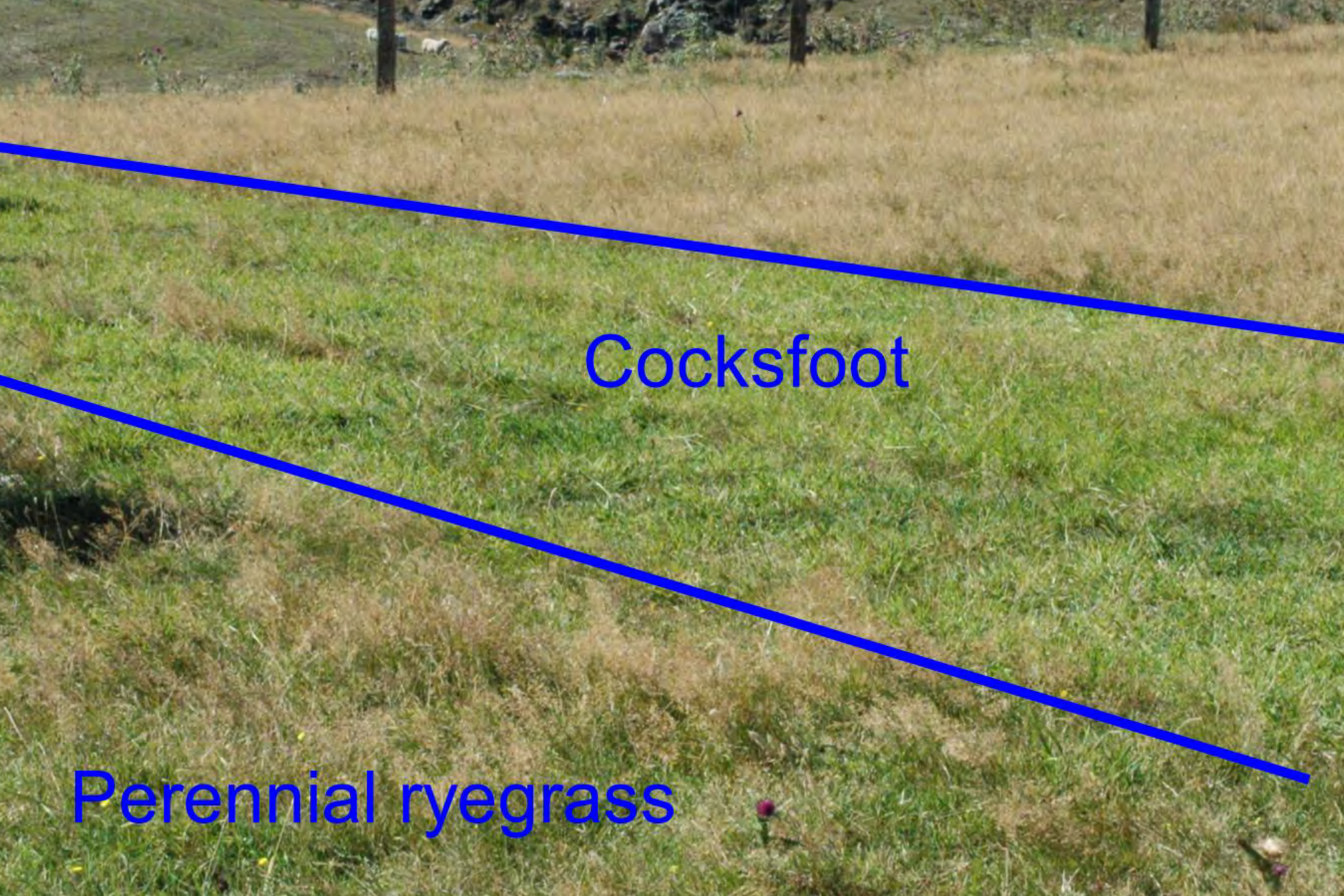
Pasture species options

- agronomy and grazing management

Dr Derrick Moot

Professor of Plant Science


Cocksfoot
Perennial ryegrass

Experiment site

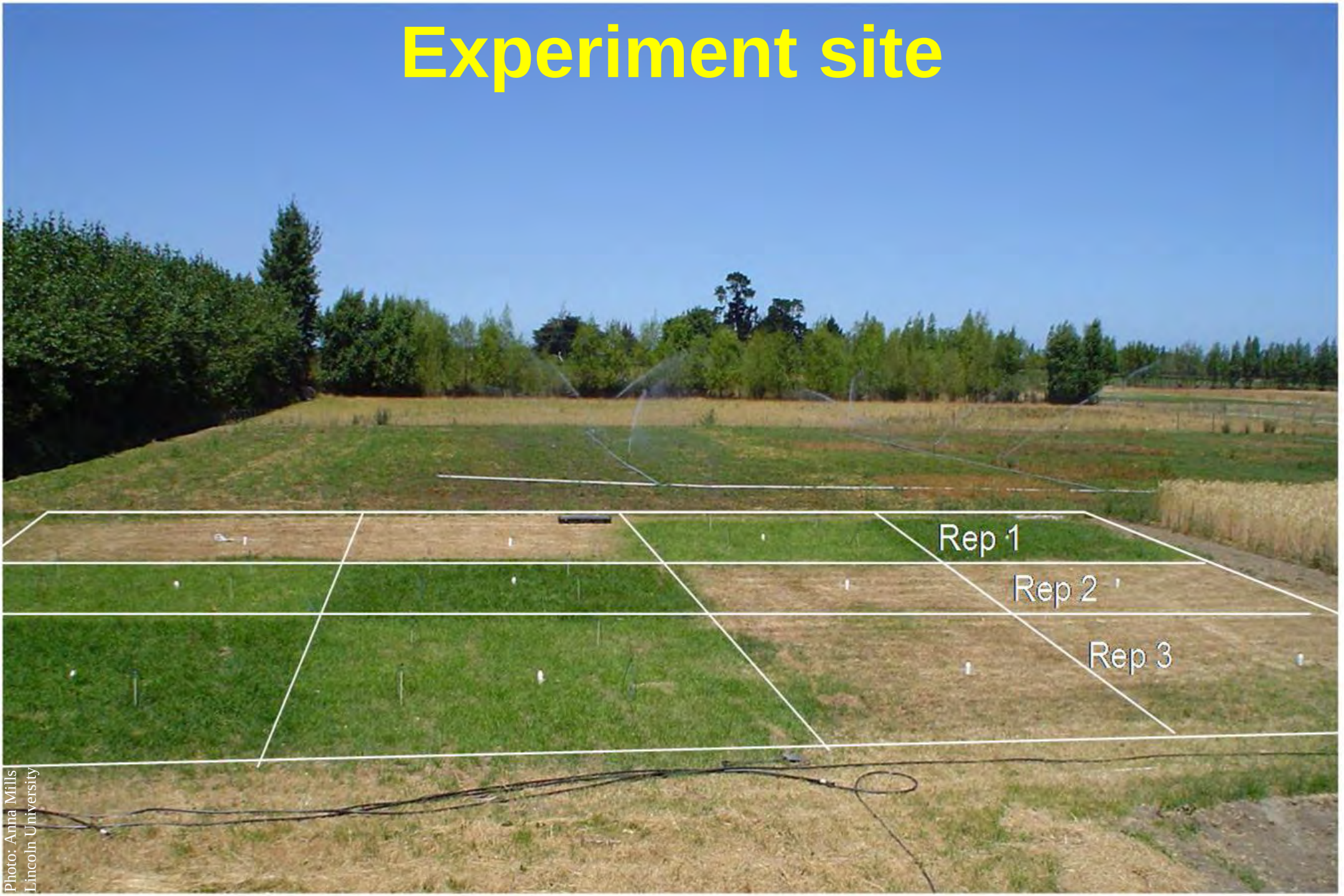
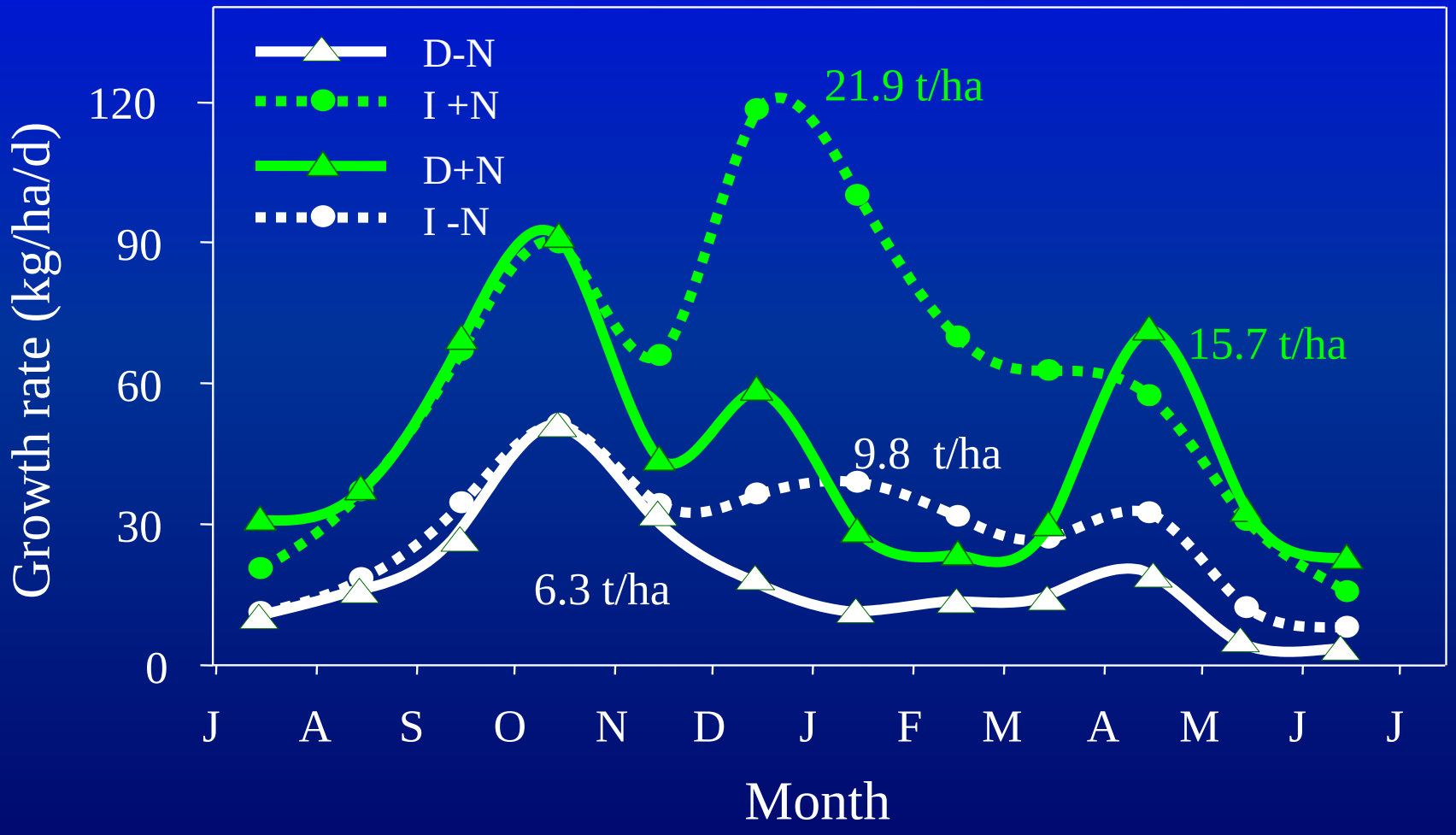


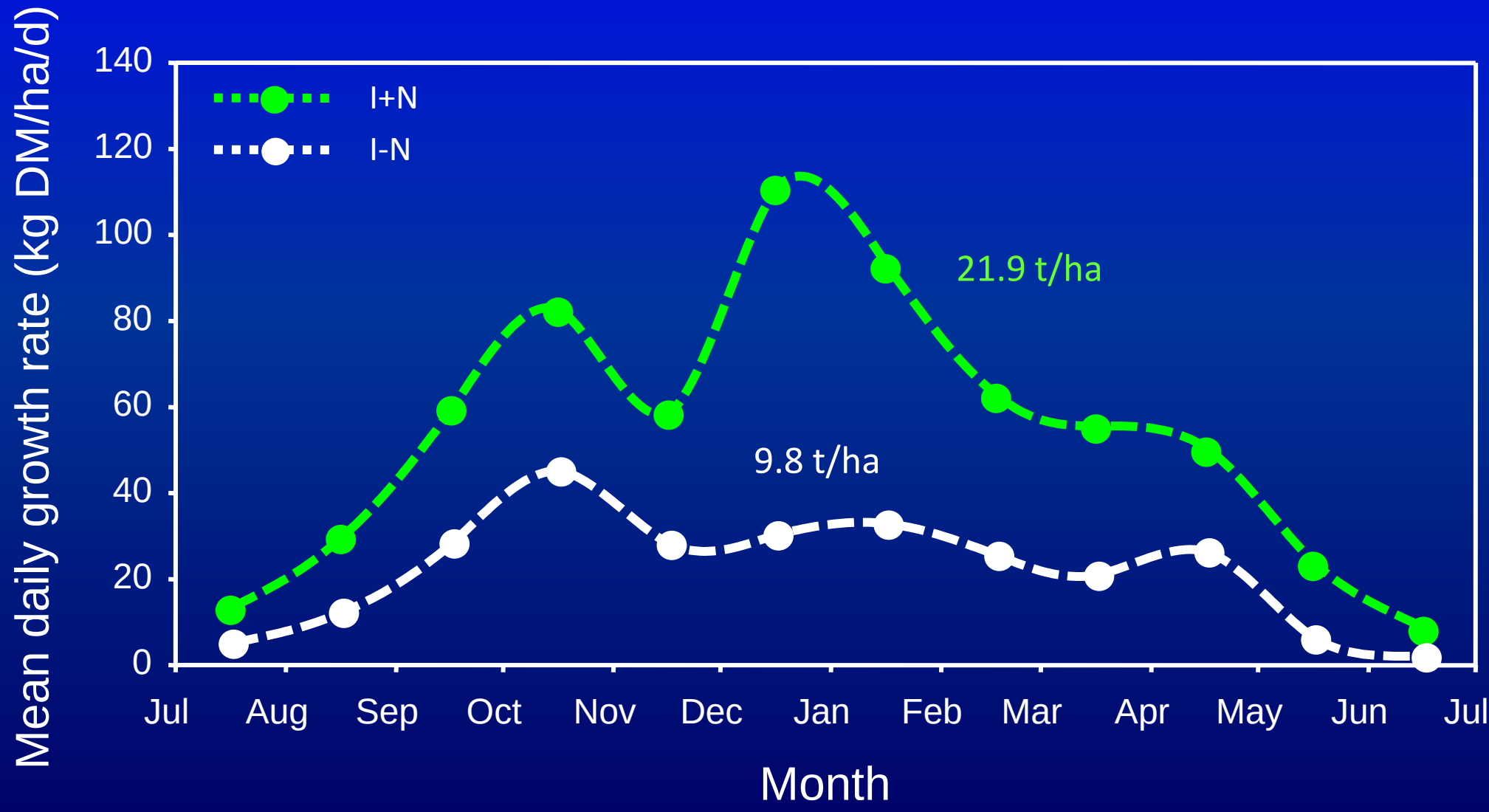
Photo: Anna Mills
Lincoln University

Growth rates (2 year means)



Source: Mills *et al*. 2006

Pasture Growth Rates – 2 yr mean



Source: Mills *et al*. 2006

Winter ⇒ temperature response

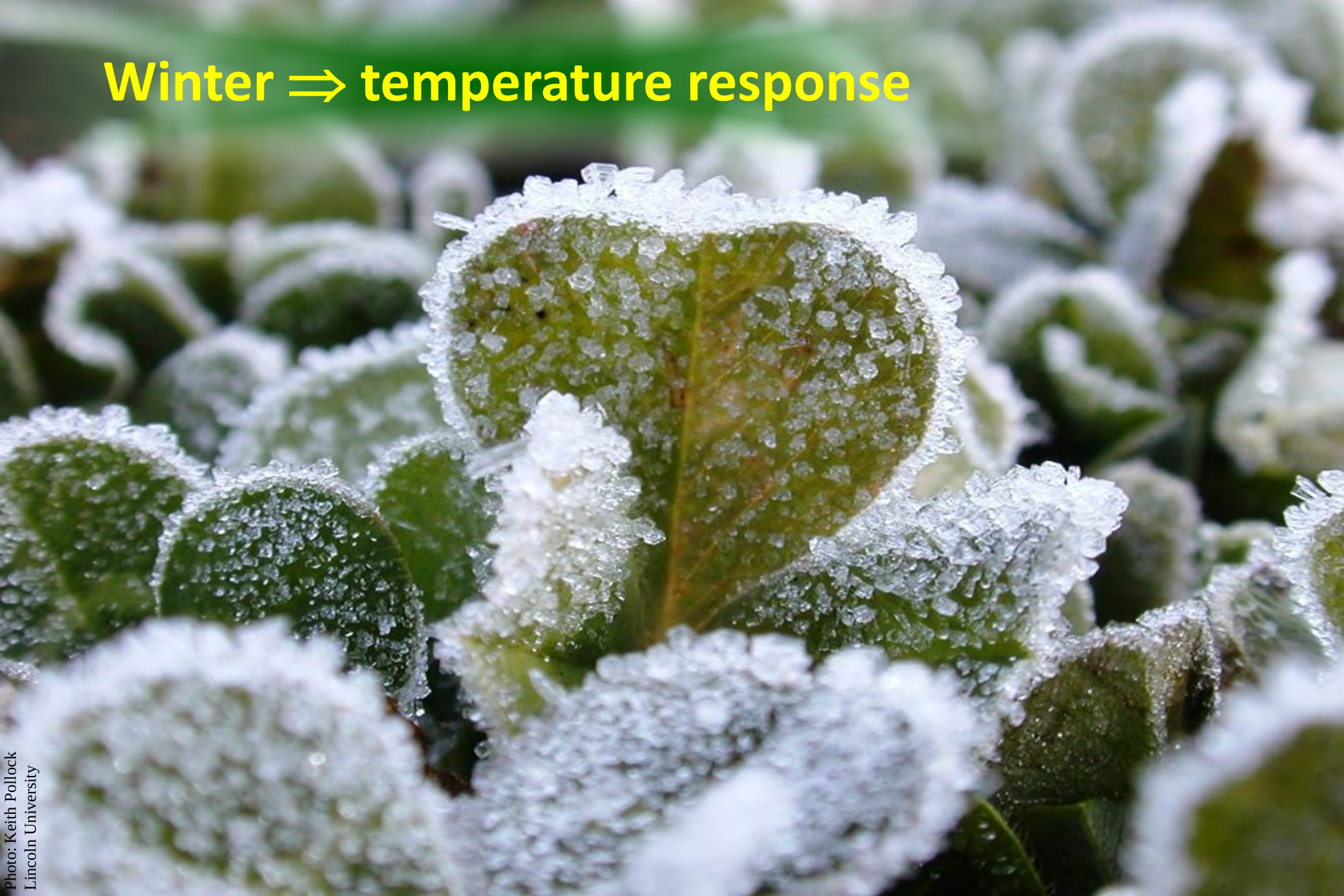
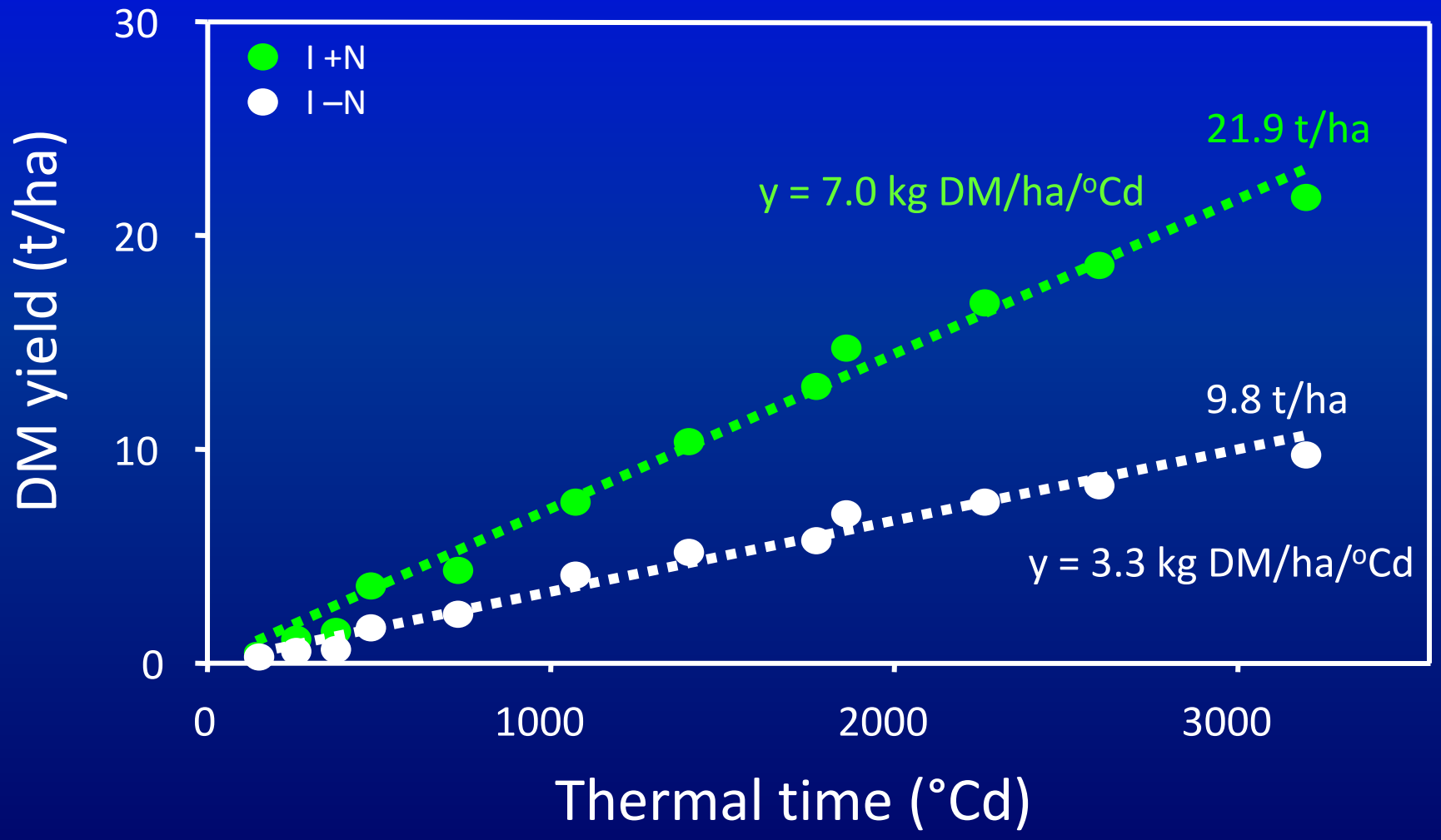


Photo: Keith Pollock
Lincoln University

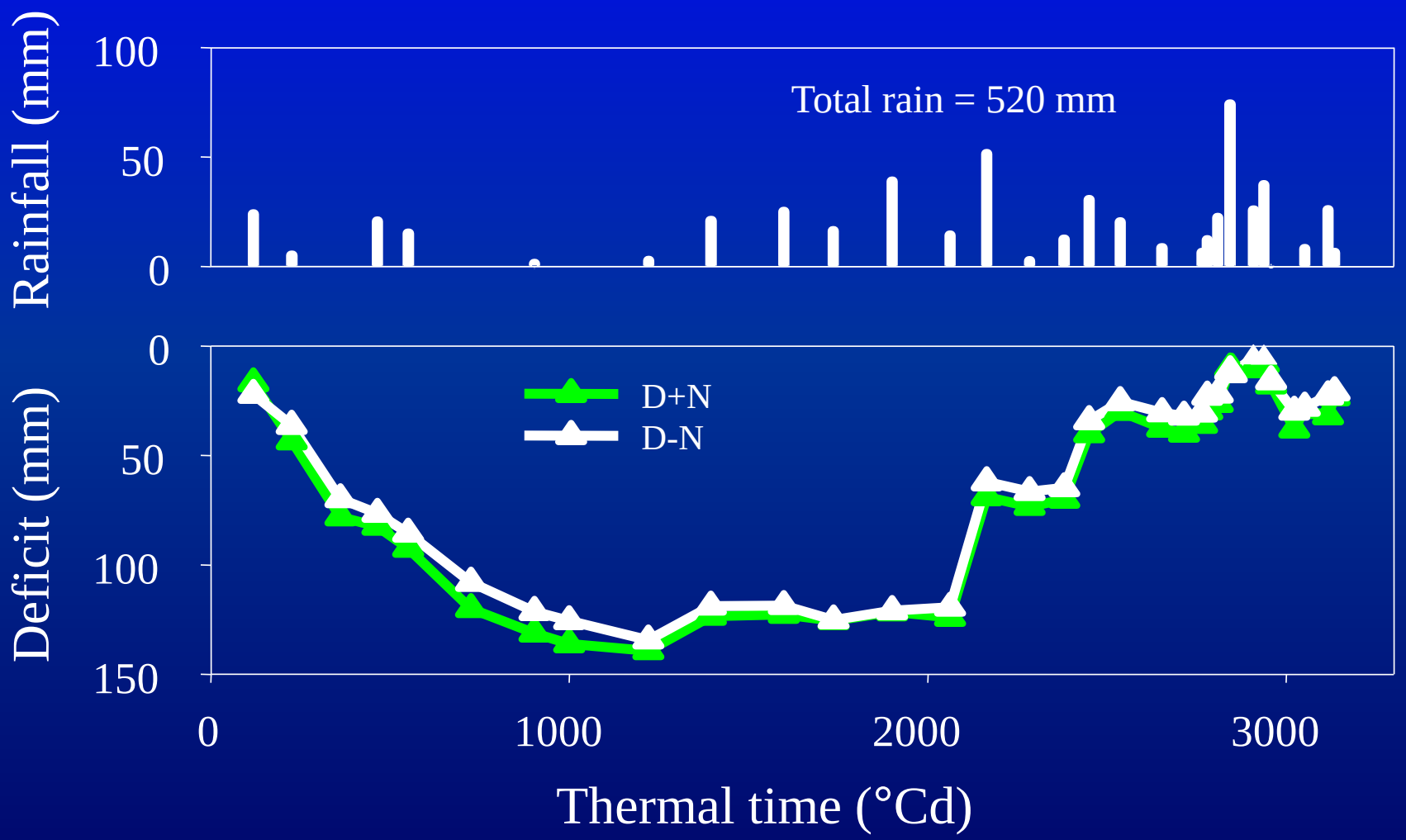
The Nitrogen gap



Source: Mills *et al*. 2006

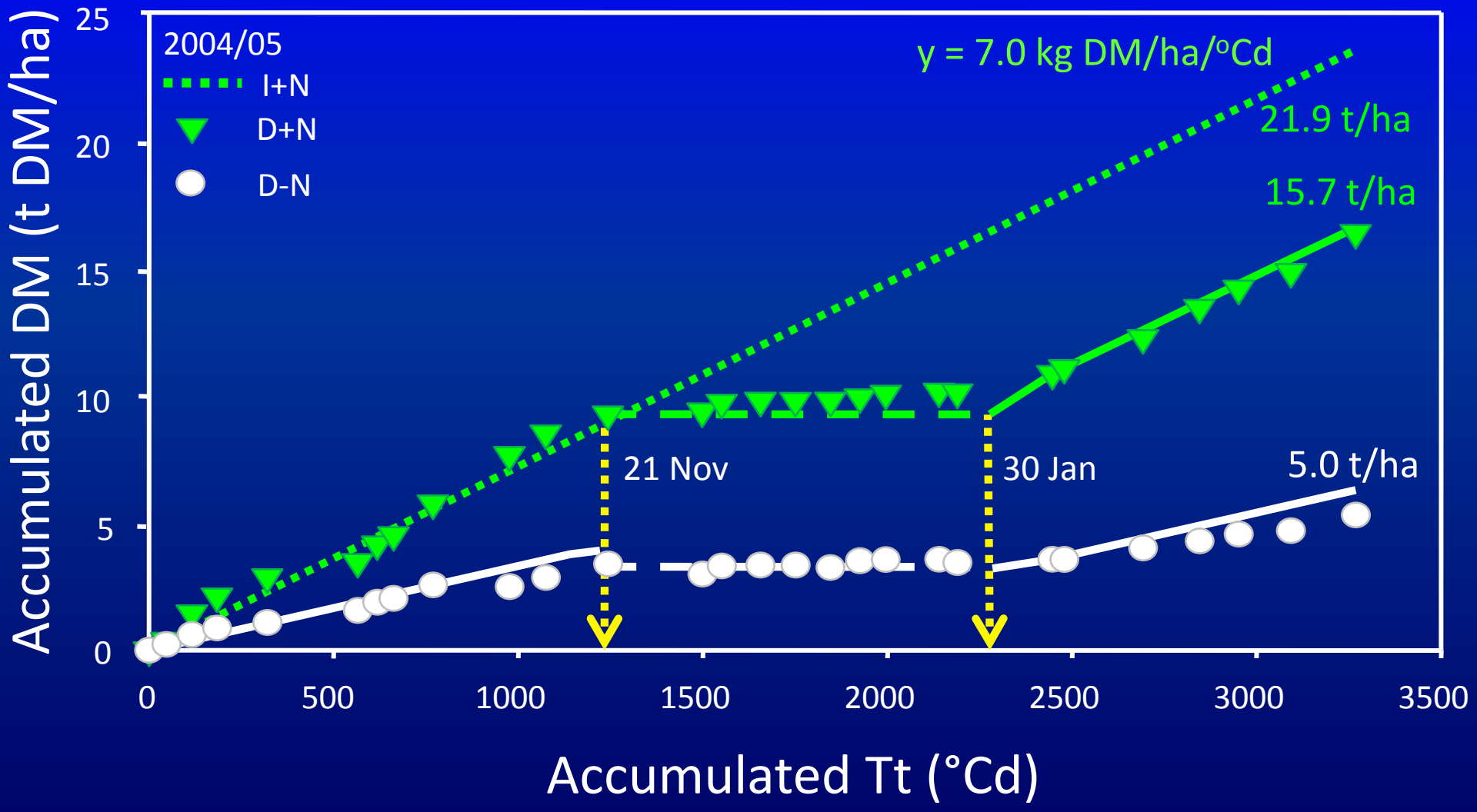

Summer ⇒ moisture response
Photo: Anna Mills
Lincoln University

Soil moisture deficit 2003/04



Source: Mills *et al*. 2006

The Nitrogen gap



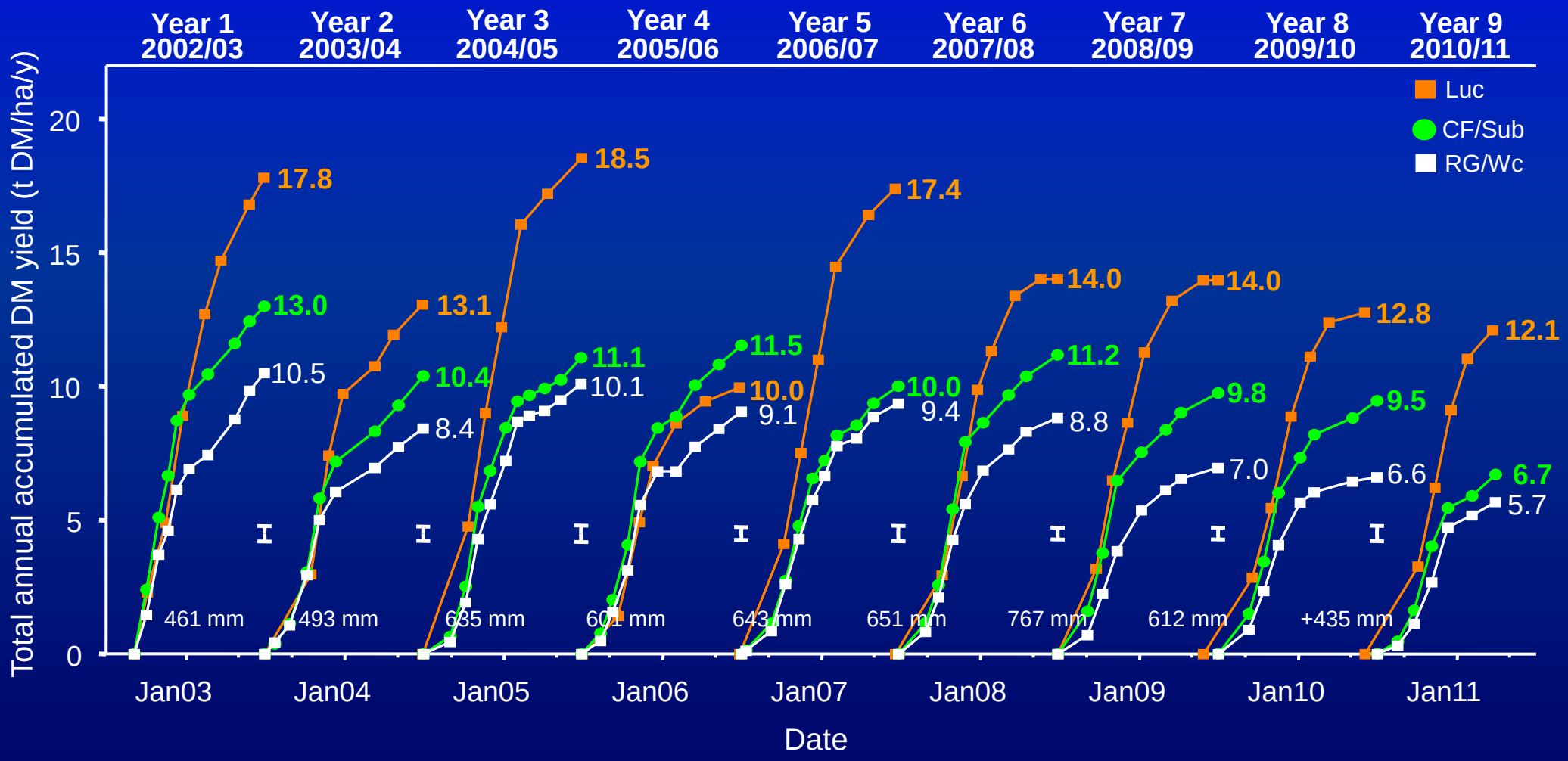
Source: Mills *et al*. 2006


beef+lamb
new zealand
Rg/Wc
Lucerne
CF/Sub
CF/Balansa
CF/Cc
CF/Wc

‘MaxClover’

‘MaxClover’ Total DM Yields

(to 30 March 2011)



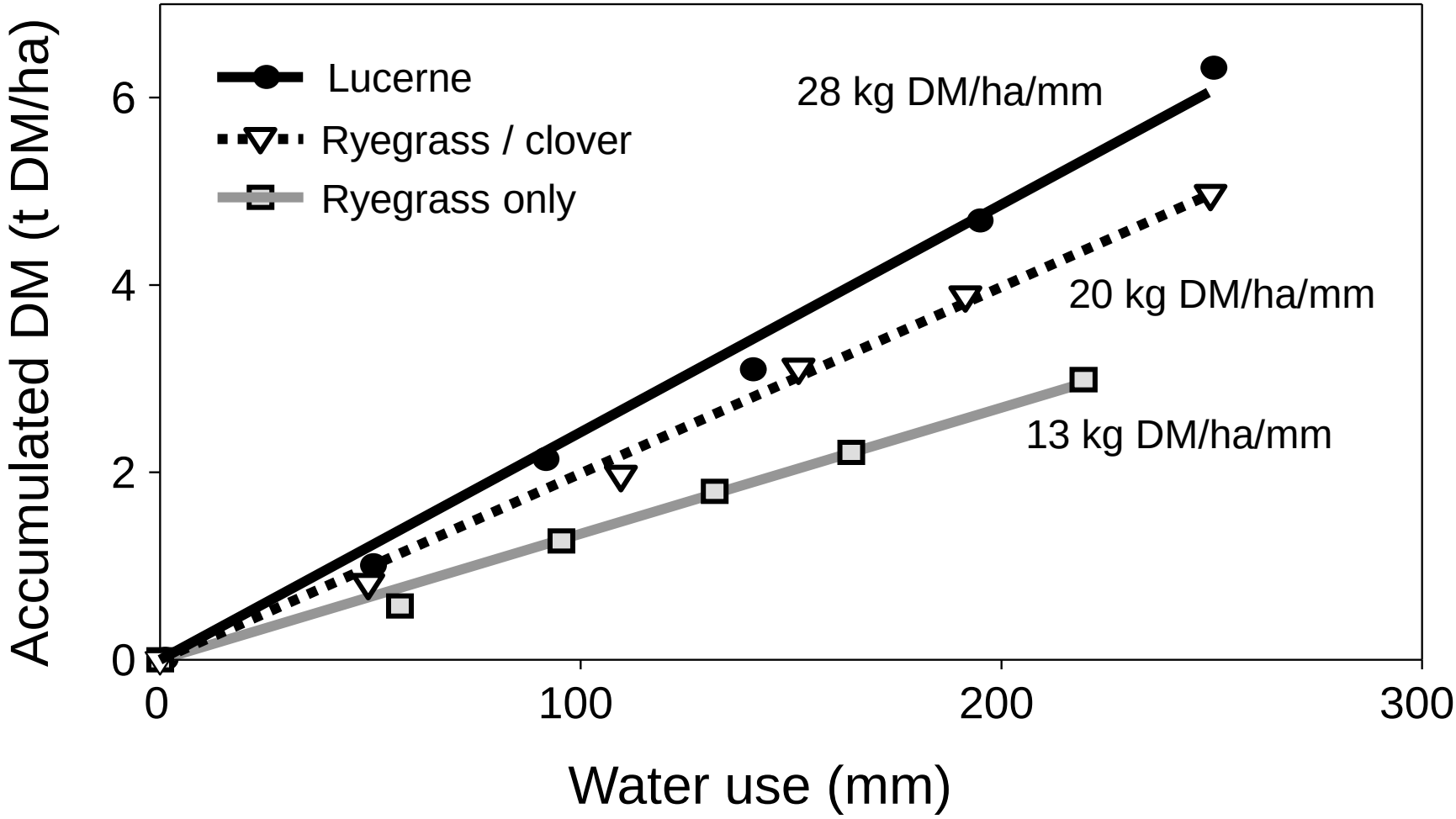
Source: Moot 2012

RG/Wc pastures

Unsown species <5% in Year 1 …….>45% in Year 6

Lucerne pastures

Spring WUE: legume = (nitrogen)

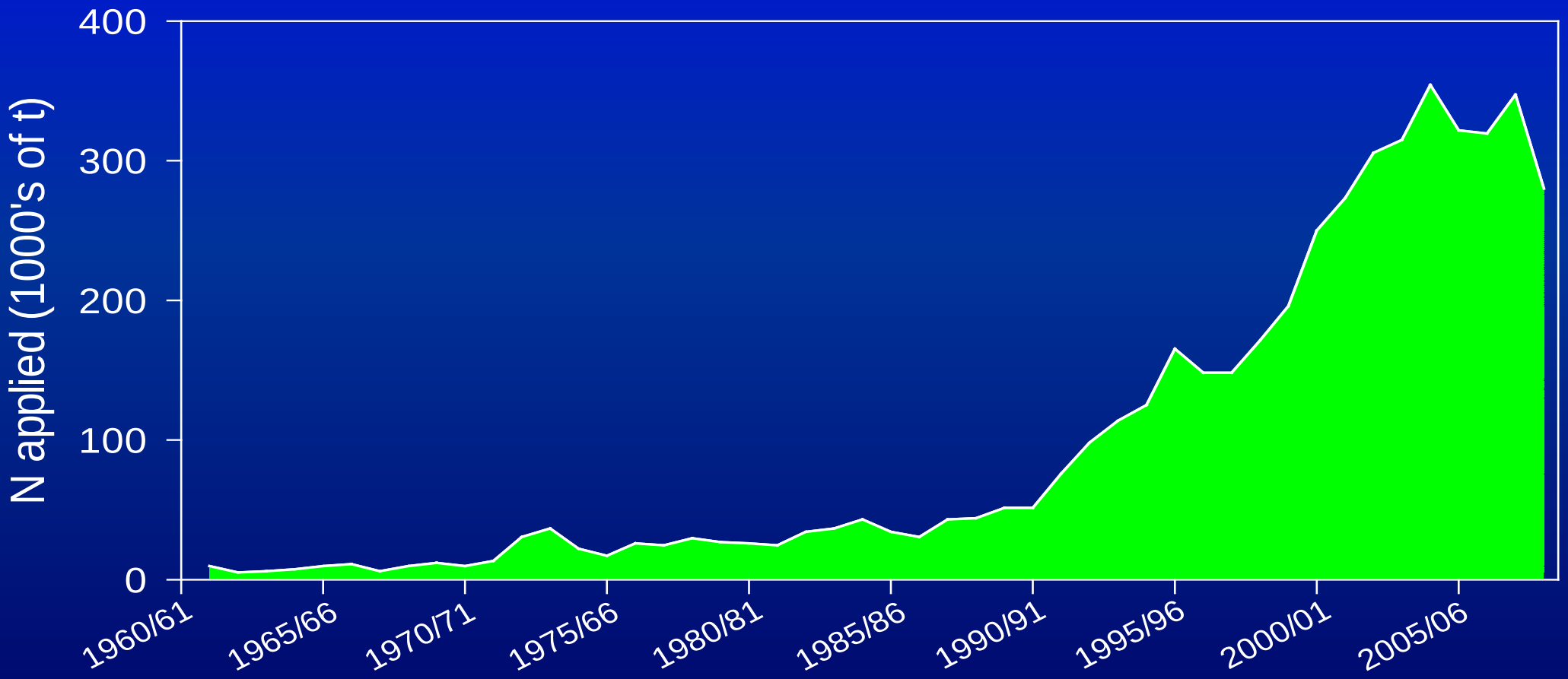


Source: Moot *et al*. 2008

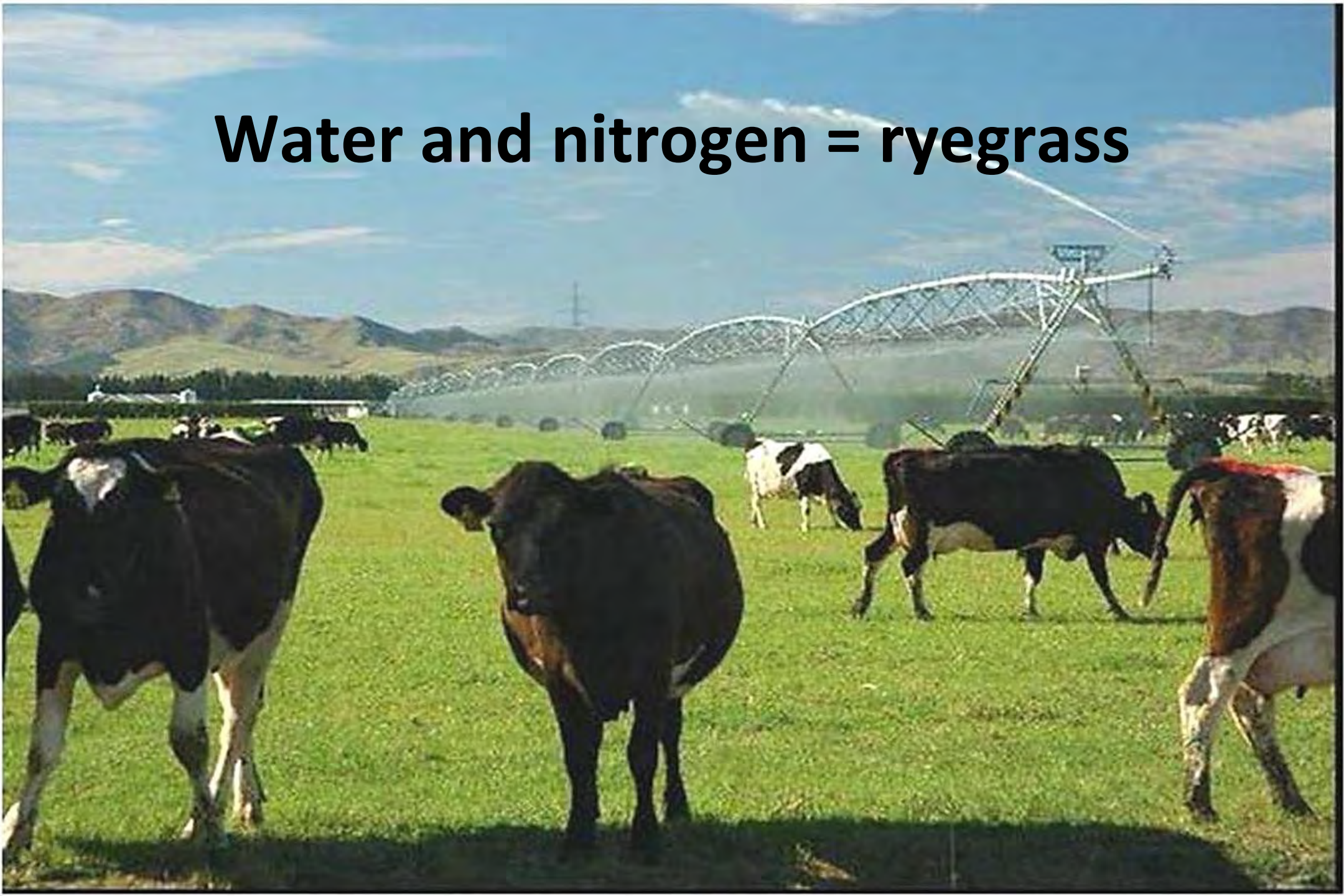
Nitrogen deficient pasture

1000 kg N/ha

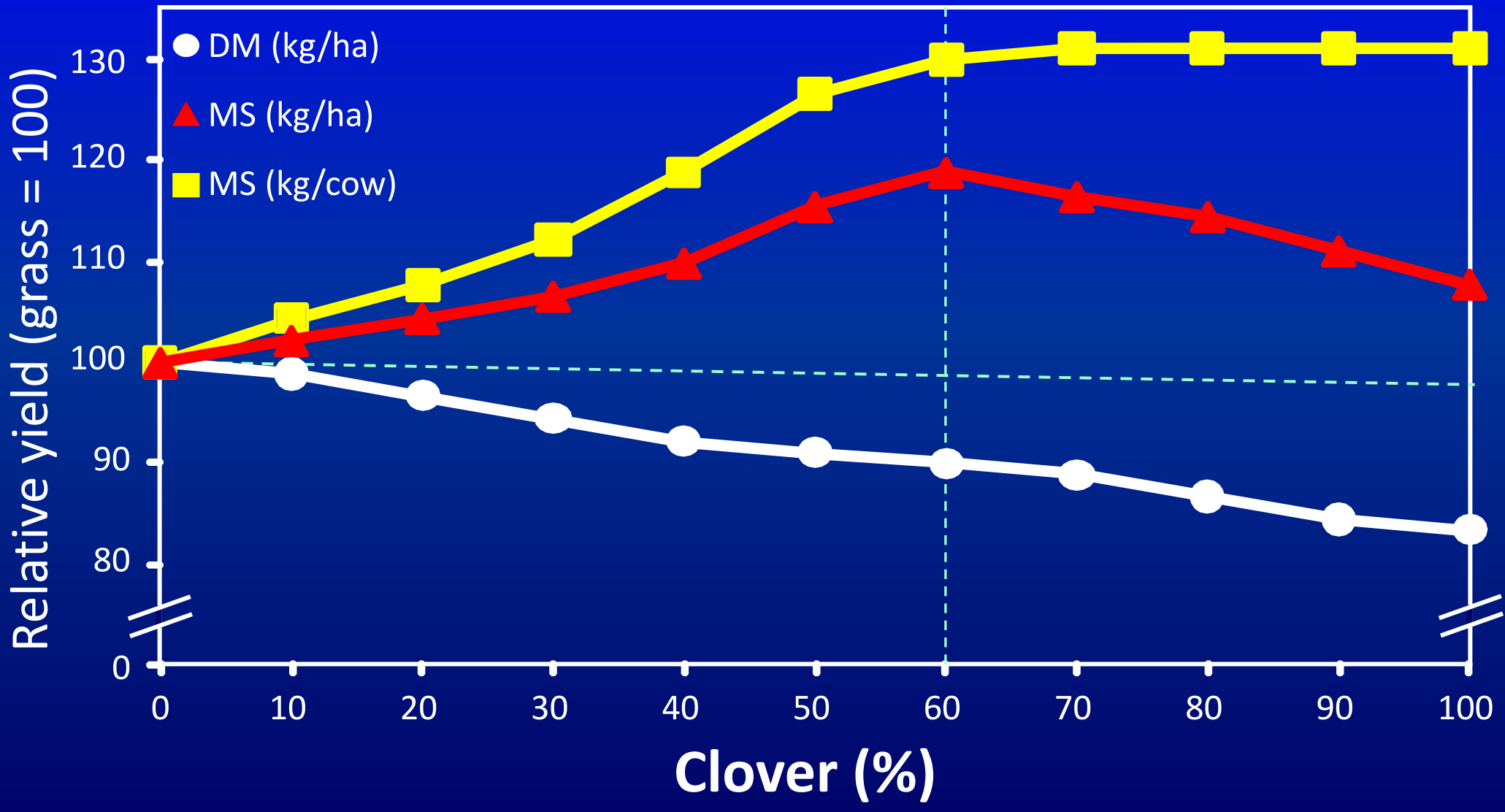
Nitrogen fertiliser use



Source: New Zealand Fertiliser Manufacturers' Research Association. 2011


Water and nitrogen = ryegrass

Clover content & milksolids production



Source: Cosgrove, 2005

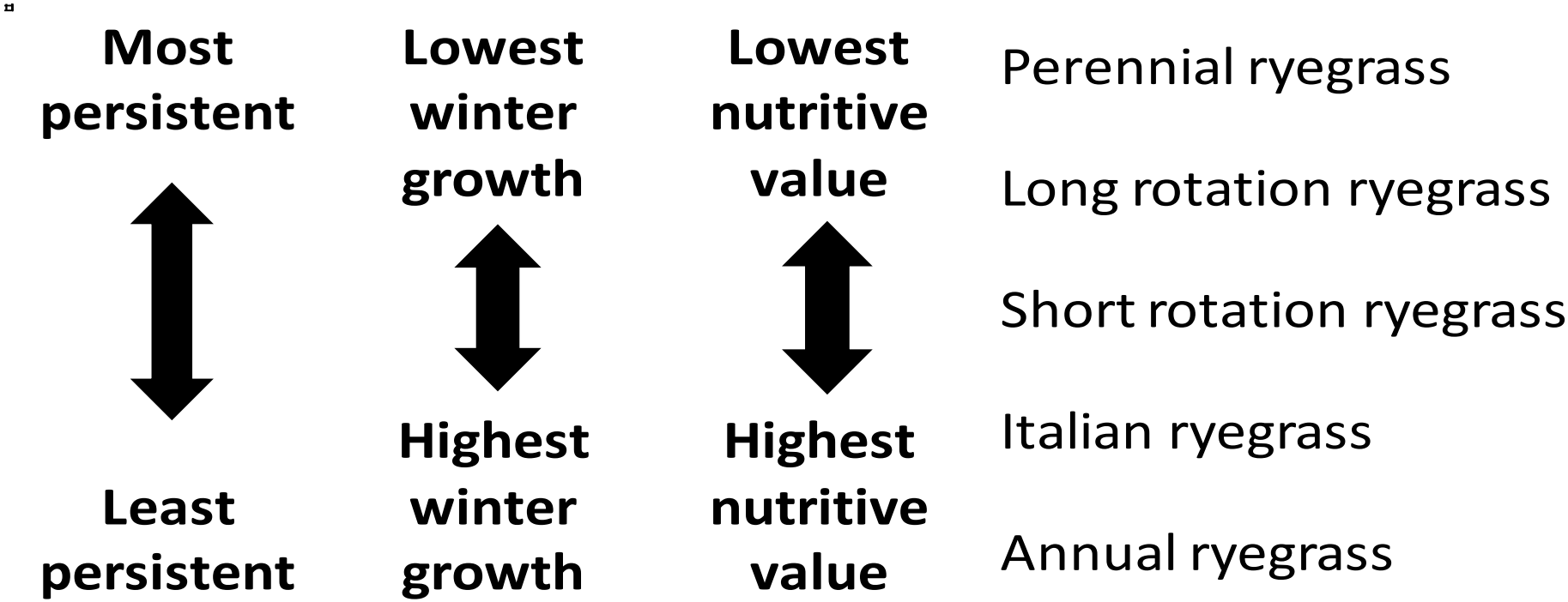
Sheep prefer 70% legume, 30% grass

Daily lamb live weight gains in summer/autumn when intake was maximised in experiments using ryegrass & white clover pastures as the control. Source: P. Kemp, Adapted from Kemp *et al*. 2010

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	

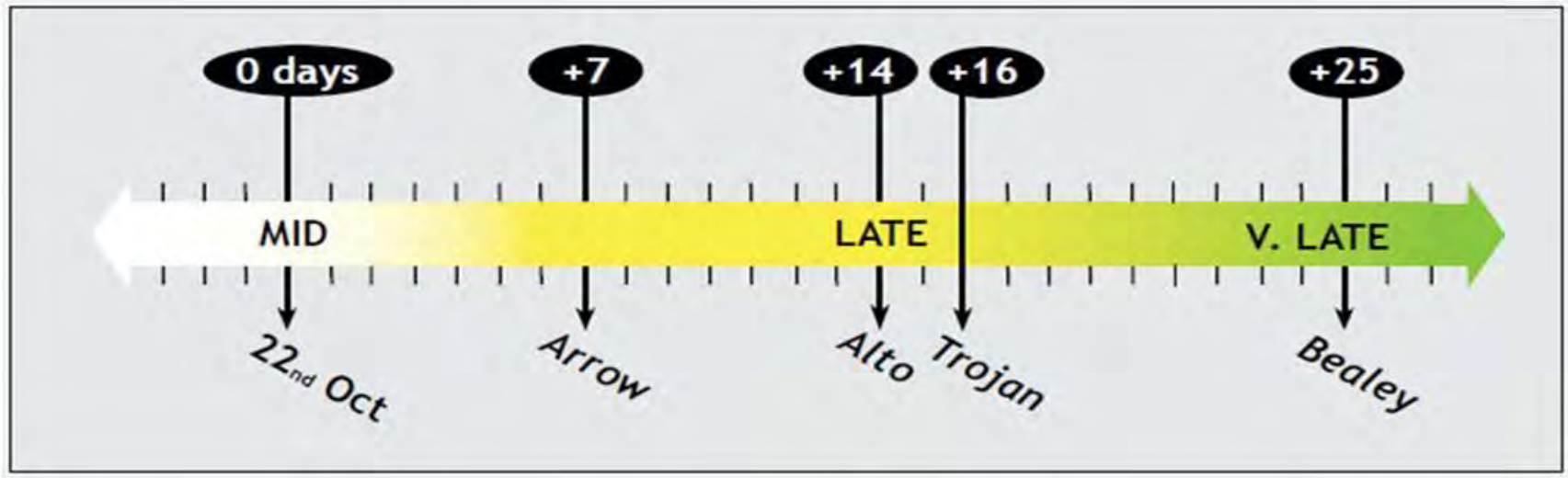

Growing point
Photo: A Black
Lincoln University

The ryegrass continuum



Heading date

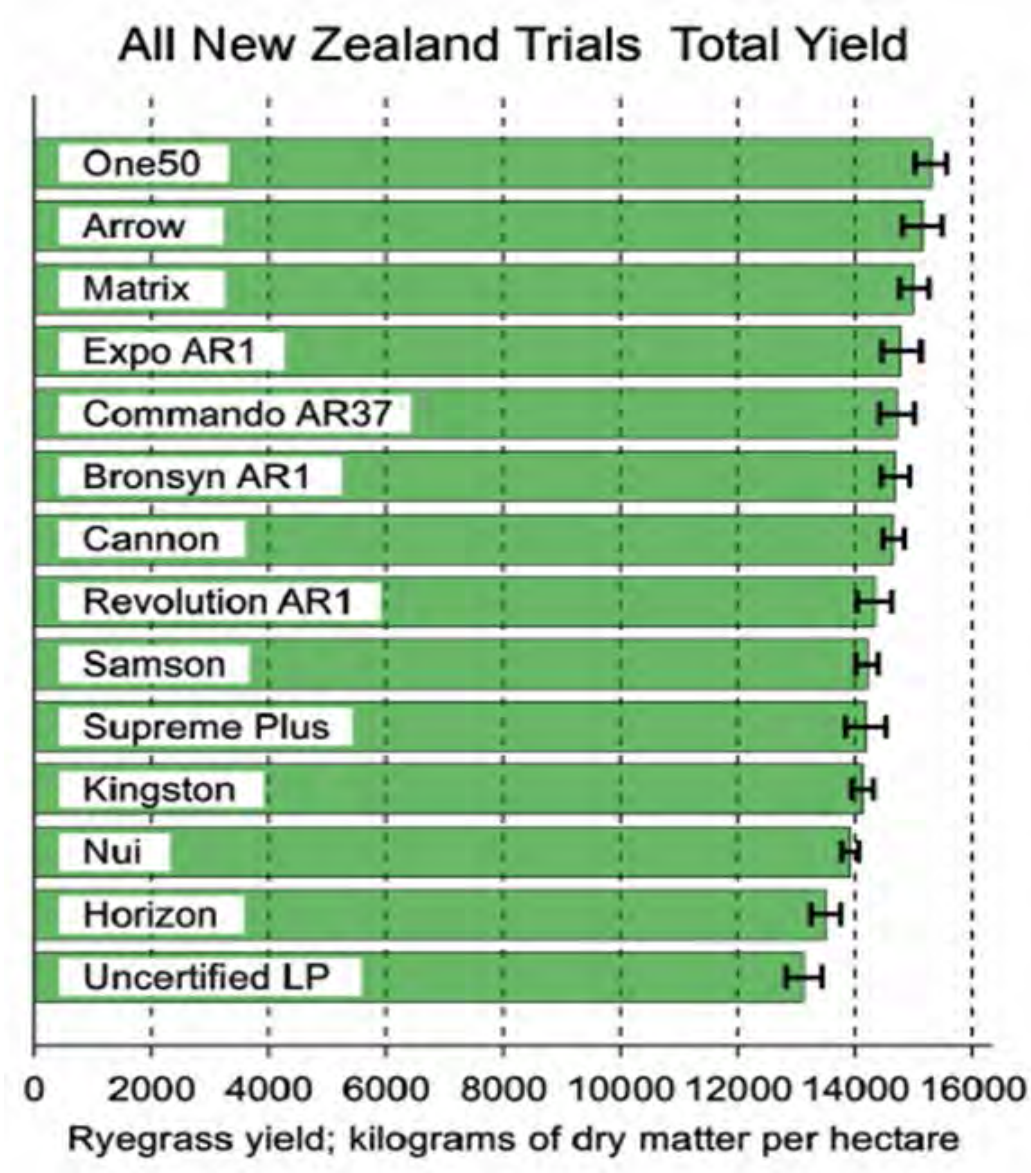
- Heading = flowering time in spring.
- Early heading - higher early spring growth.
- Late heading - late spring quality.



Source: www.agriseeds.co.nz

Forage variety trials

Perennial ryegrass cultivars



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

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


Olsen P<6


Olsen P>20

White clover

- Small seed (0.63 mg)
- Rapid germination and emergence but:
- Small seedling – needs light to produce leaves

- Establishment experiment (chicory 1.5 kg/ha)

  Dates = 4/2, 26/2, 19/3, 9/4
  Rates = 0, 4, 8, 12, 16 kg/ha ryegrass

Perennial ryegrass

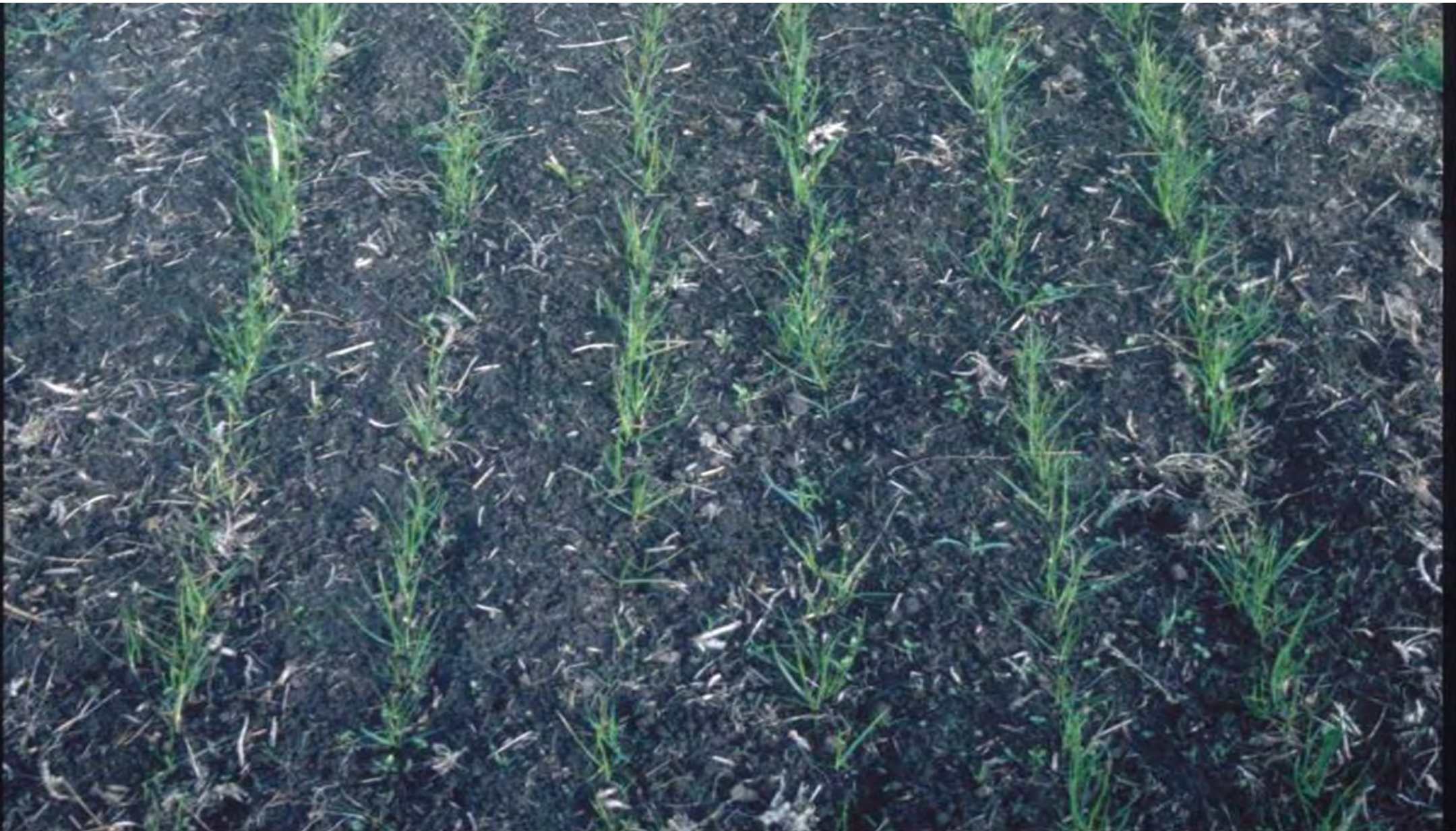
White clover

Photos: A Black
Lincoln University

Ryegrass sowing rate

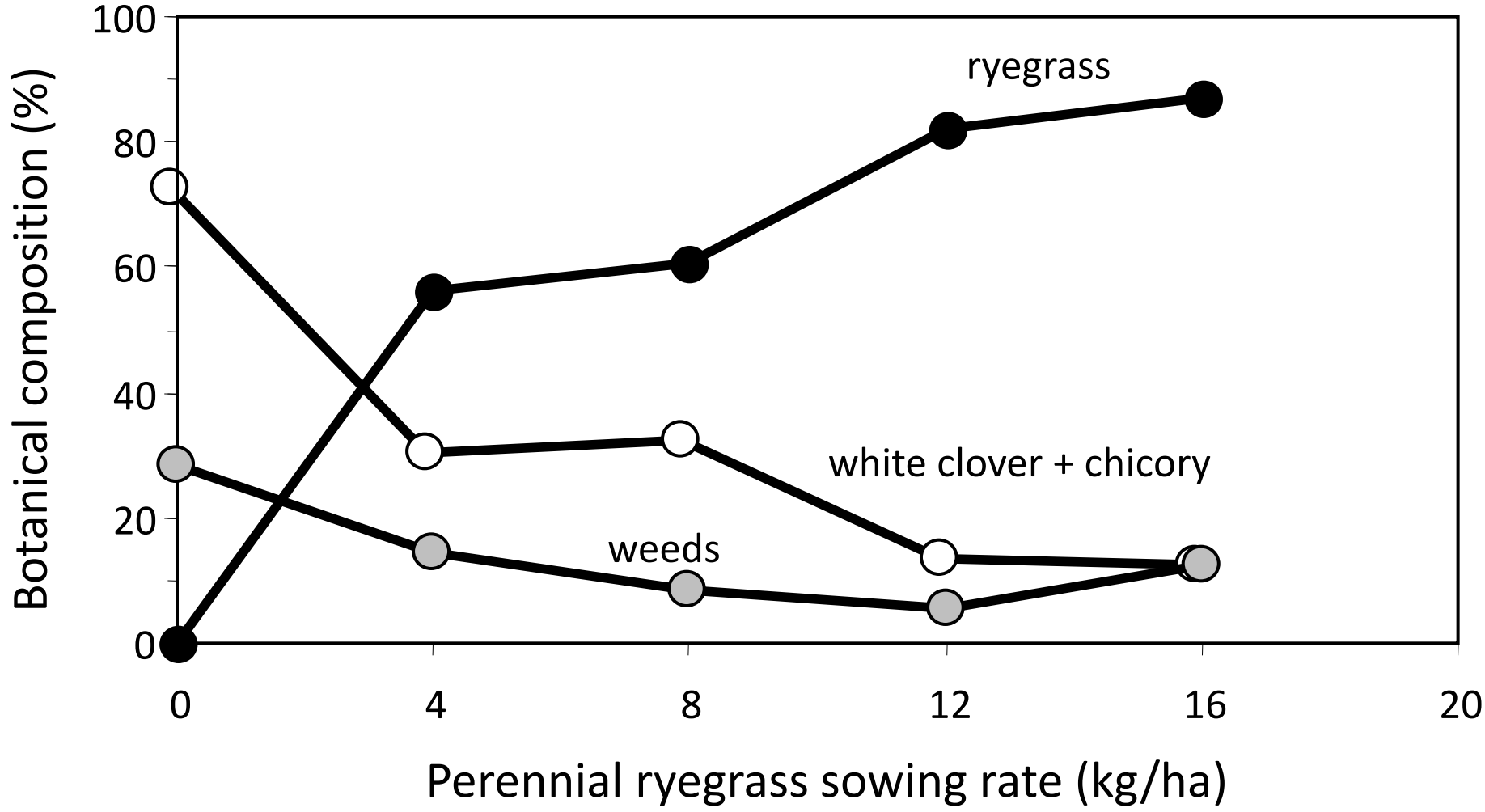
White clover @ 4 weeks

Perennial ryegrass @ 4 weeks



Italian ryegrass @ 4 weeks

Botanical composition



Source: Dumbleton 1997

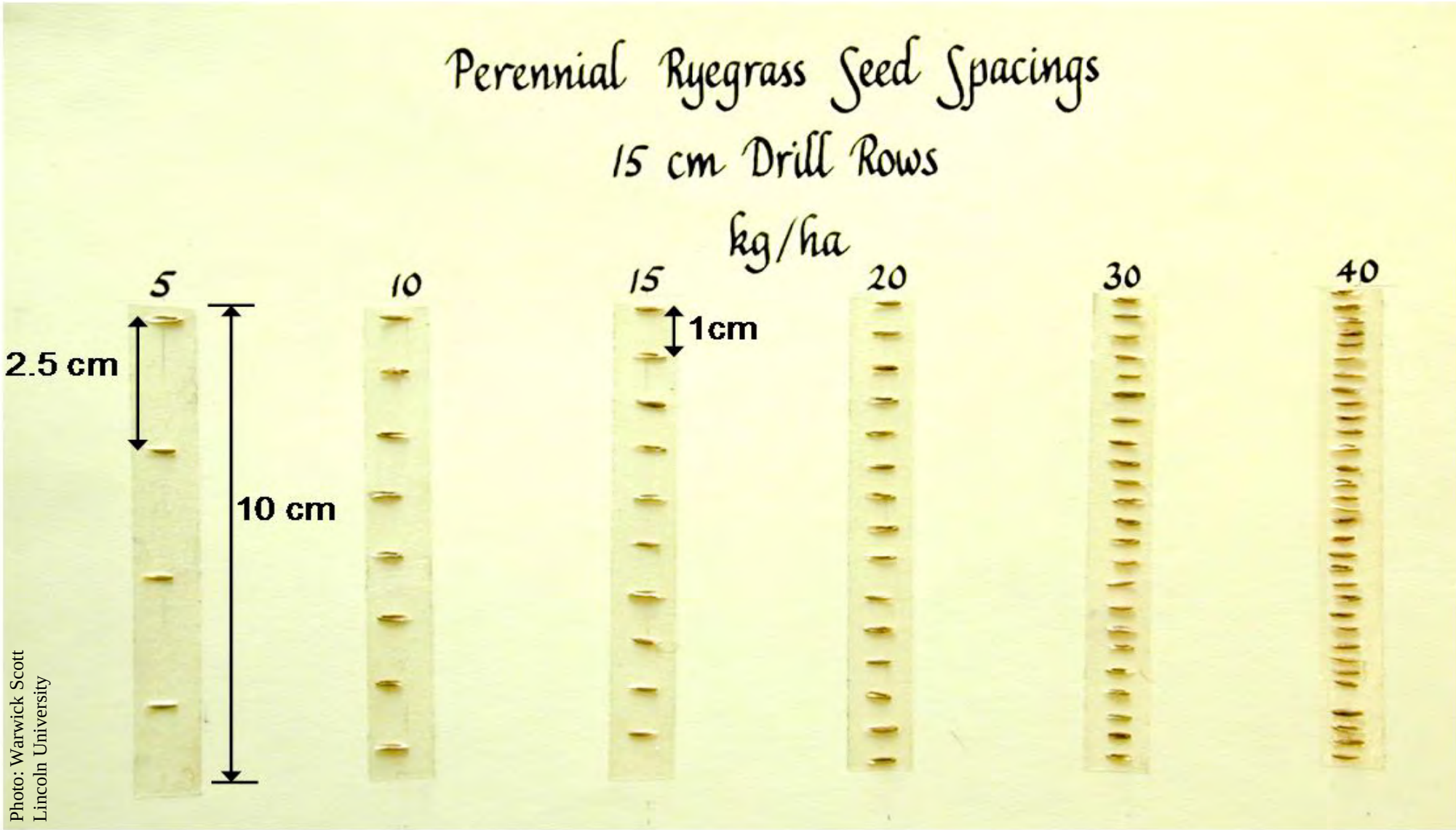
20% white clover

Number of seeds sown /m²

Ryegrass rate	Ryegrass (seeds/m²)	White clover (3 kg/ha)	Chicory (1.5 kg/ha)	Total (# of seeds)
0	0	420	120	540
4	200	420	120	740
8	400	420	120	940
12	600	420	120	1140
16	800	420	120	1340
20	1000	420	120	1540

Source: Dumbleton 1997

Sowing rates



Summary: White clover

- Autumn sowing
    - soil temperature >14°C
- Drilled with 8-10 kg/ha ryegrass in a well prepared seed bed!
- Nutrients (P) maintained
- Manage for white clover (18 months) and each spring!

Tall fescue

Photo: A Black
Lincoln University

Tall fescue

- Naturally dominant in US mid-west where summer temperatures often reach 40°C, with winter snow.
- Greater summer growth than PRG but requires high soil fertility and is slower to establish.
- Most cultivars have larger tillers and longer leaves than PRG, therefore more susceptible to frequent close defoliation.

Tall fescue

- Tolerant of wet soils and drought – mainly sown in dry areas for its summer growth.
- Large tillers, sensitive to hard/frequent grazing.
- Open sward makes it compatible with clovers.
- Cultivars differ in their seasonal growth, heading date and softness of leaves.
- Now available with novel endophyte strains.

Tall fescue

Tall fescue pasture near Madison, WI

Tall fescue survives hot summers more than ryegrass because it has a higher optimum temperature for photosynthesis.

Tall fescue pasture near Lake Ellesmere, Lincoln

Tall fescue is tolerant of wet soils yet withstands drought well because of its superior root system to ryegrass.

Renovated dairy pasture on a peat soil in Manawatu

Because of its deep root system, tall fescue has improved resistance to plant pulling over perennial ryegrass.

Tall fescue – red clover mixture

Because of a slower establishment and lower tiller population compared to ryegrass, tall fescue pastures often have a higher clover content.

Sowing tall fescue

- Tall fescue is similar in seed size to ryegrass but is much slower to establish.
- Sow as the sole grass with clover, or with low rates of cocksfoot or phalaris.
- Don’t sow with ryegrass.
- Sow at 15-30 kg/ha with clover.
- Sow into warm soils (Feb-Mar, or in Sep-Oct).

Tall fescue

Perennial ryegrass

Photos: A Black
Lincoln University

Tall fescue

Perennial ryegrass

Photos: A Black
Lincoln University

Seedling vigour

- Slow establishing species (e.g. cocksfoot) need more thermal time than ryegrass to emerge

Thermal time to emergence of autumn sown pasture species

Species	Seed wt (mg)	Emergence (°Cday)*	Shoot wt (mg)**
Red clover	3.1	101	50
Italian ryegrass	4.0	125	380
Perennial ryegrass	2.0	144	180
White clover	0.63	148	15
Tall fescue	2.6	175	91
Cocksfoot	0.9	230	35

*Calculated above a base temperature of 0°C. **Shoot weight @ 57 days after 21/3. Source: Moot *et al*., (2000) NZ J.Ag.Res.

Photo: A Black
Lincoln University

Grazing management

- Tall fescue requires different grazing management to ryegrass.
- Frequent hard grazing in spring and summer to prevent excessive seed head development.
- Some spelling from grazing in autumn when the plant is forming new tillers.
- Performs under cattle grazing, can struggle to persist under intense sheep grazing.

Grazing management of tap rooted plants (1)

Key principles:

- Do not graze into the crown
- Use a rotation that maintains tap root size & protects initial growth of next generation of shoots
- Recovery of root reserves more sensitive to grazing frequency than intensity
- Avoid treading damage

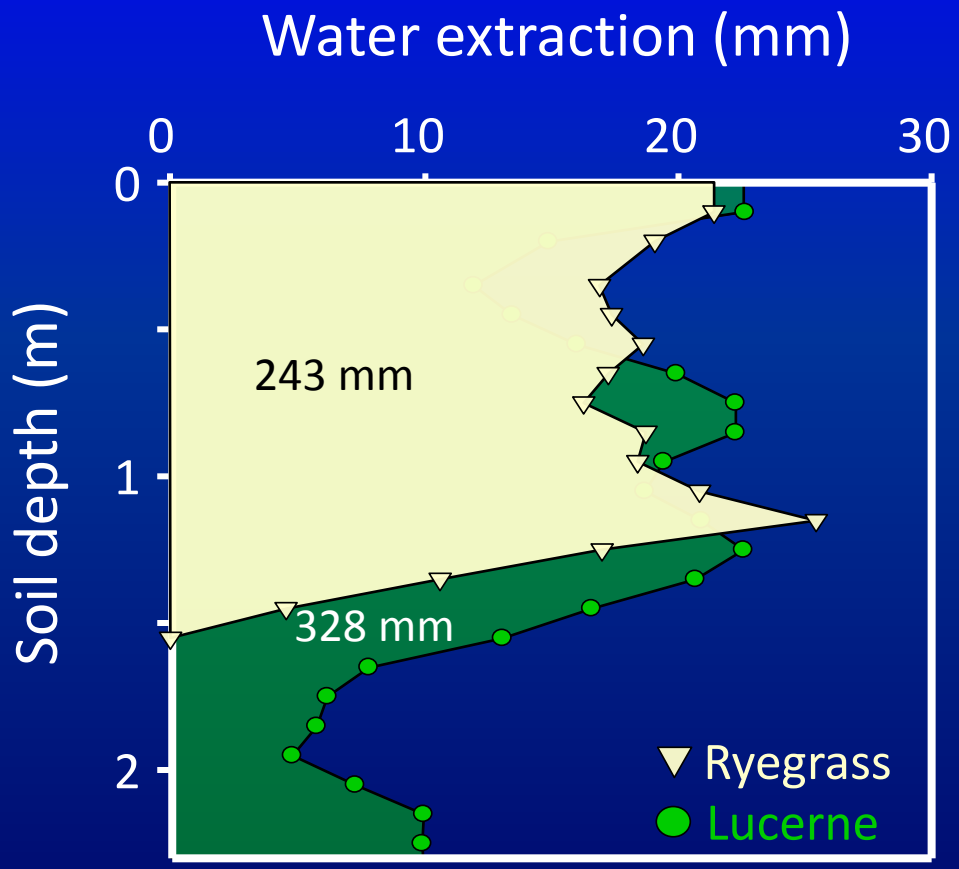
Chicory seedling survival after first grazing

- First grazed at 4.8 leaves/plant – 69% survival

- First grazed at 6.6 leaves/plant – 84% survival

Ryegrass/clover vs. Lucerne

Soil water extraction: Species



Lucerne has 85 mm more available water

Source: Moot *et al*. 2008

Resistance to Pests and Diseases

Cultivar	Dormancy	BGA	PA	SAA	BW	SN	PRR	VW	LD
Grasslands Kaituna	I	R	R	R	R	R	R	-	MR
Grasslands Otaio	I	R	R	R	R	R	R	-	S
Grasslands Torlesse	D	HR	R	R	R	R		-	MR
P54Q53	D	MR	MR	MR	HR	HR	HR	-	-
P54V09	D	-	HR	R	HR	HR	HR	HR	-
Runner	D	-	-	-	R	-	S	-	-
Wairau	SD	S	S	S	S	S	S	S	S
WL 325HQ	I	R	R	R	R	MR	R	-	-

BGA = Blue-green aphid
BW = Bacterial Wilt
VW = Verticillium wilt

PA = Pea aphid
SN = Stem nematode
LD = Leaf diseases

SAA = Spotted alfalfa aphid
PRR = Phytopthora root rot

D = Dormant
SD = Semi-dormant

HR = 50%+ resistant
MR = 16-30%

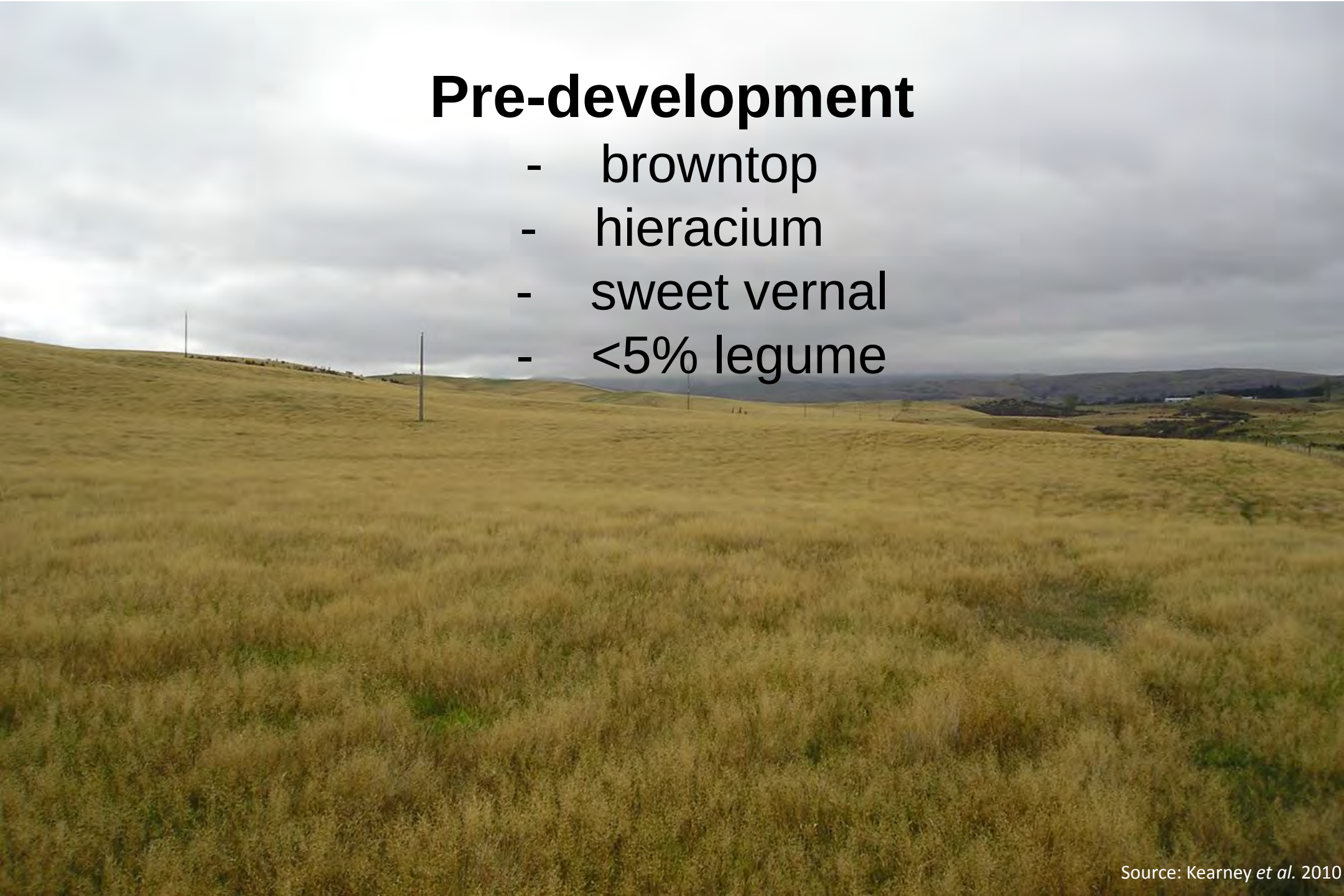
R = Resistant = (31-50%)
S = Susceptible

Updated from Dunbier & Easton 1986

1. Lucerne establishment

Soils
- deep free draining
- pH 6.0 – 7.0
- rg/wc fertility

Sowing
- inoculated
- 10-25 mm
- bare or coated 8-10 kg/ha
- spring or autumn (grass grub)
- cultivated or direct drilled
- after fallow?



Pre-development

- browntop
- hieracium
- sweet vernal
- <5% legume

Source: Kearney *et al.* 2010

Lime and Fertiliser Application

Lime 3-5 ton/ha

Fertiliser 250-500kg/ha

Source: Kearney *et al.* 2010

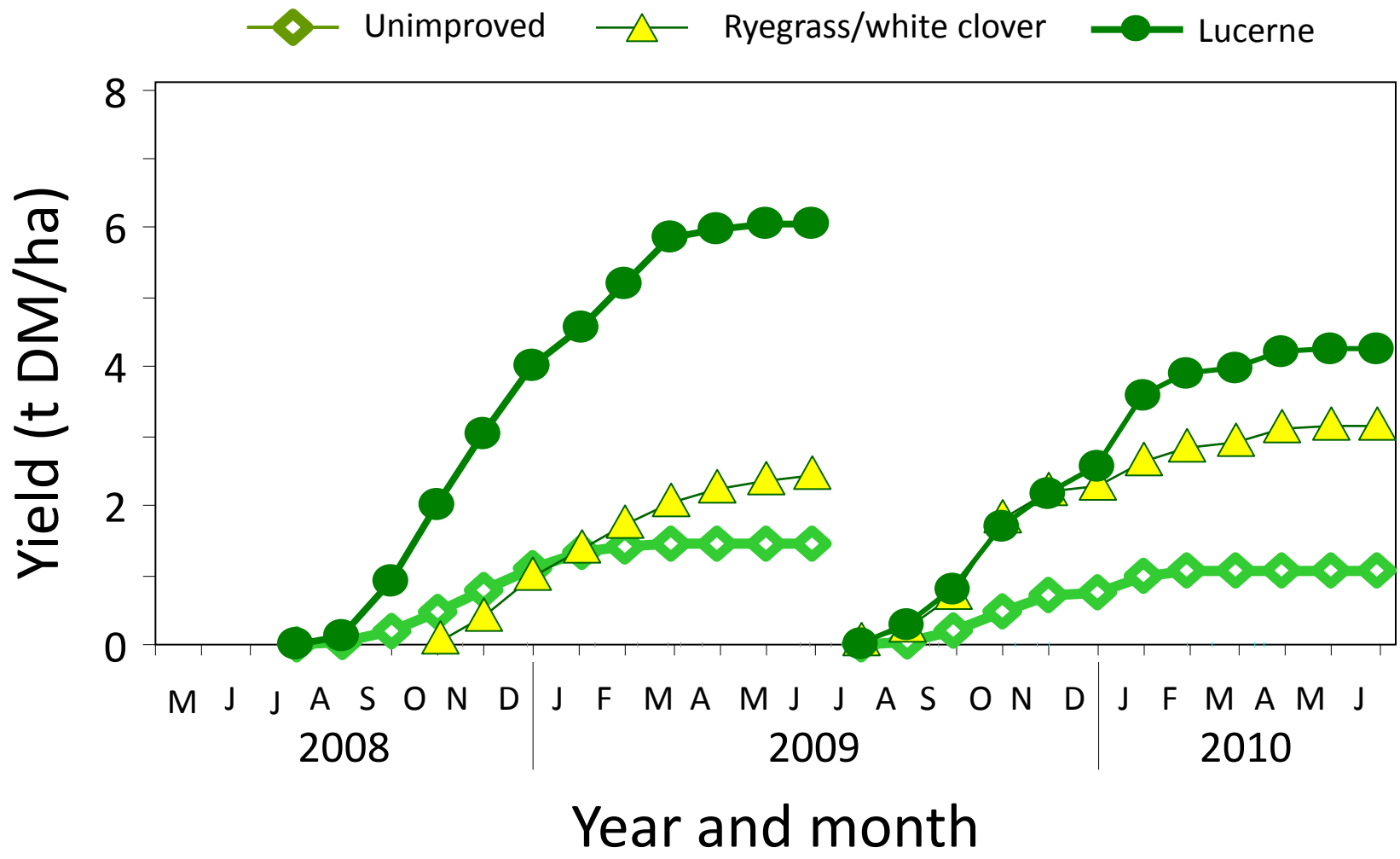

2nd Spray – Spring
Glyphosate, insecticide, penetrant
Result from Autumn spray, photo taken 1 November 2010
Source: Kearney *et al.* 2010

Drilling seed with fertiliser
Direct drilling = seed + fertiliser

Source: Kearney *et al.* 2010

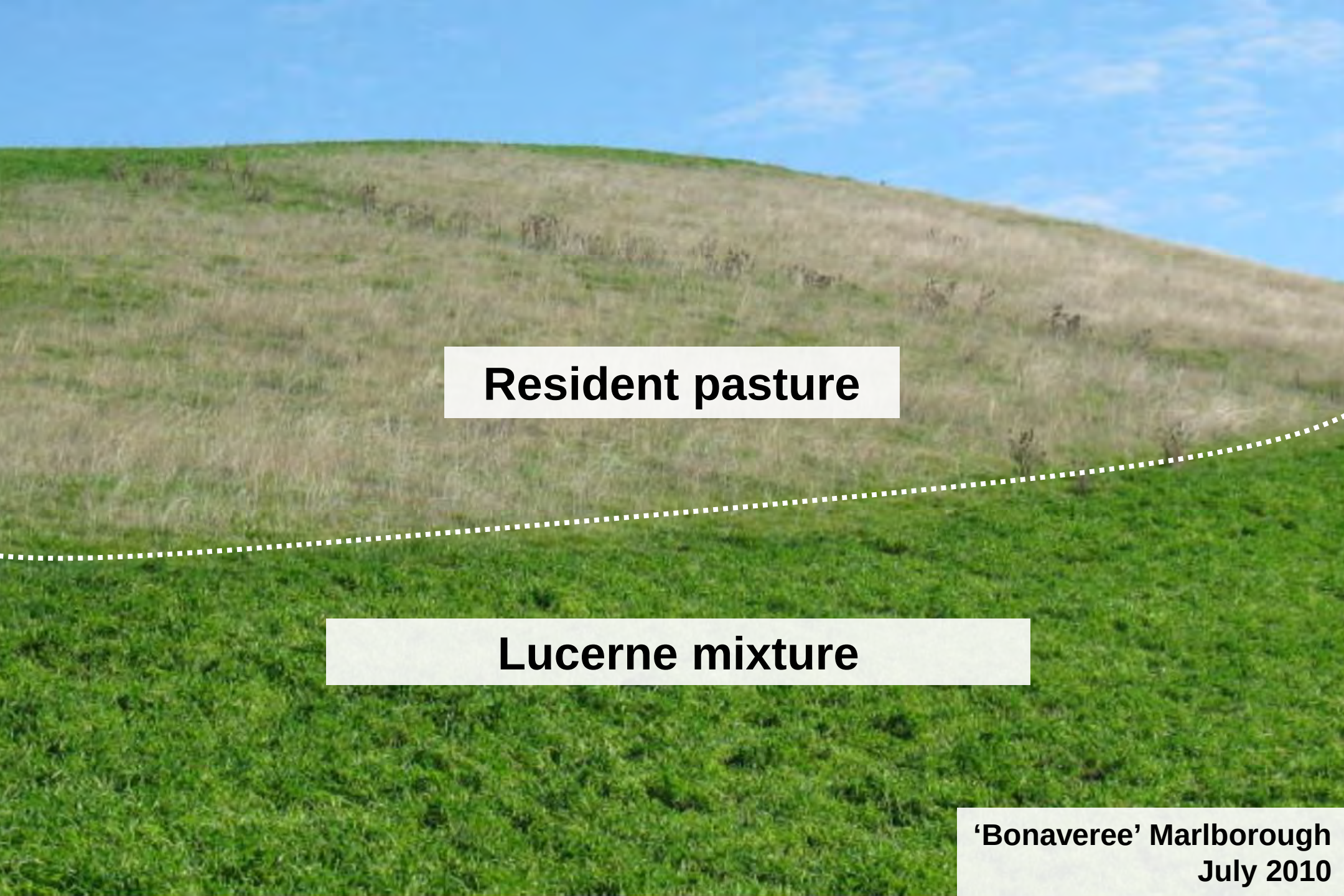

Sown 21/11/2007
Photo taken 1/11/2010
Styx Station
Source: Kearney *et al.* 2010

Pasture growth



Source: Kearney *et al.* 2010

Doug and Fraser Avery “Bonavaree”



‘Bonaveree’ Marlborough
July 2010

Maximize reliable spring growth – high priority stock

Ewe hoggets grown on lucerne 54 kg ave

Conclusions

- Aim to transform farms to be economically, environmentally and socially resilient.
- Require regionally **specific** technical solutions and ongoing extension.
- Nitrogen from legumes is the key to improve pastoral water use efficiency.
- Lucerne, herbs and other grasses have a key role to play in pastoral farming for deer, beef, dairy and sheep.

Acknowledgements

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

References

Cosgrove G. 2005. Novel grazing management: making better use of white clover. Proceedings of the 2005 SIDE Conference. Online: http://www.side.org.nz/IM_Custom/ContentStore/Assets/7/43/5084880571838b9ff7514c0efc22097d/Novel%20grazing%20management%20options.pdf

Dumbleton, A.J. 1997. White clover and chicory production from four sowing dates with five rates of ryegrass. B.Ag.Sci (Hons) dissertation, Lincoln University, Canterbury. 85 pp.

Dunbier, M. W. and Easton, H. S. 1982. Longer stand life with new cultivars. *In:* R. B. Wynn-Williams (ed). Lucerne for the 80's. Special Publication No. 1. Palmerston North: Agronomy Society of New Zealand, 121-126.

Kemp, P.D., Kenyon, P.R., Morris, S.T. 2010. The use of legume and herb forage species to create high performance pastures for sheep and cattle grazing systems . *Revista Brasileira de Zootecnia* (Special Supplement) 39: 169-174. Online: http://dx.doi.org/10.1590/S1516-35982010001300019

Mills, A., Moot, D. J. and McKenzie, B. A. 2006. Cocksfoot pasture production in relation to environmental variables. *Proceedings of the New Zealand Grassland Association*, 68, 89-94.

Moot, D. J., Brown, H. E., Pollock, K. and Mills, A. 2008. Yield and water use of temperate pastures in summer dry environments. *Proceedings of the New Zealand Grassland Association*, 70, 51-57.

Moot, D. J., Scott, W. R., Roy, A. M. and Nicholls, A. C. 2000. Base temperature and thermal time requirements for germination and emergence of temperate pasture species. *New Zealand Journal of Agricultural Research*, 43, 15-25.

New Zealand Fertiliser Manufacturers' Research Association. 2011. Annual update (New Zealand Fertiliser Manufacturers' Research Association). 15 pp. Date Accessed: 5/5/2011. Online: http://www.fertresearch.org.nz/resource-centre/annual-updates . Last Updated: Dec 2009.

Pasture Species Options
- agronomy and grazing management

Professor Moot gave this presentation at:

Whangerai Waikato

On:

21 Feb 2012