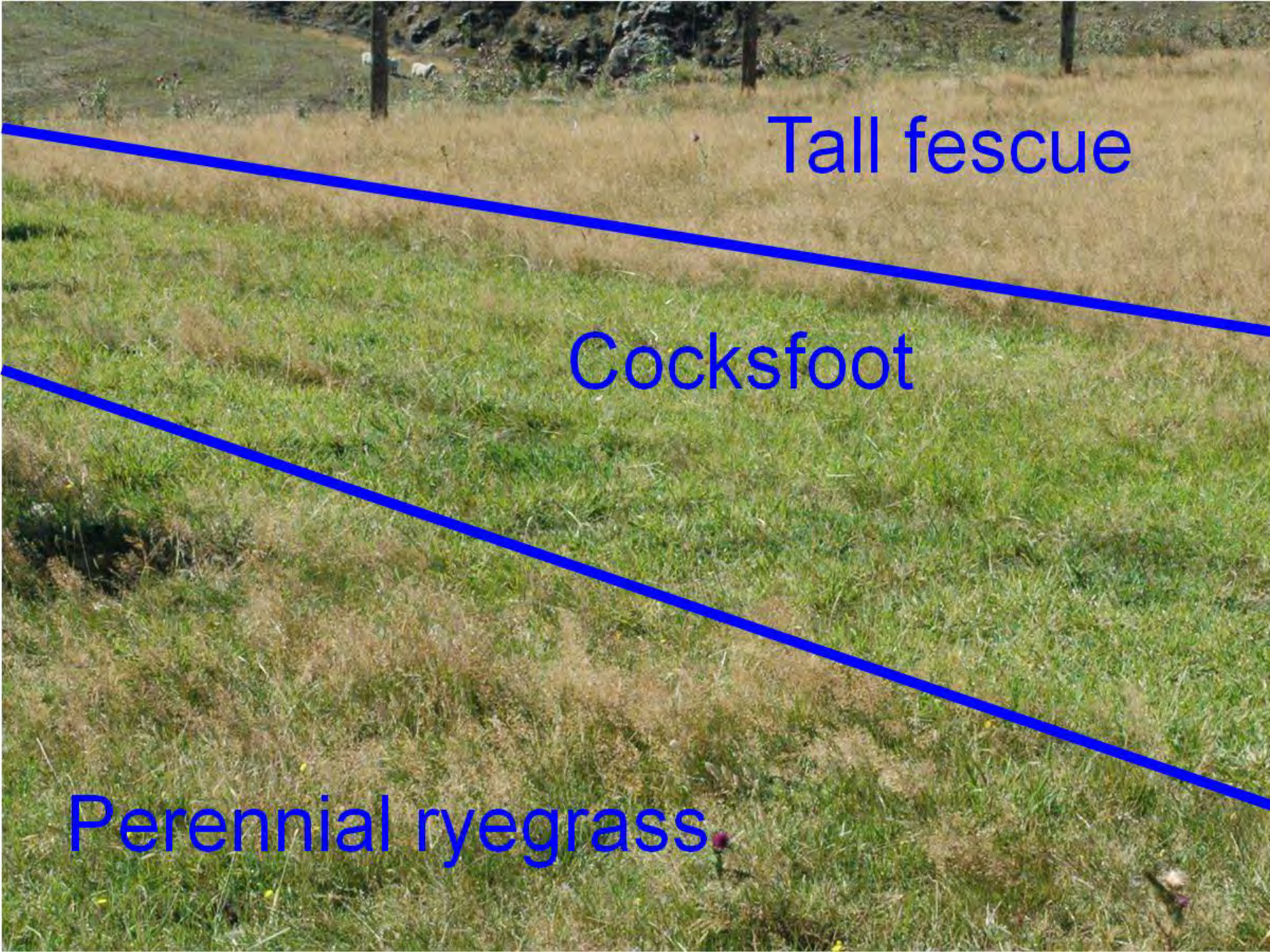
Sheep prefer 70% legume, 30% grass

RG/Wc pastures

Unsown species

<5% in Year 1

>45% in Year 6


Tall fescue
Cocksfoot
Perennial ryegrass

Objective

Quantify the effect of temperature, moisture and nitrogen on cocksfoot yields.

Experiment site

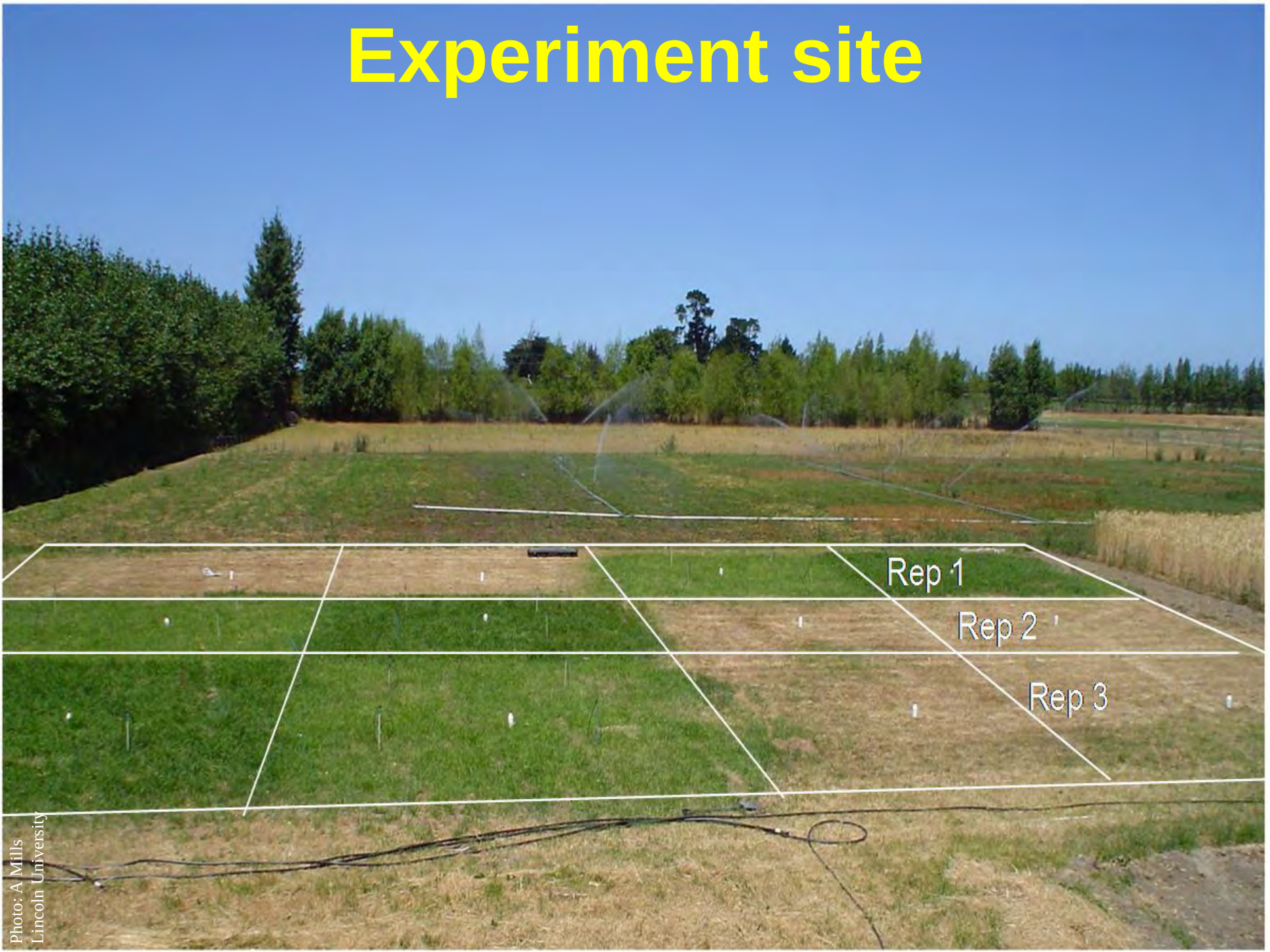
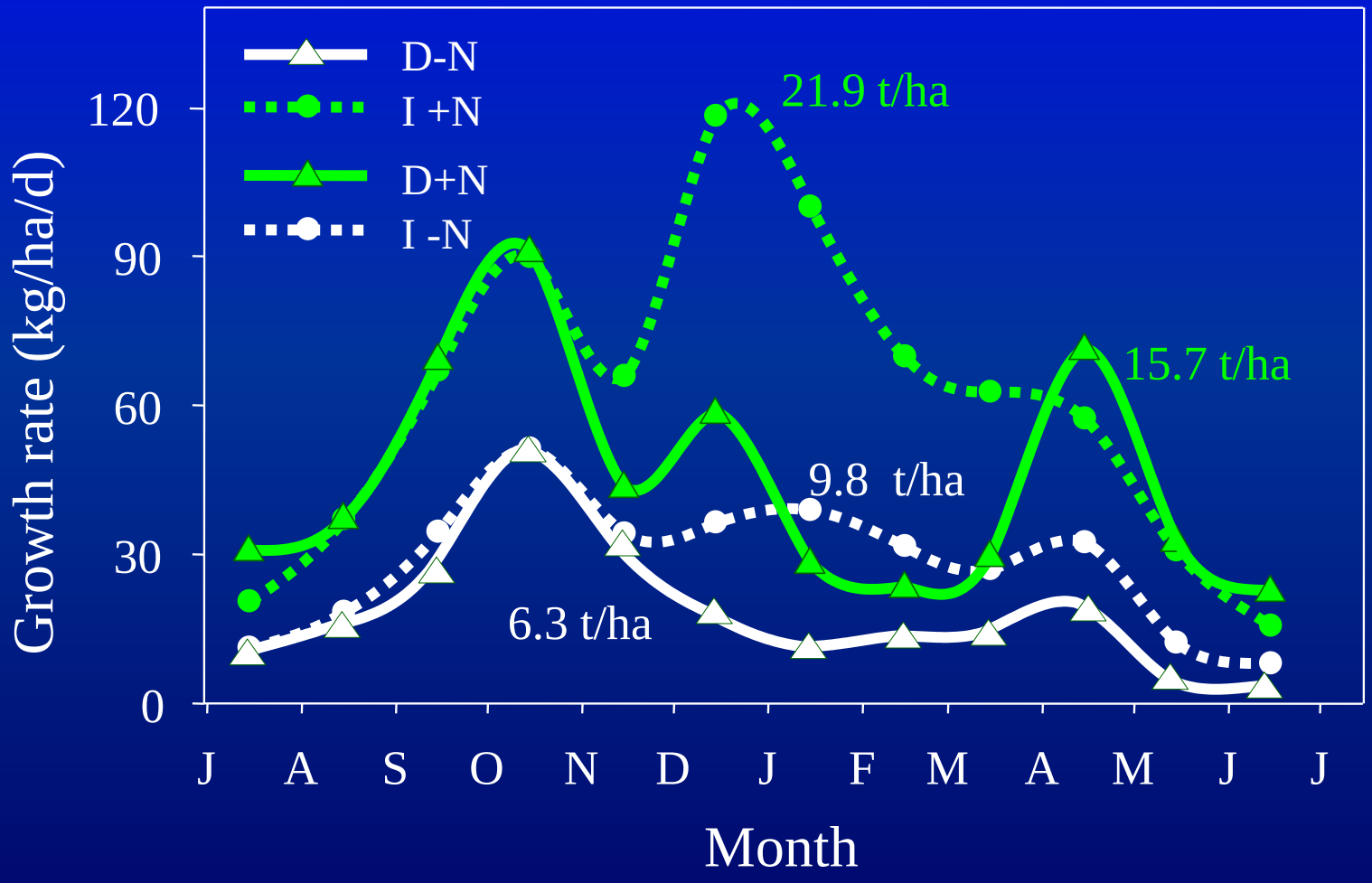


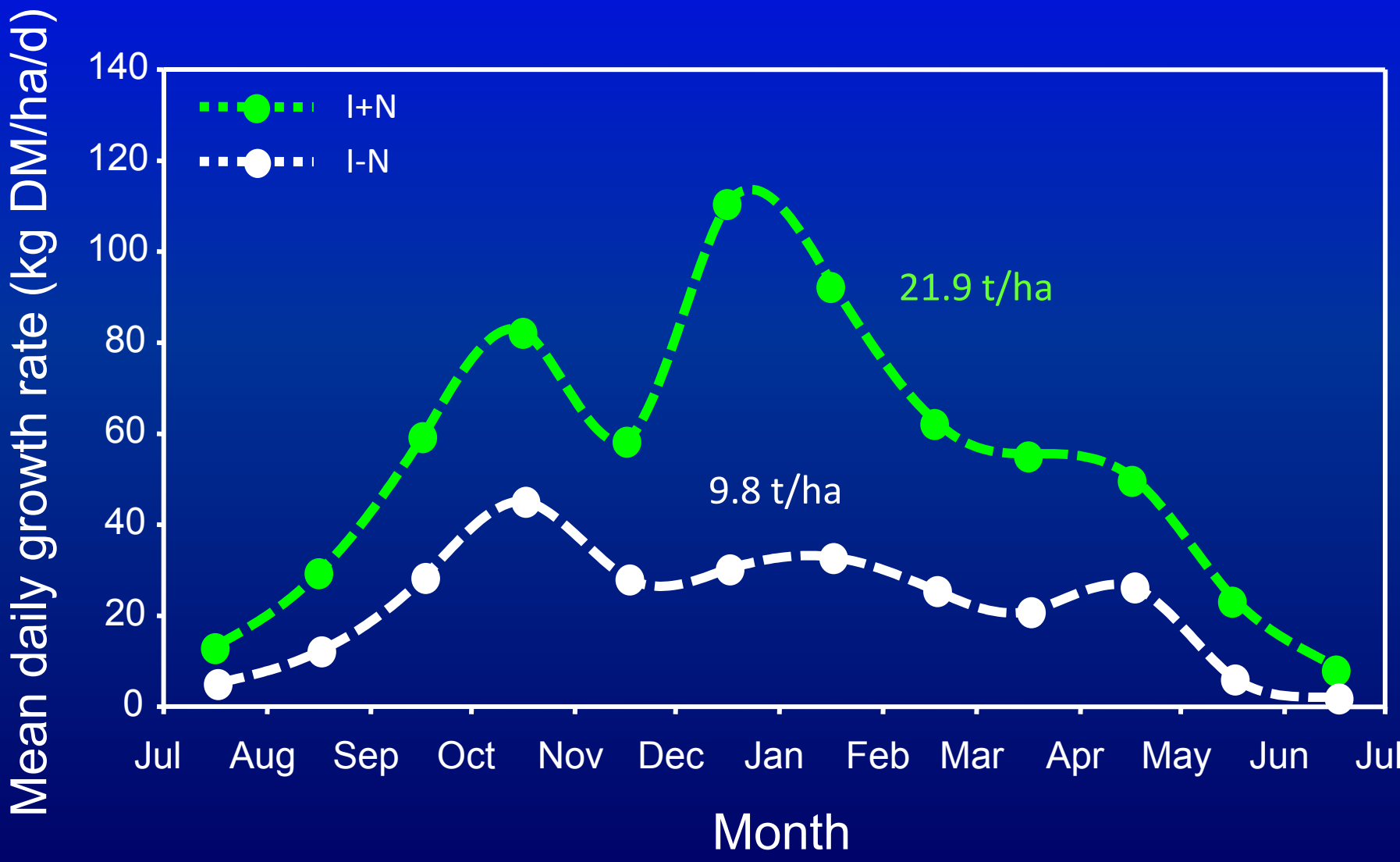
Photo: A Mills
Lincoln University

Growth rates (2 year means)



Source: Mills *et al*. 2006

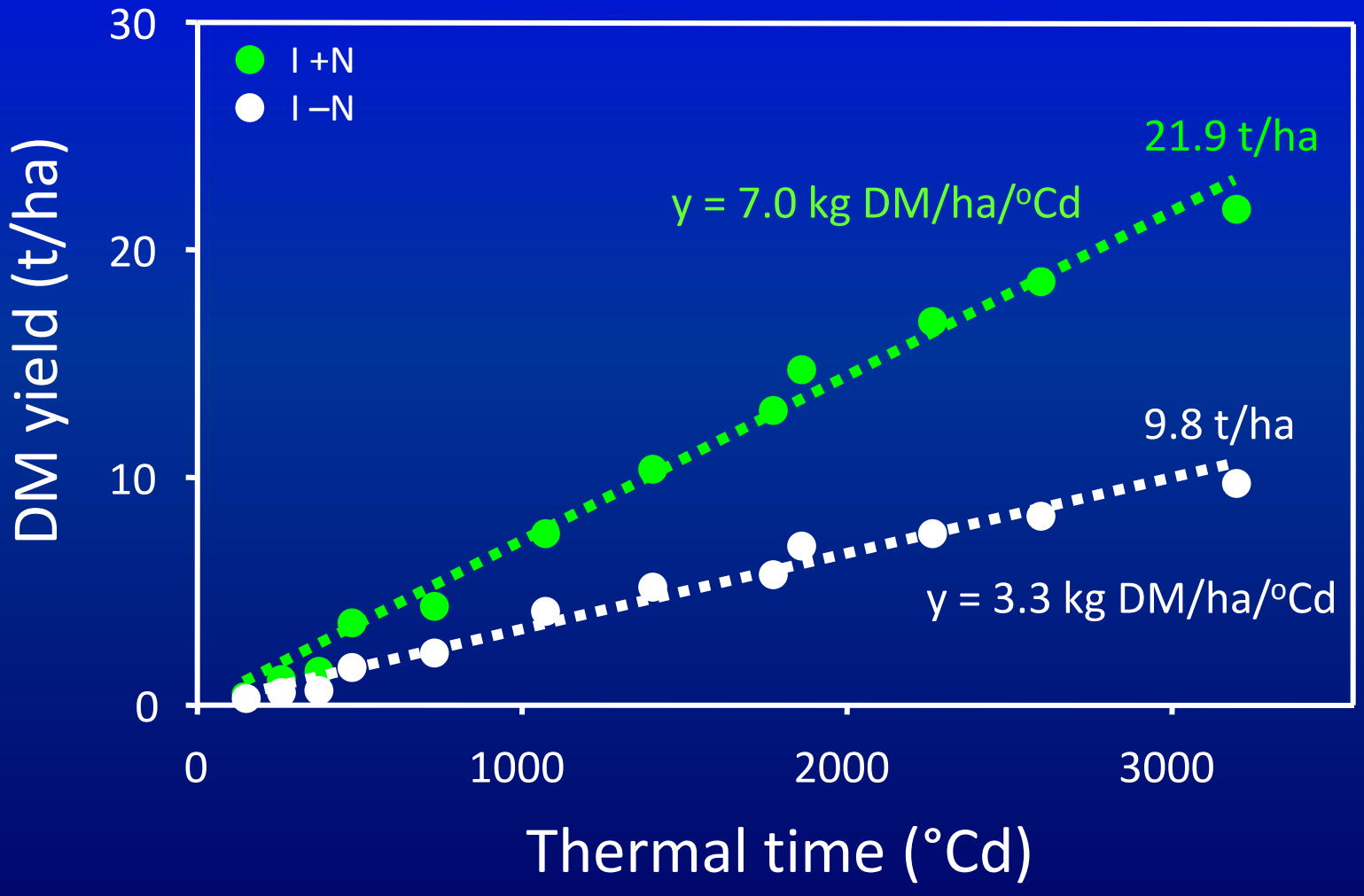
Pasture Growth Rates – 2 yr mean



Source: Mills *et al*. 2006


Winter ⇒ temperature response

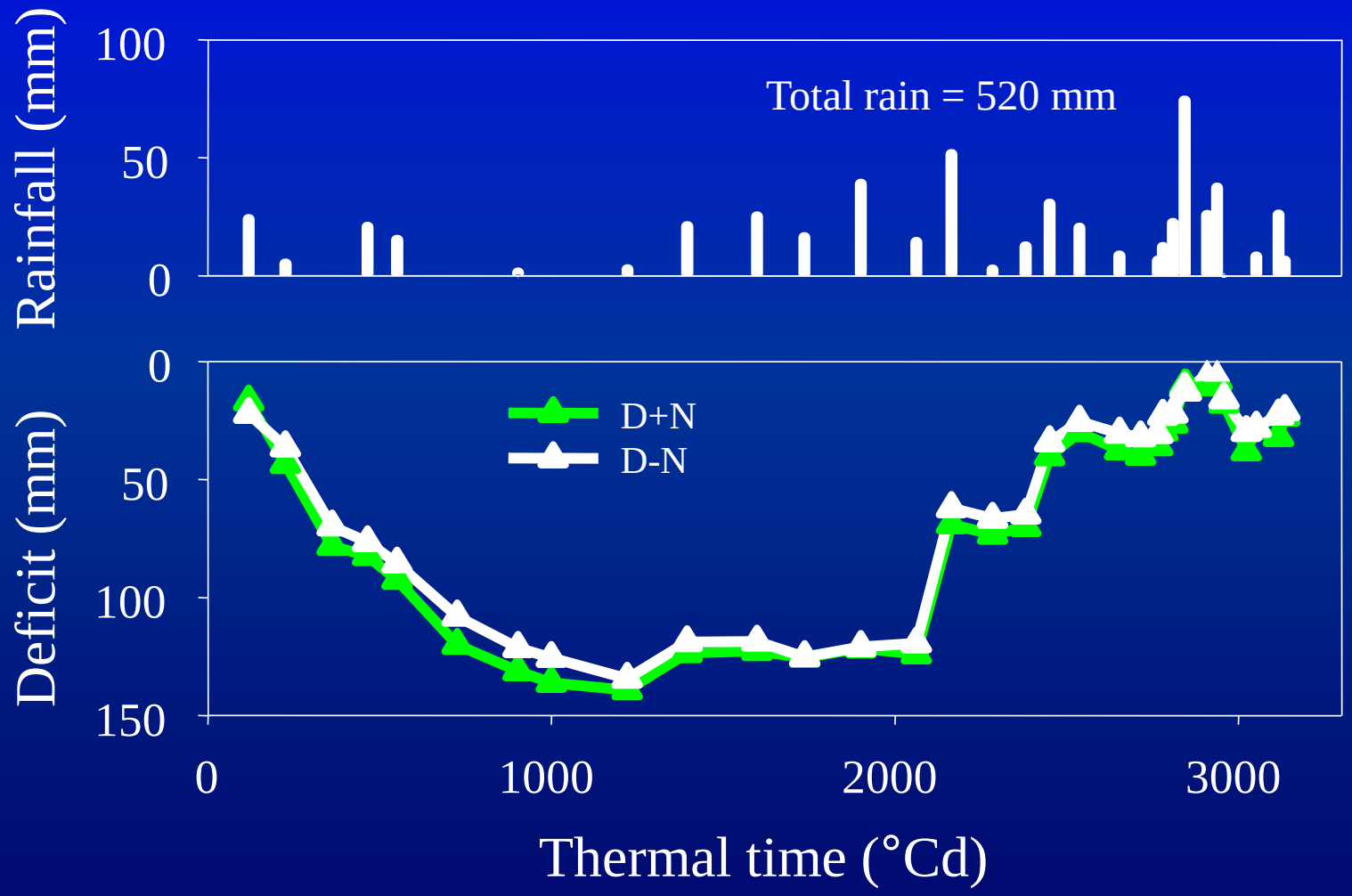
The Nitrogen gap



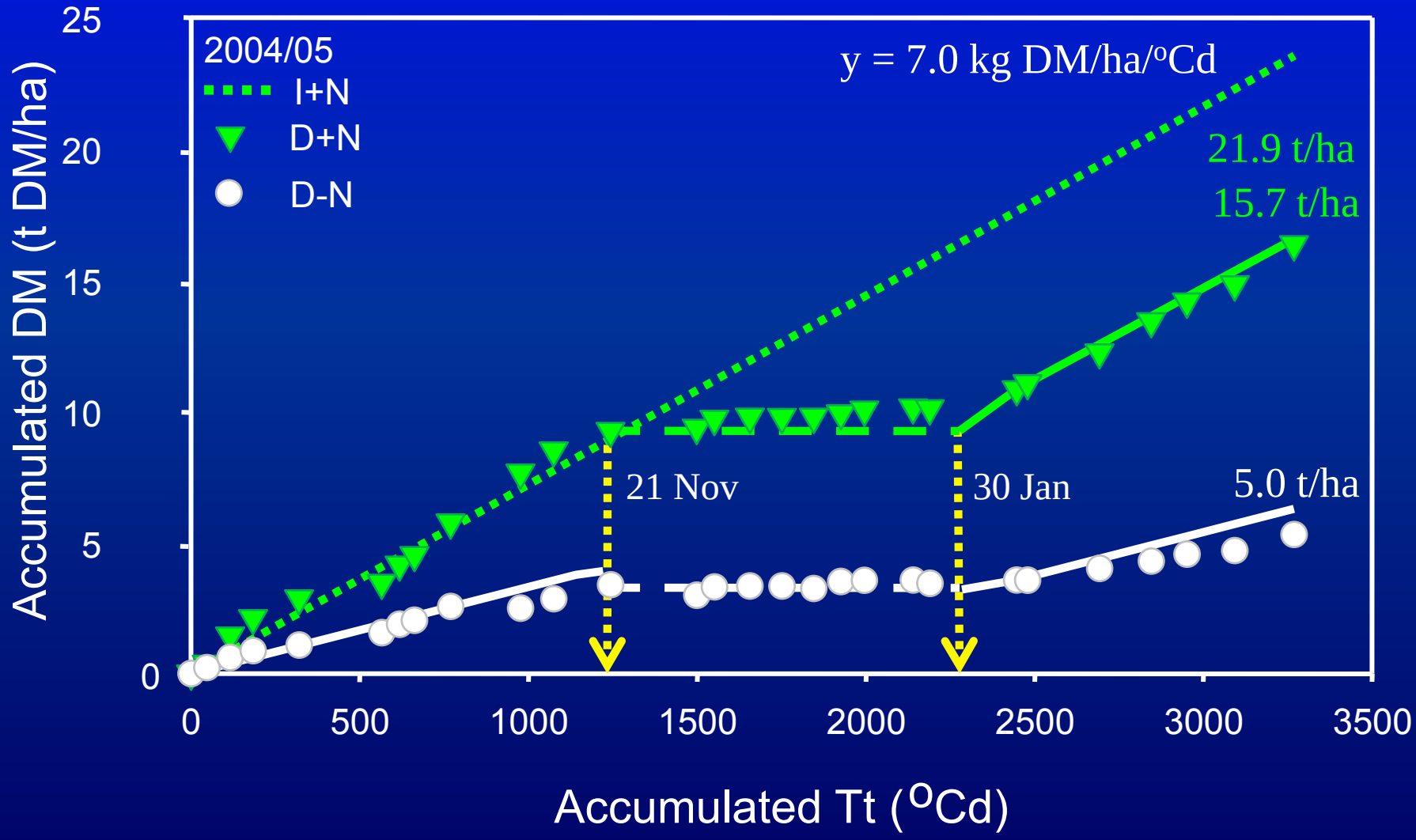
Source: Mills *et al*. 2006


Summer ⇒ moisture response

Soil moisture deficit 2003/04



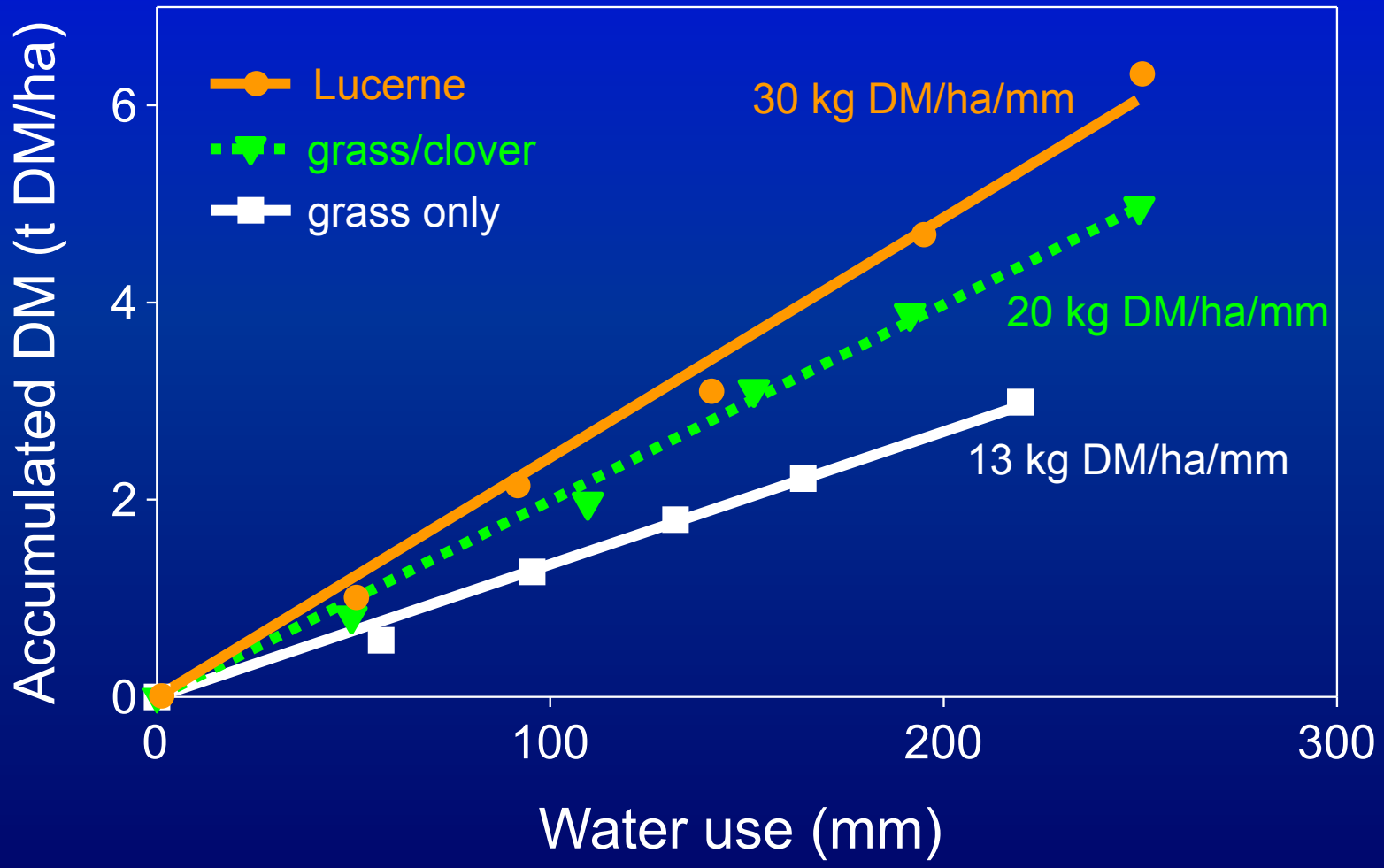
Source: Mills *et al*. 2006



Source: Mills *et al*. 2006

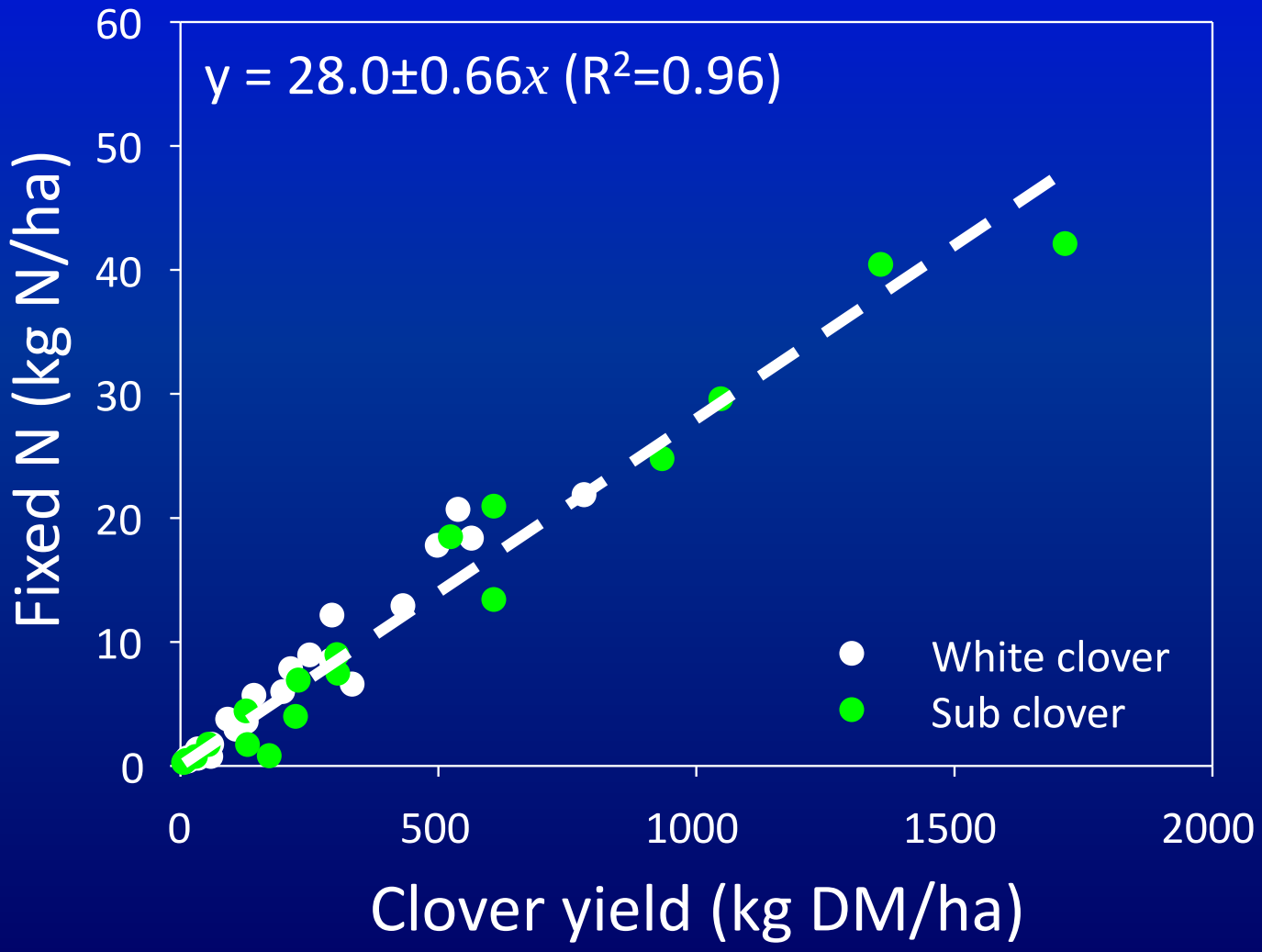

Photo: DP Monks
Lincoln University
Nitrogen fixation
25 kg N/t DM

Spring WUE: legume = (nitrogen)



Source: Moot *et al*. 2008

Biological N fixation



Source: Lucas *et al*. 2010


By 2030 - Drier:
Drought – increased duration and frequency
Annual and tap rooted dryland pasture species?
Photo: DJ Moot
Lincoln University

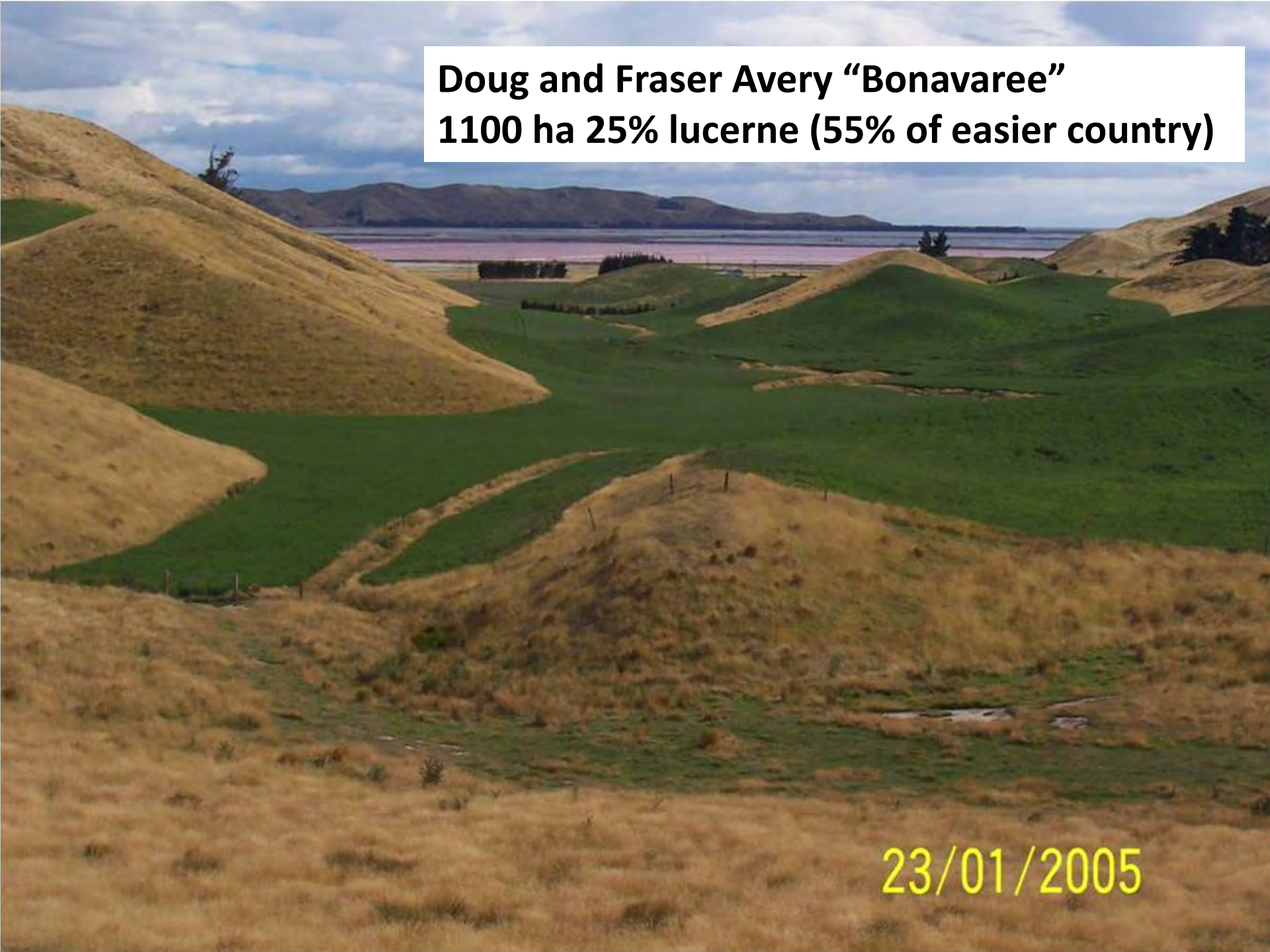
Transformational change
&
Adaptation to climate change

Source: Kearney *et al.* 2010

Hills Creek Station

- 60 000 ha by one company -

Source: Kearney *et al.* 2010


Doug and Fraser Avery “Bonavaree”
1100 ha 25% lucerne (55% of easier country)
23/01/2005

Lucerne + cocksfoot

Lucerne + Prairie grass

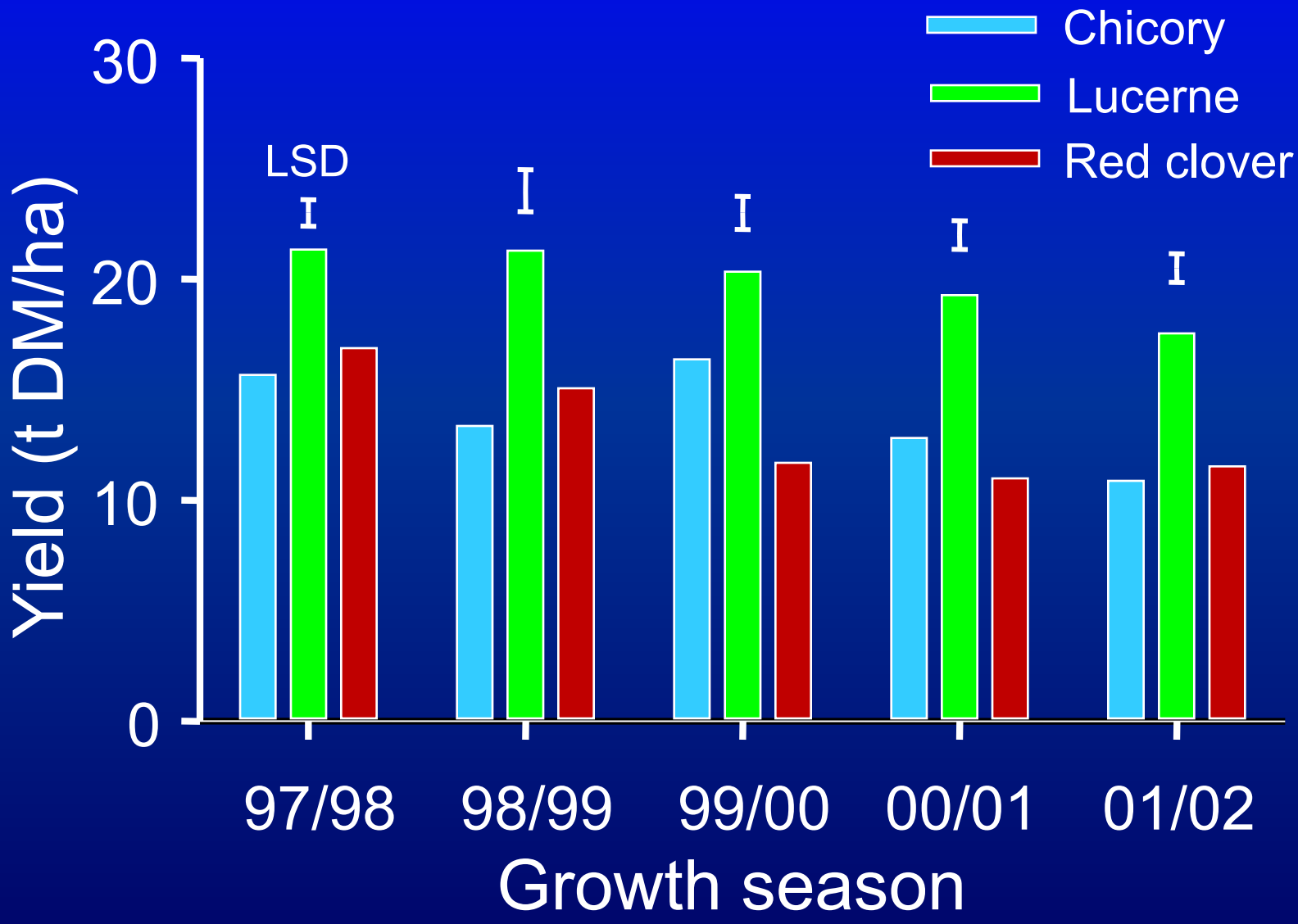
Growth in the field

20 month old plants – grazed by sheep

Photo: K Widdup
AgResearch

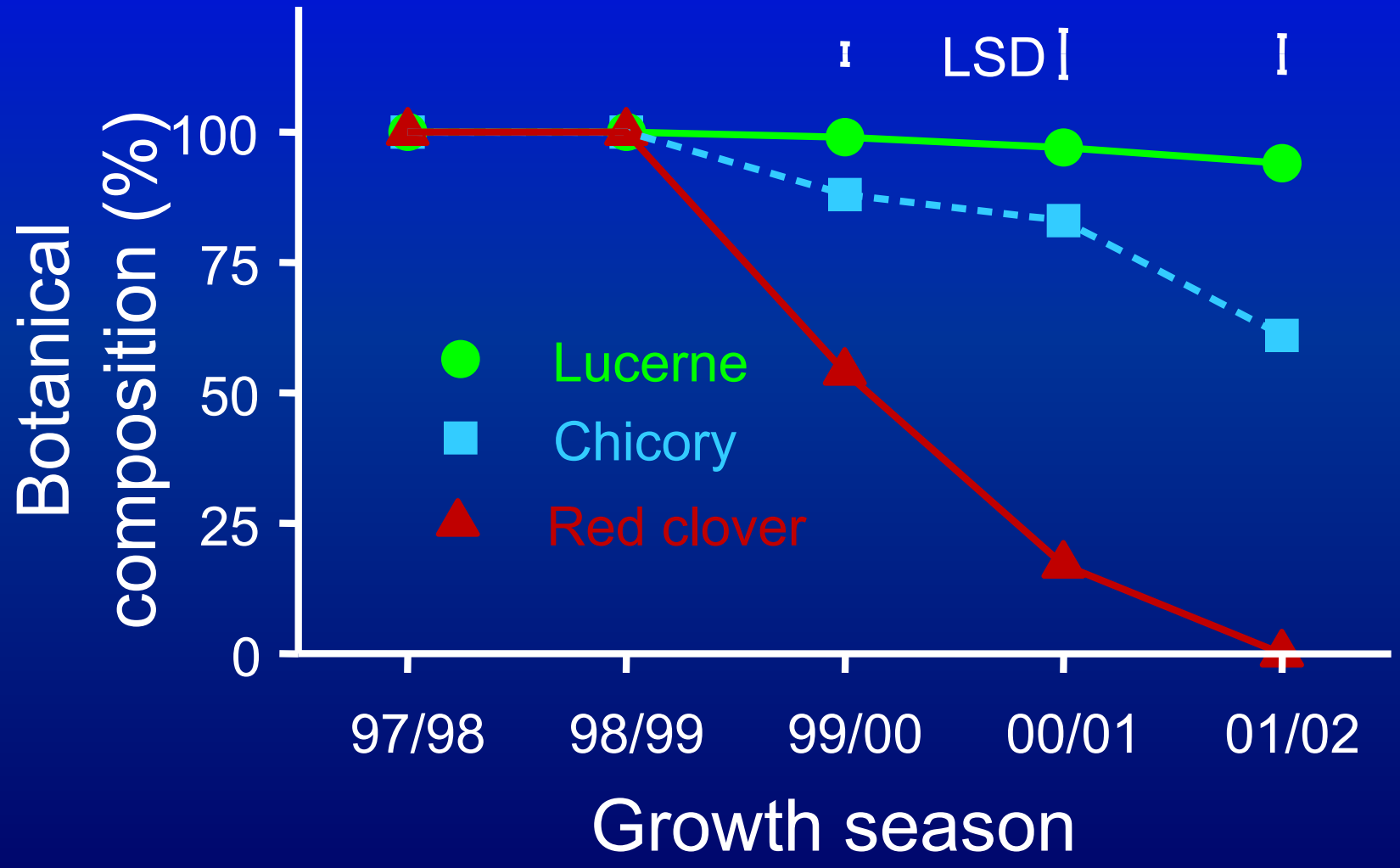
Source: Widdup et al. 2003

Annual dry matter yields



Source: Brown *et al*. 2005

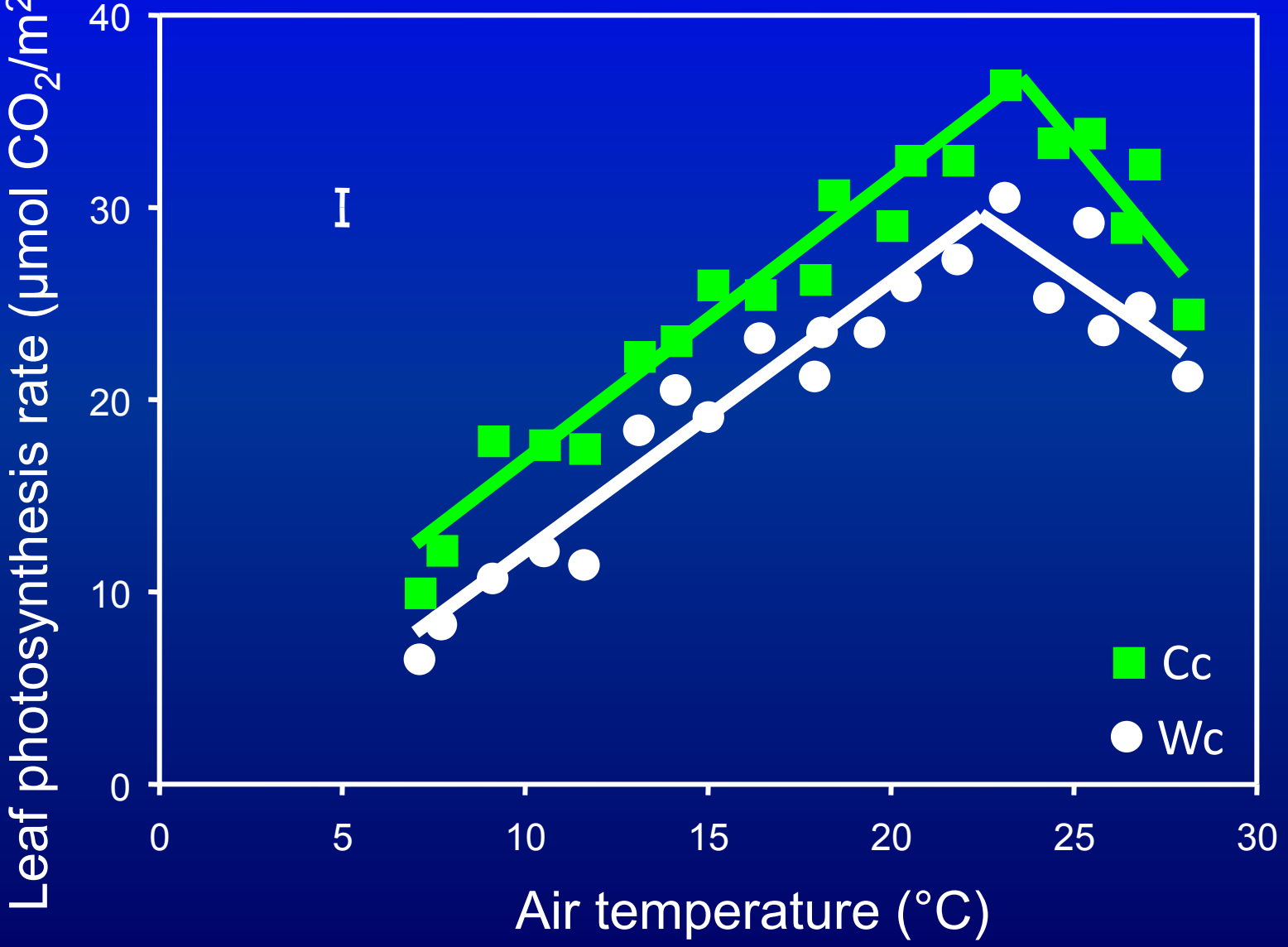
Persistence



Source: Brown *et al*. 2004

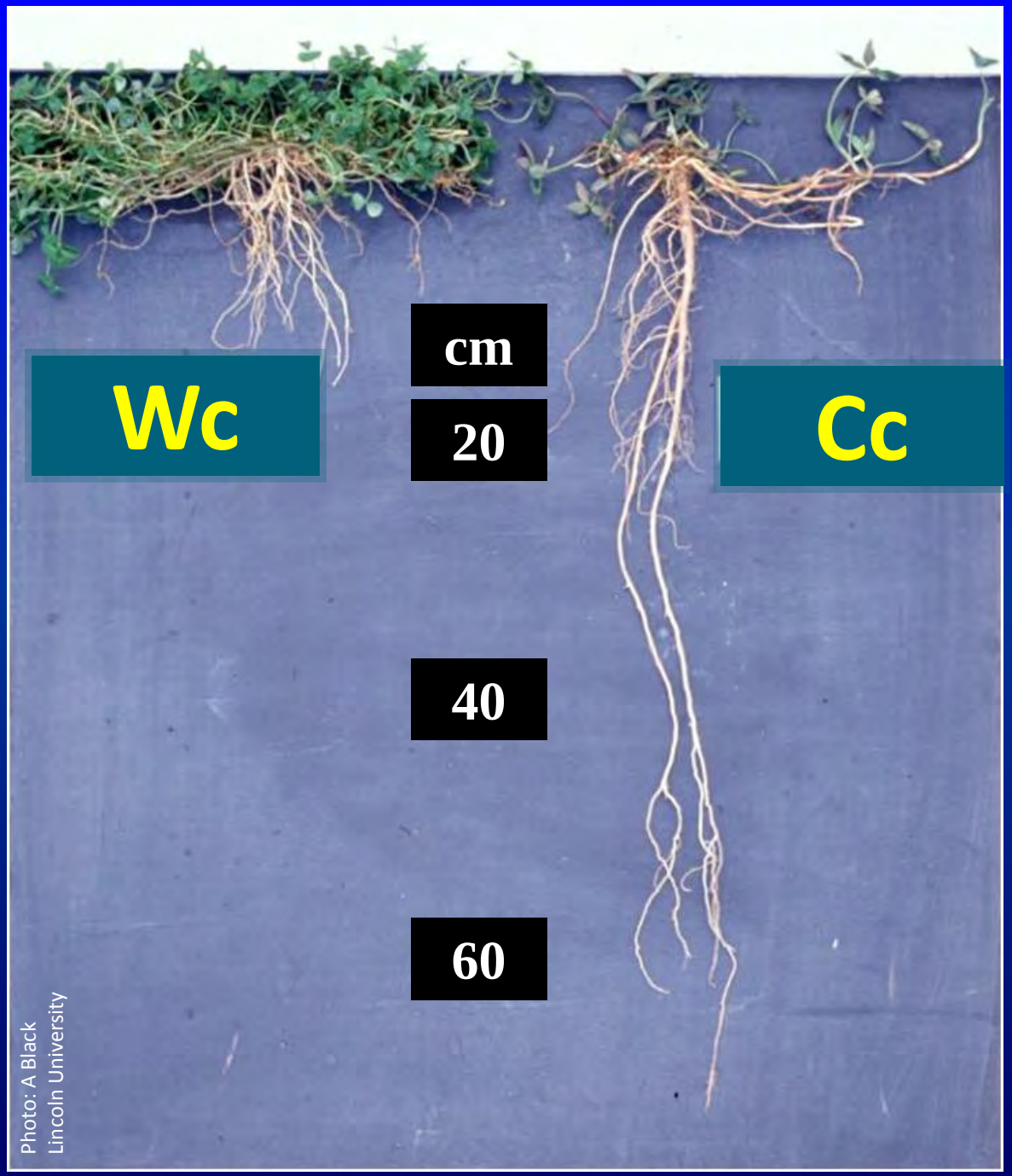
Caucasian clover

Caucasian vs. white clover



Source: Black *et al*. 2003

2 years after sowing



Source: Hurst *et al*. 2000


9 year old pasture

Tall fescue/Caucasian

90% cover, 60% clover DM on offer

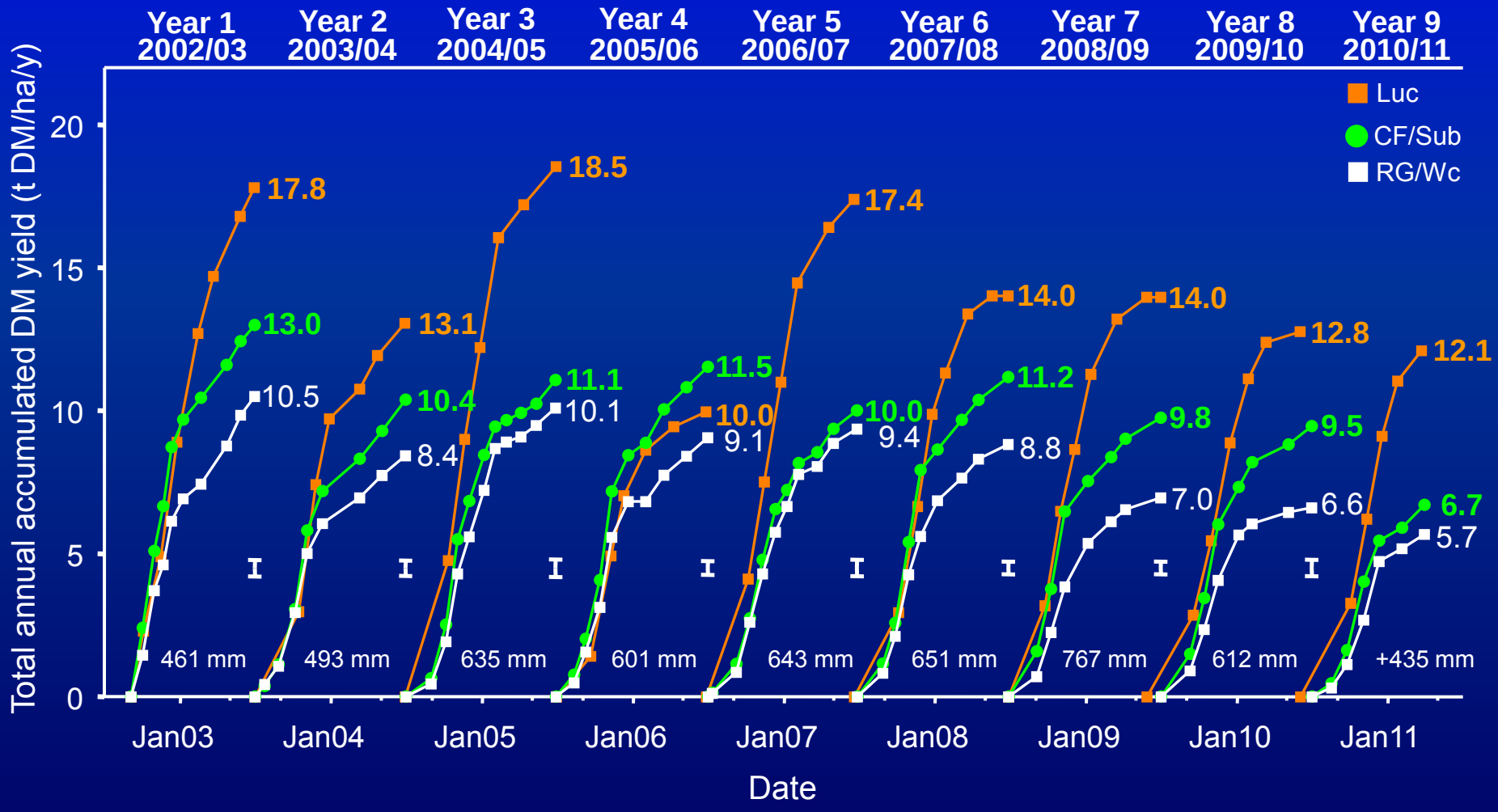

Temporal separation


Olsen P <6


Olsen P >20

‘MaxClover’ Total DM Yields

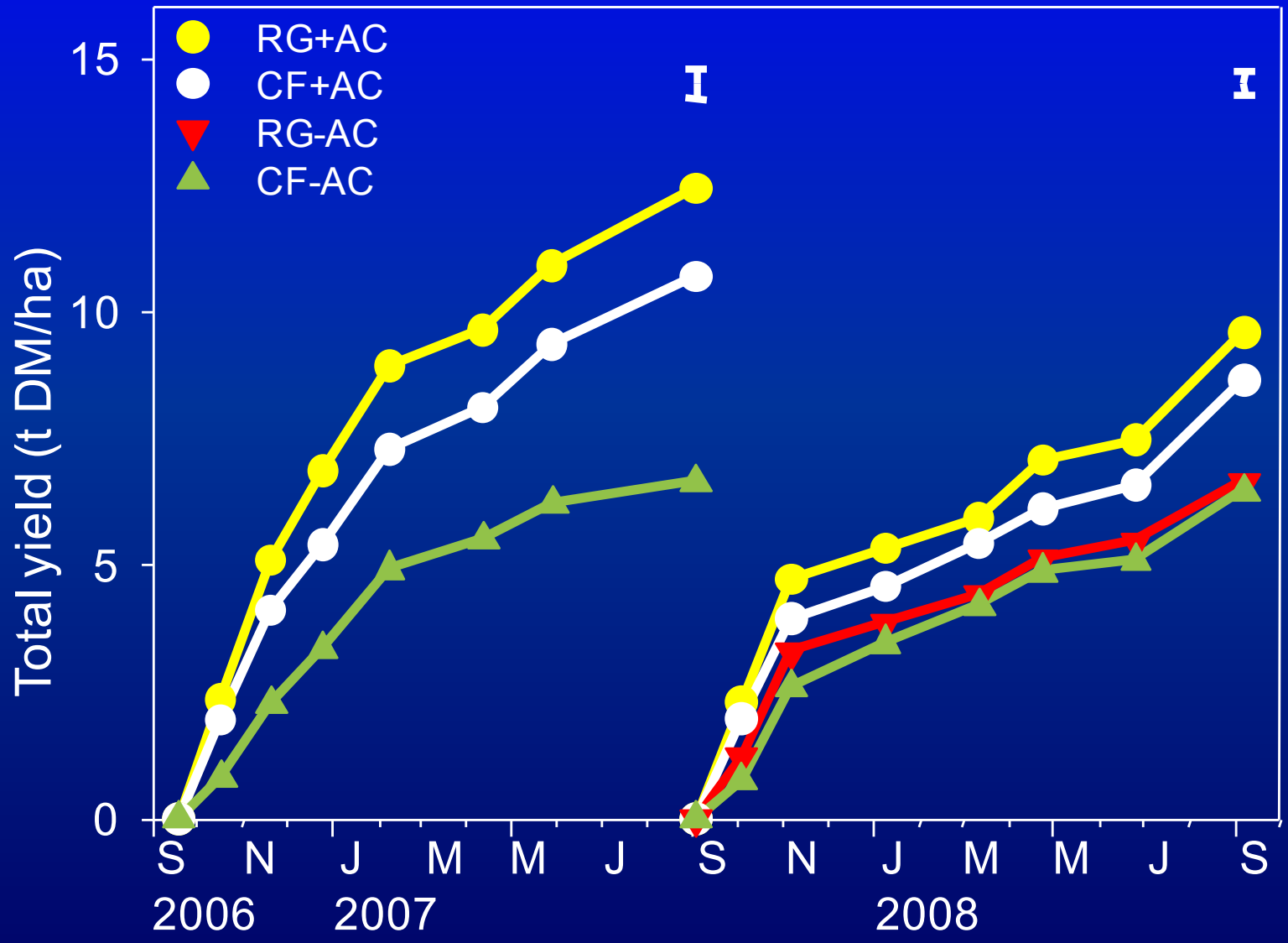
(to 30 March 2011)



Source: Moot 2012

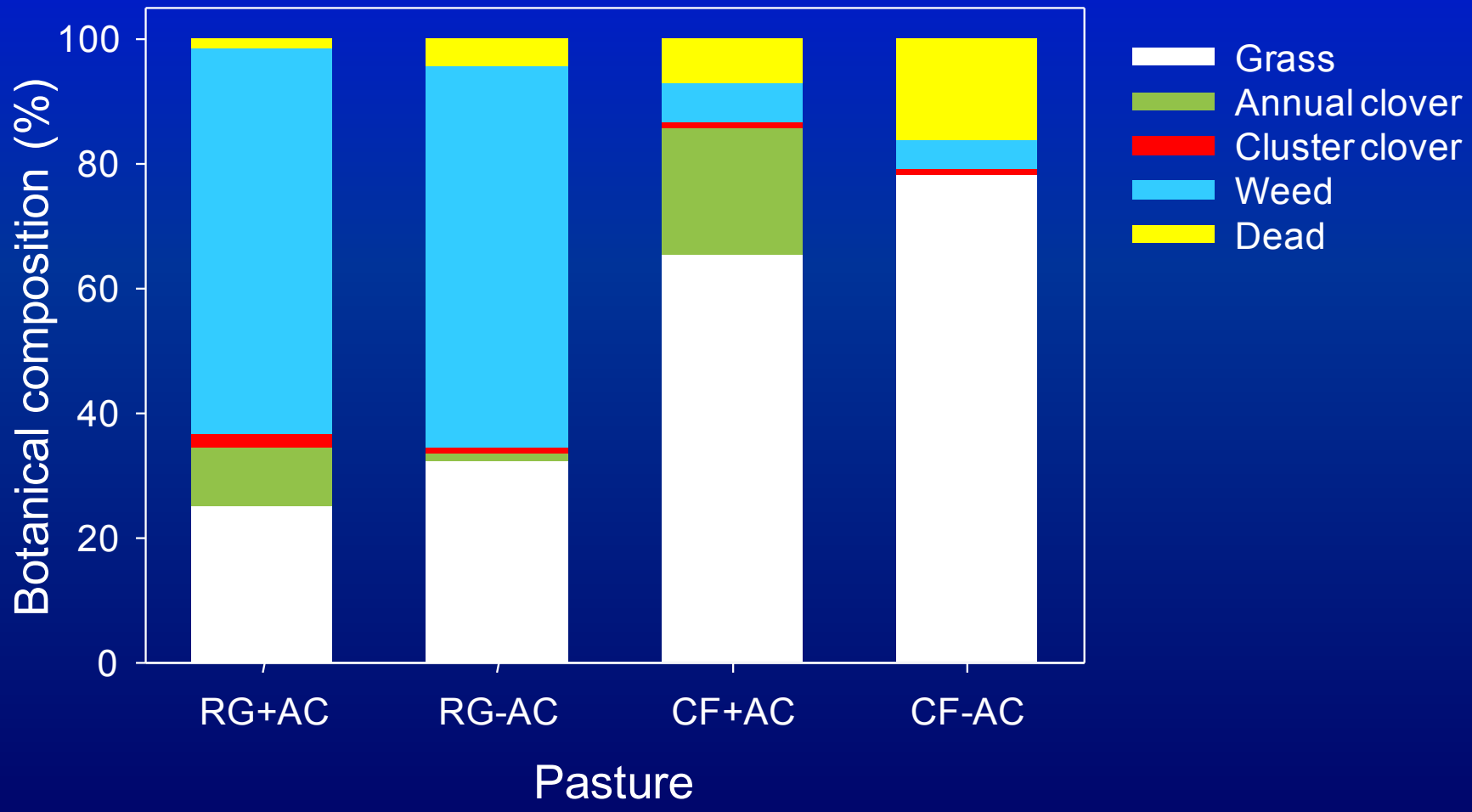
Source: Costello and Costello 2003

Total DM yield



Source: Ates *et al*. 2010

Botanical composition – 26 June 08



Source: Ates *et al*. 2010

Balansa clover + annual forages

Photo: Persian clover
Ashley Dene

‘Bolta’ balansa clover: 25th Sept ‘06

Photo: DP Monks
Lincoln University

Flowering is essential in estab. year

End of summer must have 50% bare

Photo: DP Monks
Lincoln University

21 Feb

Photo: DP Monks
Lincoln University

Gland clover

Arrowleaf clover

Build seed bank in first year

Acknowledgements

- Beef & Lamb NZ Ltd/ Pastoral21
- Lincoln University
- MAF Sustainable Farming Fund

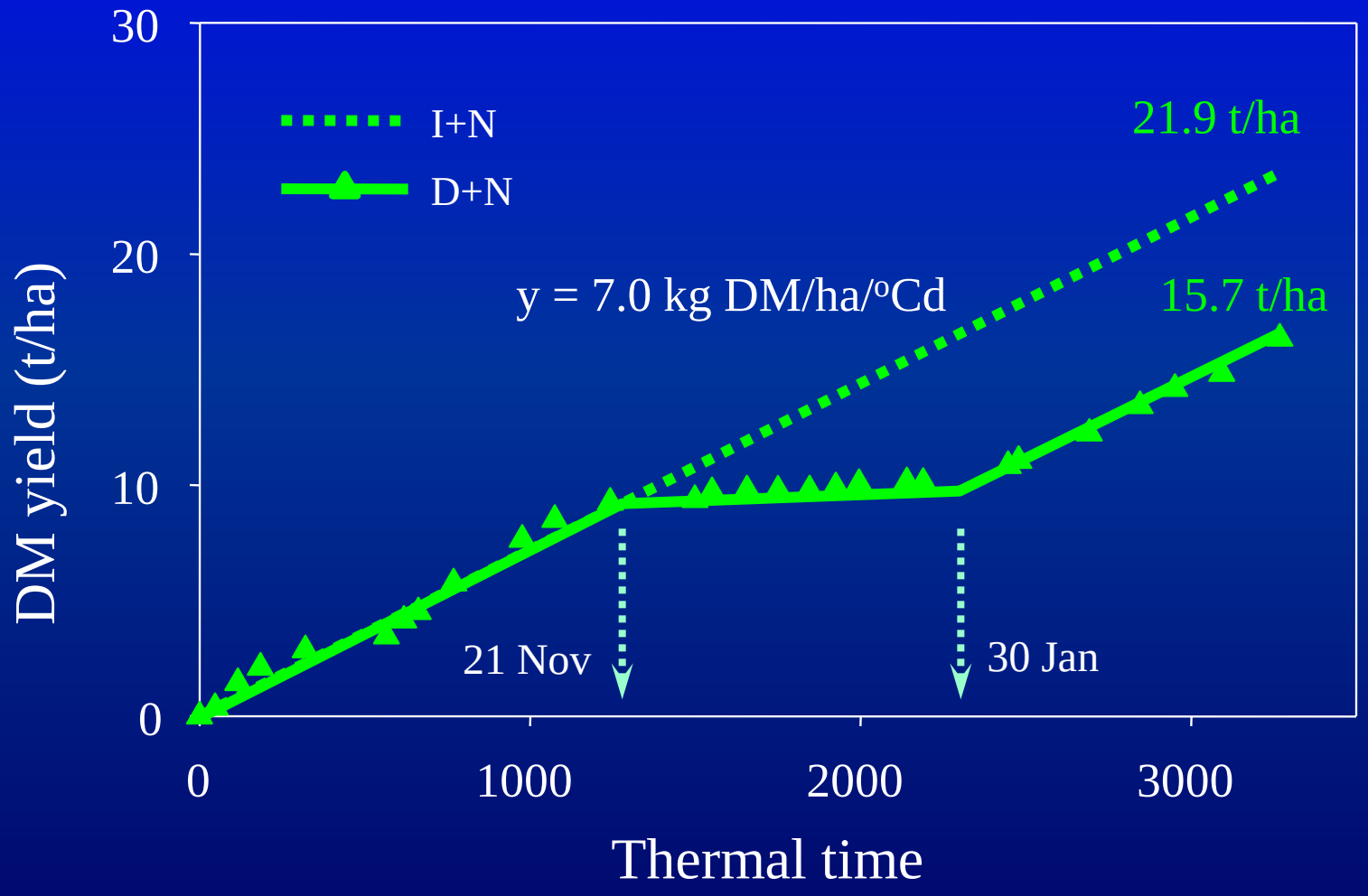
Lincoln University
Te Whare Wānaka o Aoraki
CHRISTCHURCH•NEW ZEALAND
New Zealand's specialist land-based university

beef+lamb new zealand

Sustainable Farming Fund
Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere

RESEARCH SCIENCE & TECHNOLOGY

Water stress effect on yield



Source: Mills *et al*. 2006

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Professor Moot gave this presentation at:

Lincoln University

On:

24 June 2011

For the:

Beef & Lamb New Zealand

Science Day