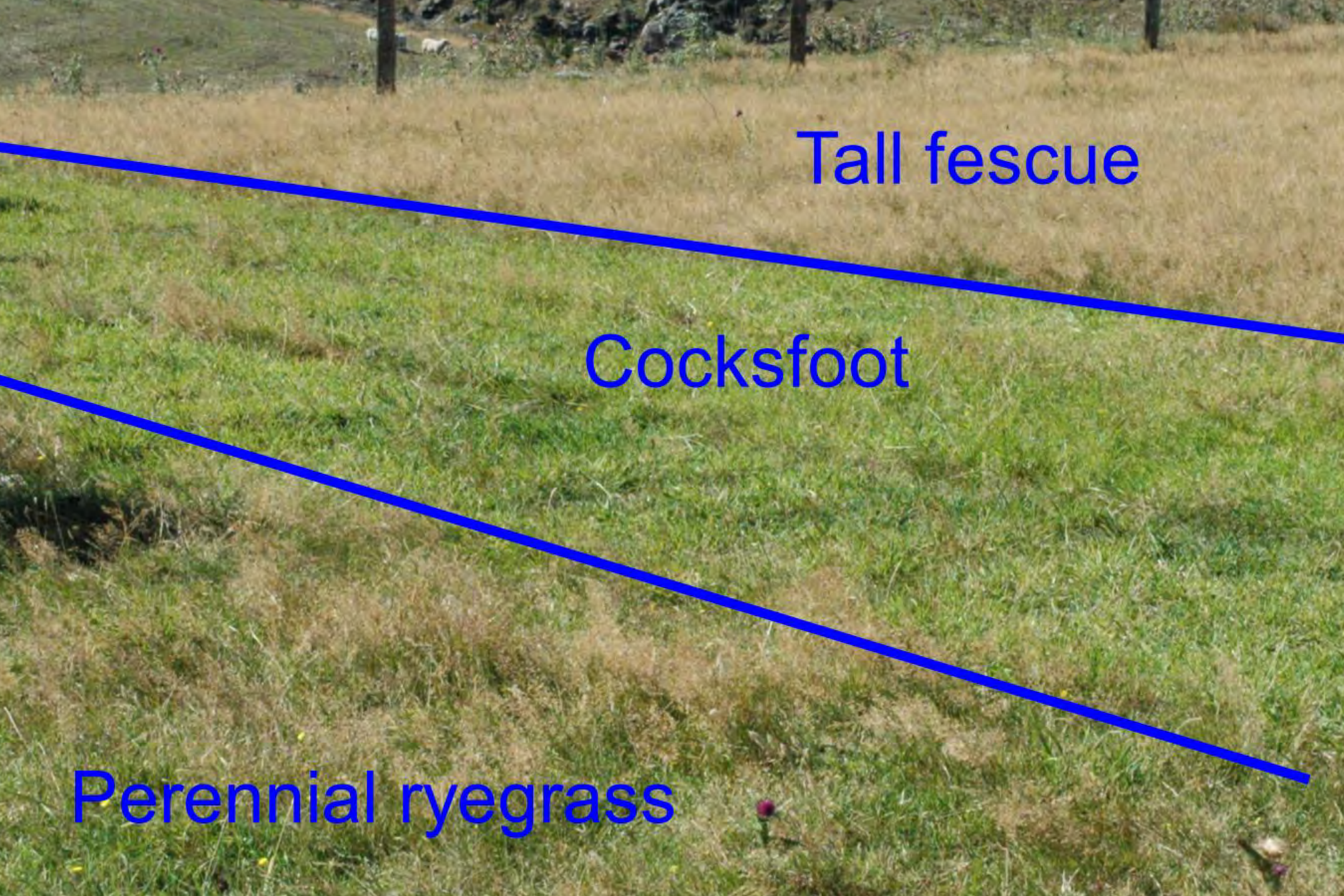
Dryland Pastures- Lucerne

- agronomy and grazing management

Dr Derrick Moot

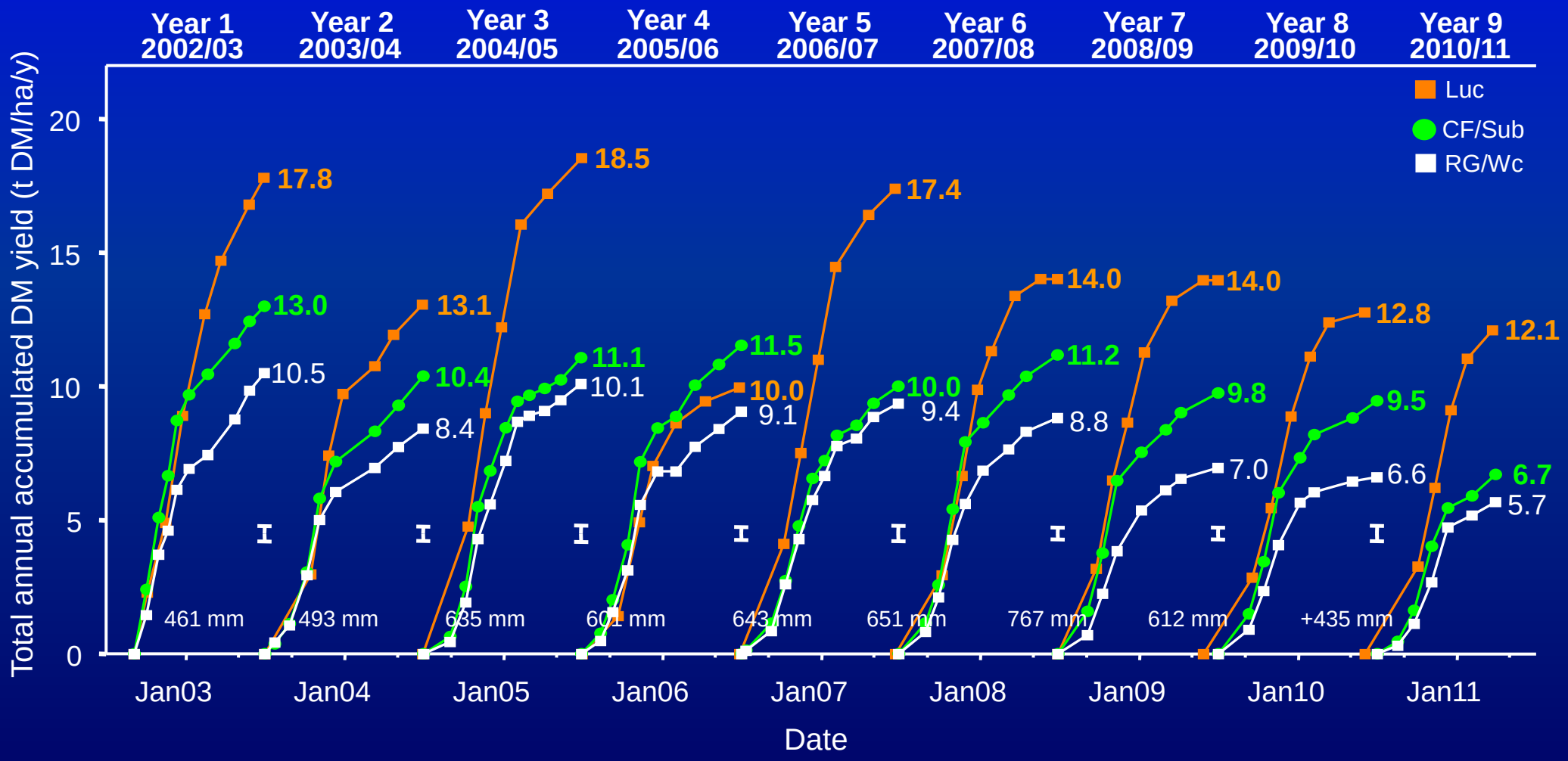
Professor of Plant Science


Tall fescue
Cocksfoot
Perennial ryegrass

‘MaxClover’

‘MaxClover’ Total DM Yields

(to 30 March 2011)



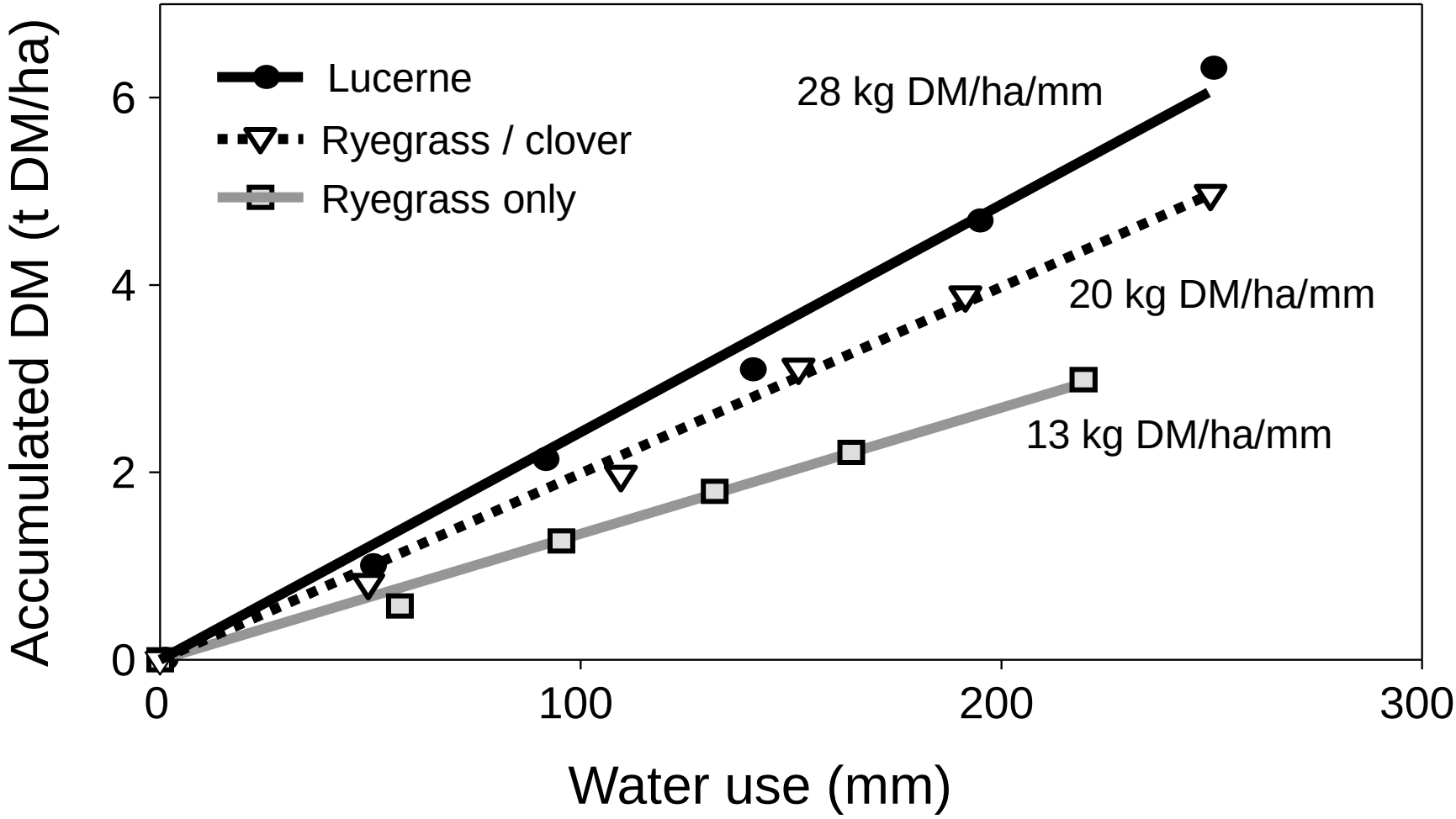
Source: Moot 2012

RG/Wc pastures

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

Lucerne pastures

Spring WUE: legume = (nitrogen)

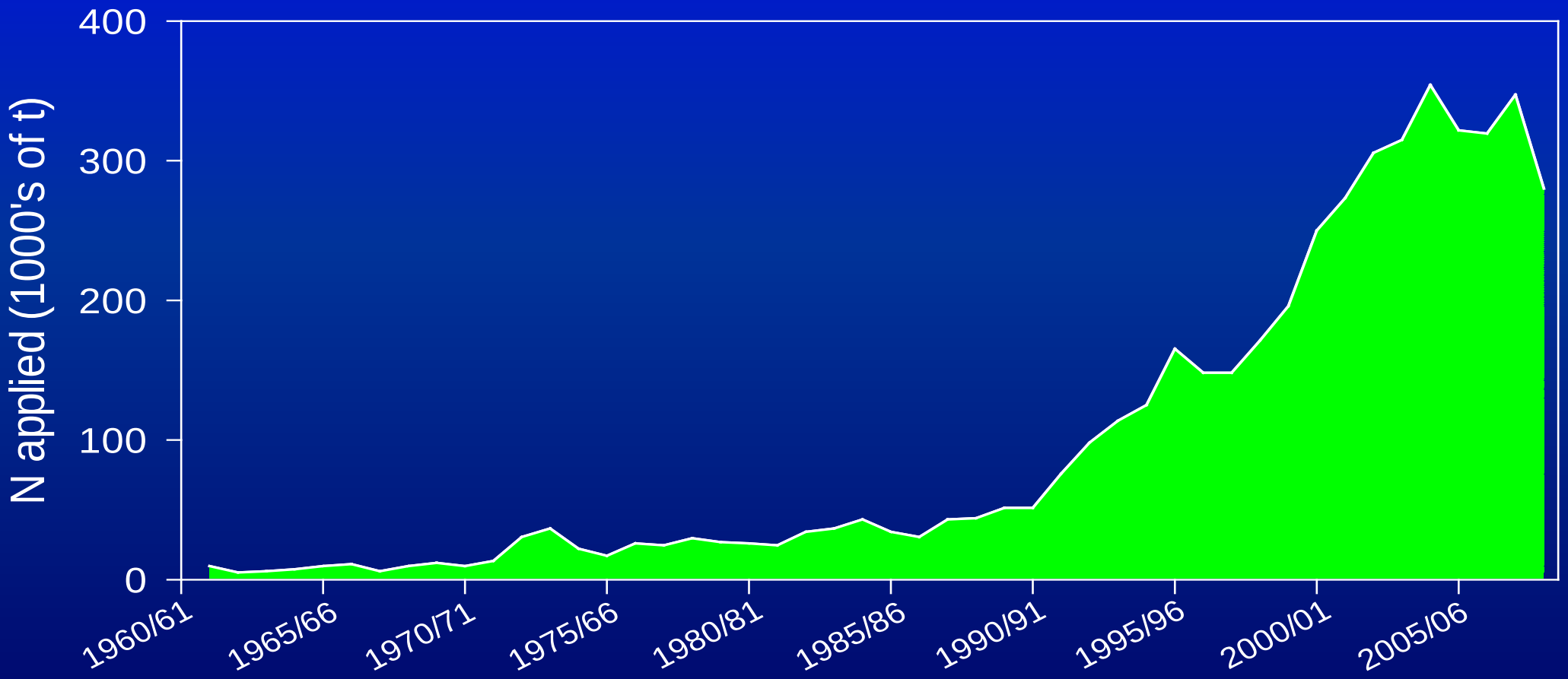


Source: Moot *et al.* 2008

Nitrogen deficient pasture

1000 kg N/ha

Nitrogen fertiliser use



Source: New Zealand Fertiliser Manufacturers' Research Association

Water and nitrogen = ryegrass

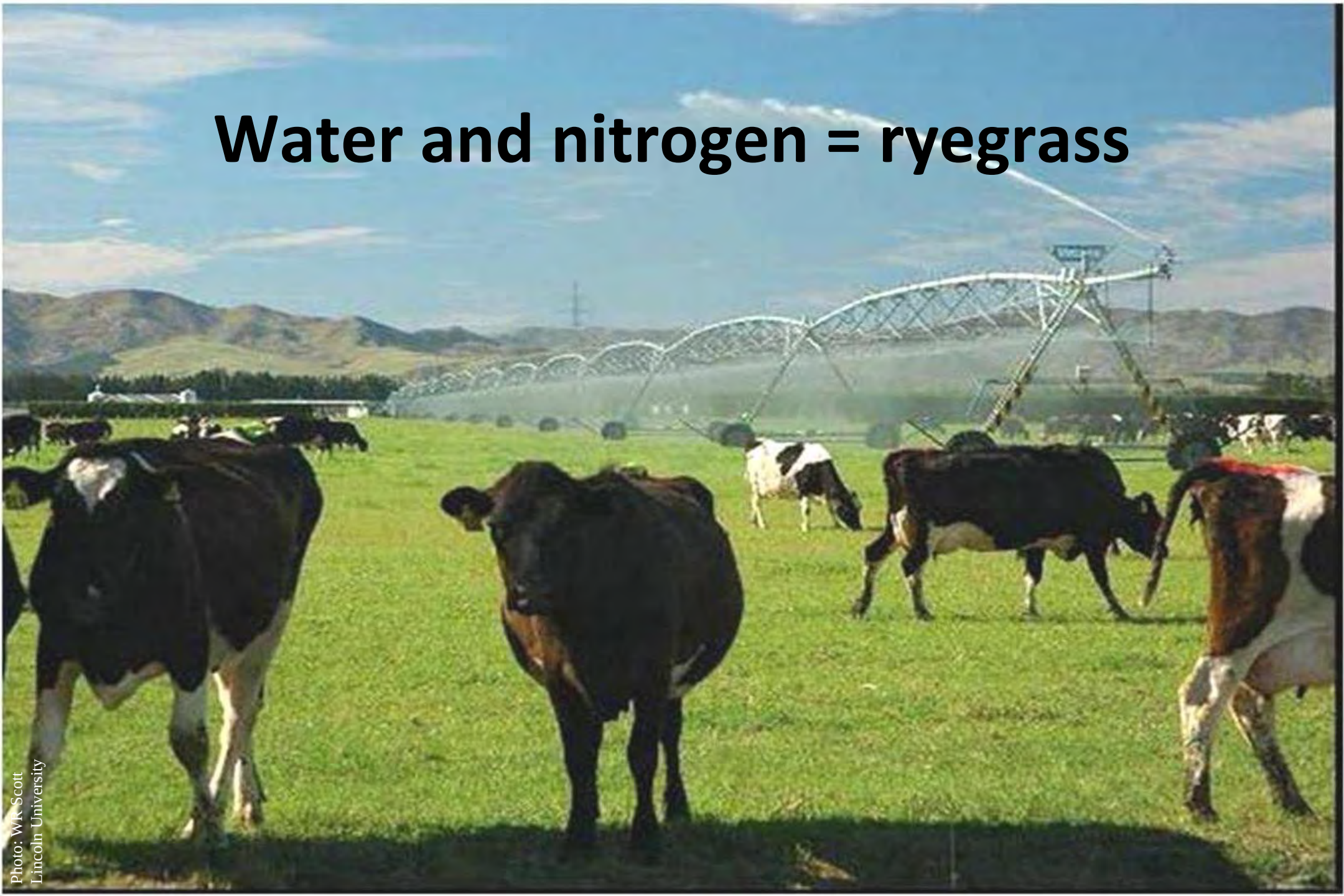
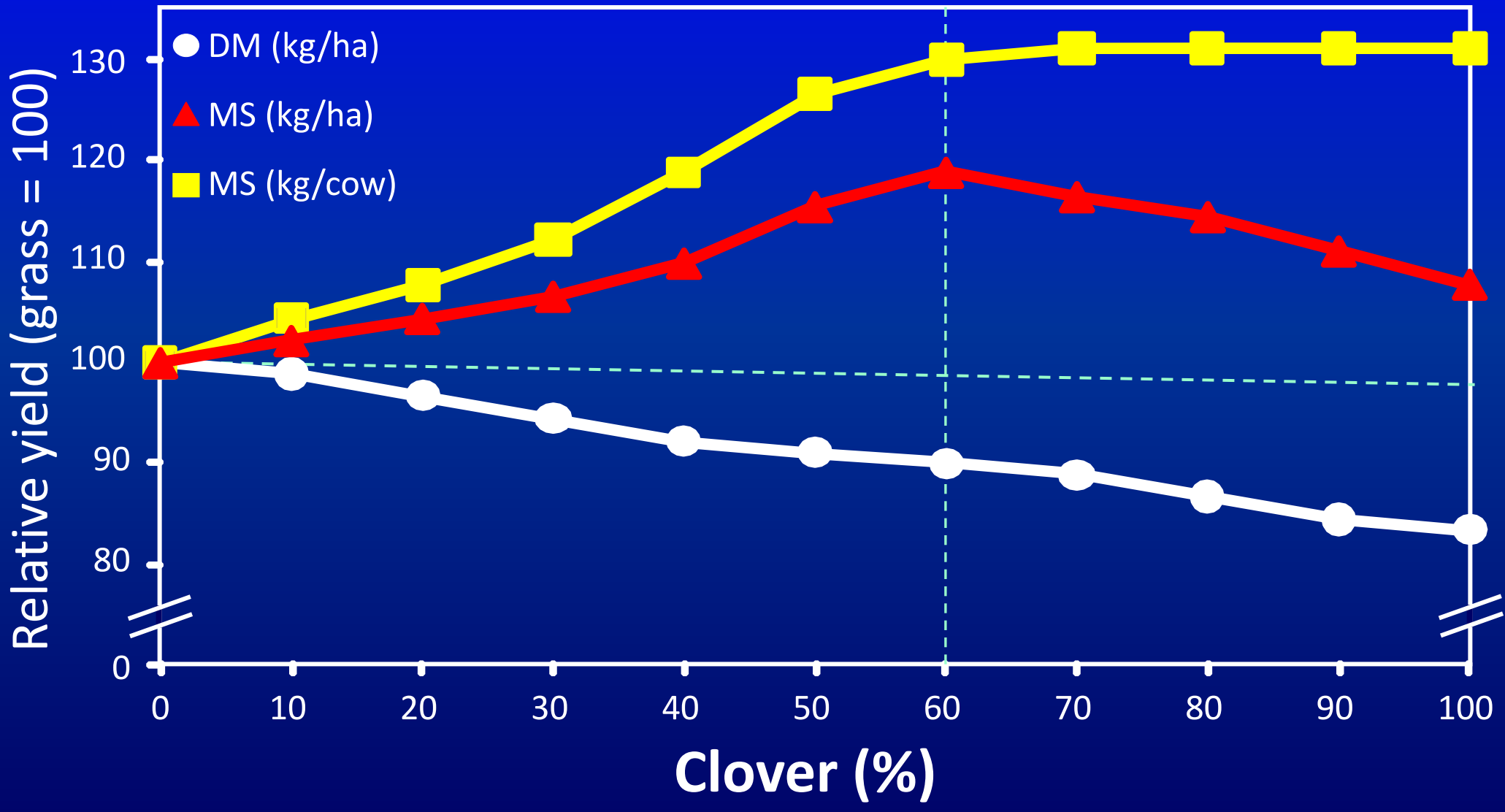


Photo: WR Scott
Lincoln University

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	

INTERNATIONAL SHEEP RESEARCH CENTRE

Feeding value of temperate pasture species based on liveweight gain when fed *ad libitum* to growing lambs. Ranking is relative to white clover (100) (Source: P Kemp from Waghorn *et al*. 2007).

Species	Ranking	No. Trials
White clover	100	15
Chicory	95	1
Lotus corniculatus	87	4
Lotus pedunculatus	84	6
Tetraploid ryegrass	83	1
Alfalfa	82	12
Red clover	70	7
Timothy	67	5
Perennial ryegrass	52	16
Agrostis capillaris	46	2

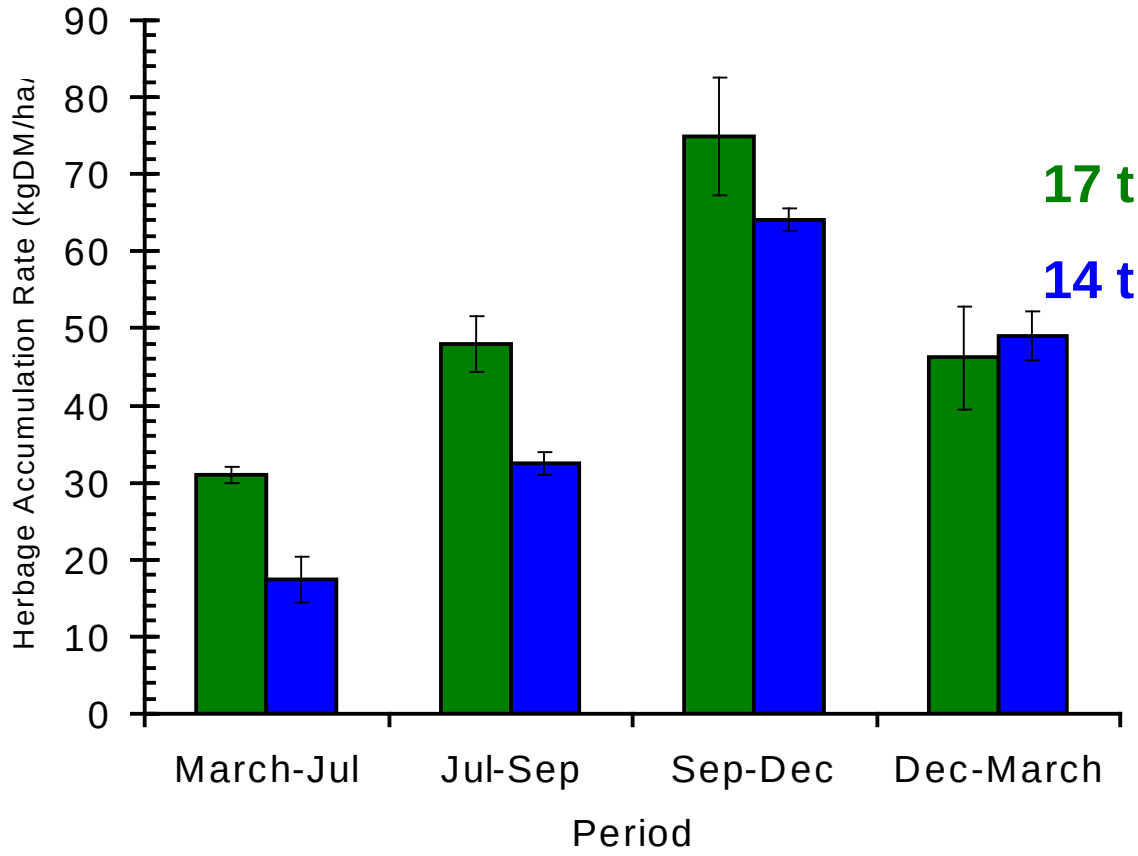
Nutritive value in February

OMD Organic matter digestibility
ME metabolisable energy
NDF neutral detergent fibre

Treatment	OMD g/kg DM	ME MJ/kg DM	NDF g/kg DM
Herb/legume	829	11.4	281
Ryegrass/white clover	641	9.0	481

Supplied: P Kemp

HOW MUCH PRODUCTION IN THE FIRST YEAR?



17 t DM/ha/yr plantain

14 t DM/ha/yr chicory

Figure 1. Dynamics of herbage accumulation rate (HAR) in plantain (green) and chicory (blue)

Supplied: P Kemp

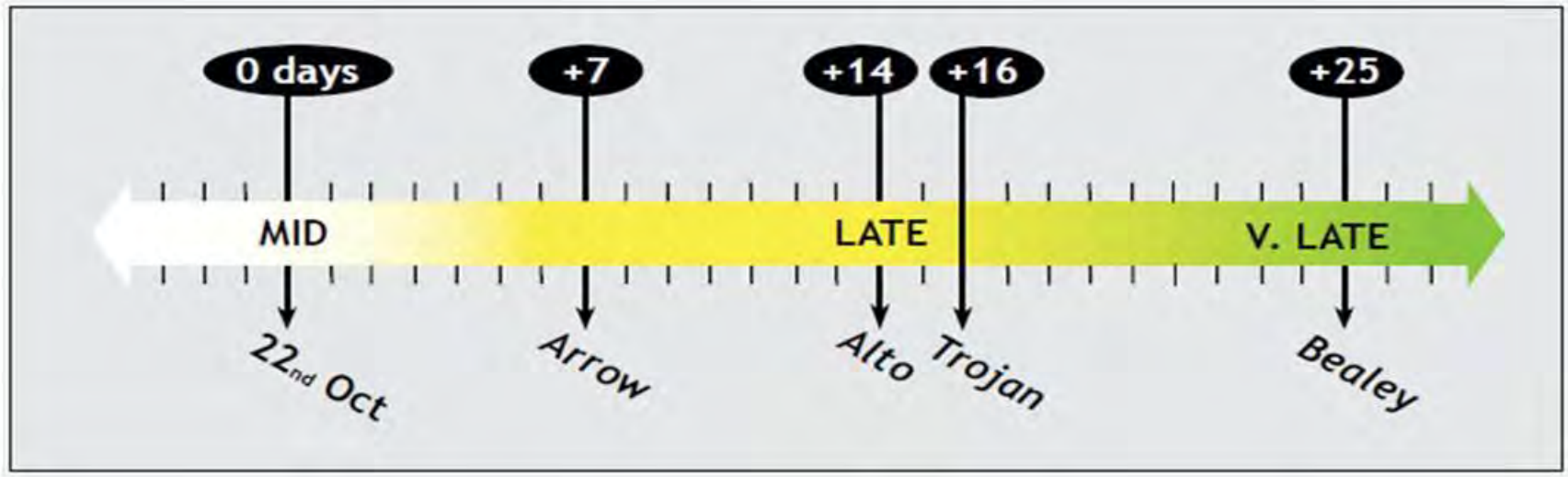
Photo: A Black
Lincoln University

The ryegrass continuum

Most persistent	**Lowest winter growth**	**Lowest nutritive value**	Perennial ryegrass
↕	↕	↕	Long rotation ryegrass
			Short rotation ryegrass
	Highest winter growth	**Highest nutritive value**	Italian ryegrass
Least persistent			Annual ryegrass

Heading date

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

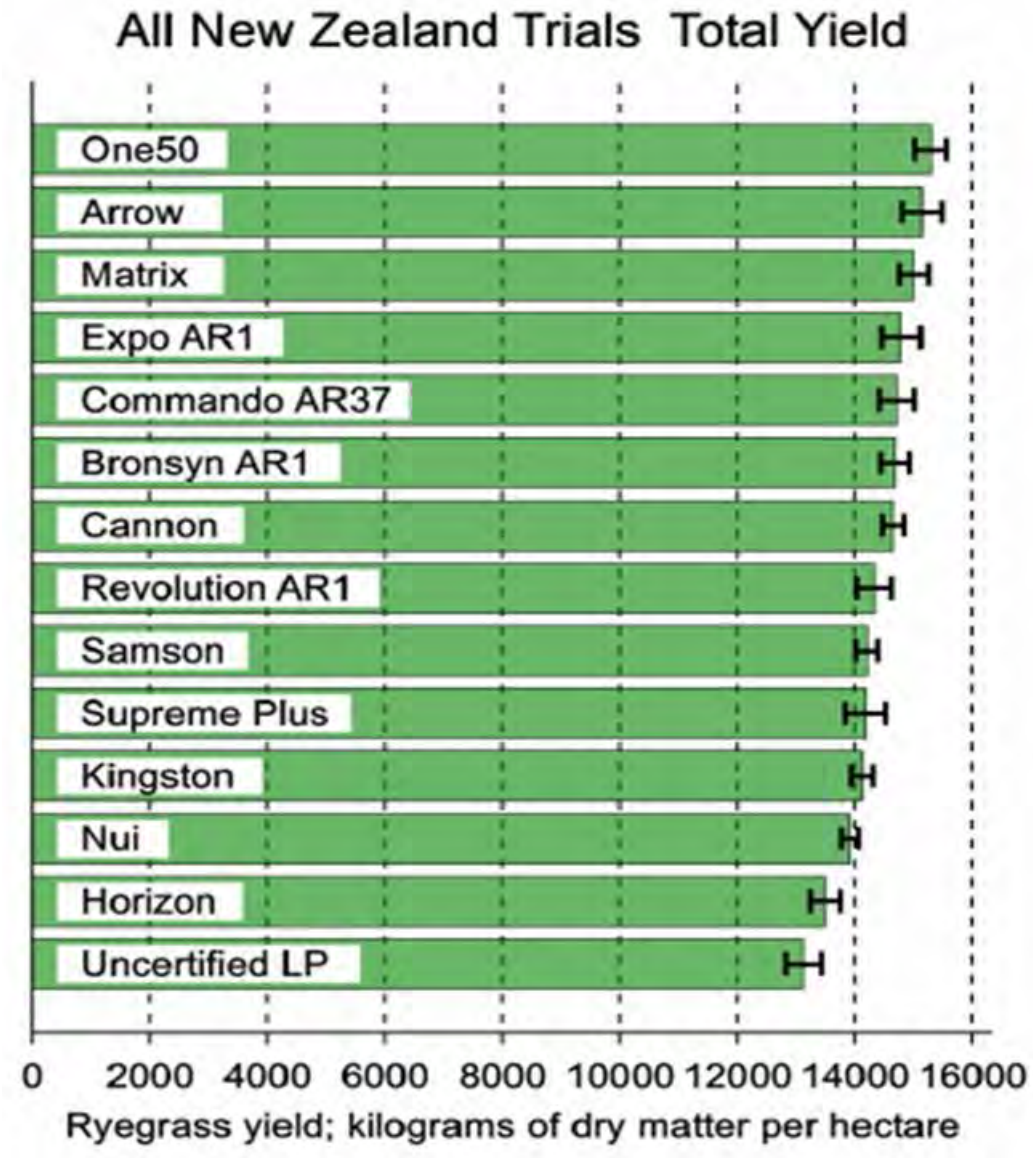


Source: www.agriseeds.co.nz

Forage variety trials

Photo: A Black
Lincoln University

Perennial ryegrass cultivars



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

Photo: DJ Moot
Lincoln University

40% white clover

Photo: DJ Moot
Lincoln Unversity

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

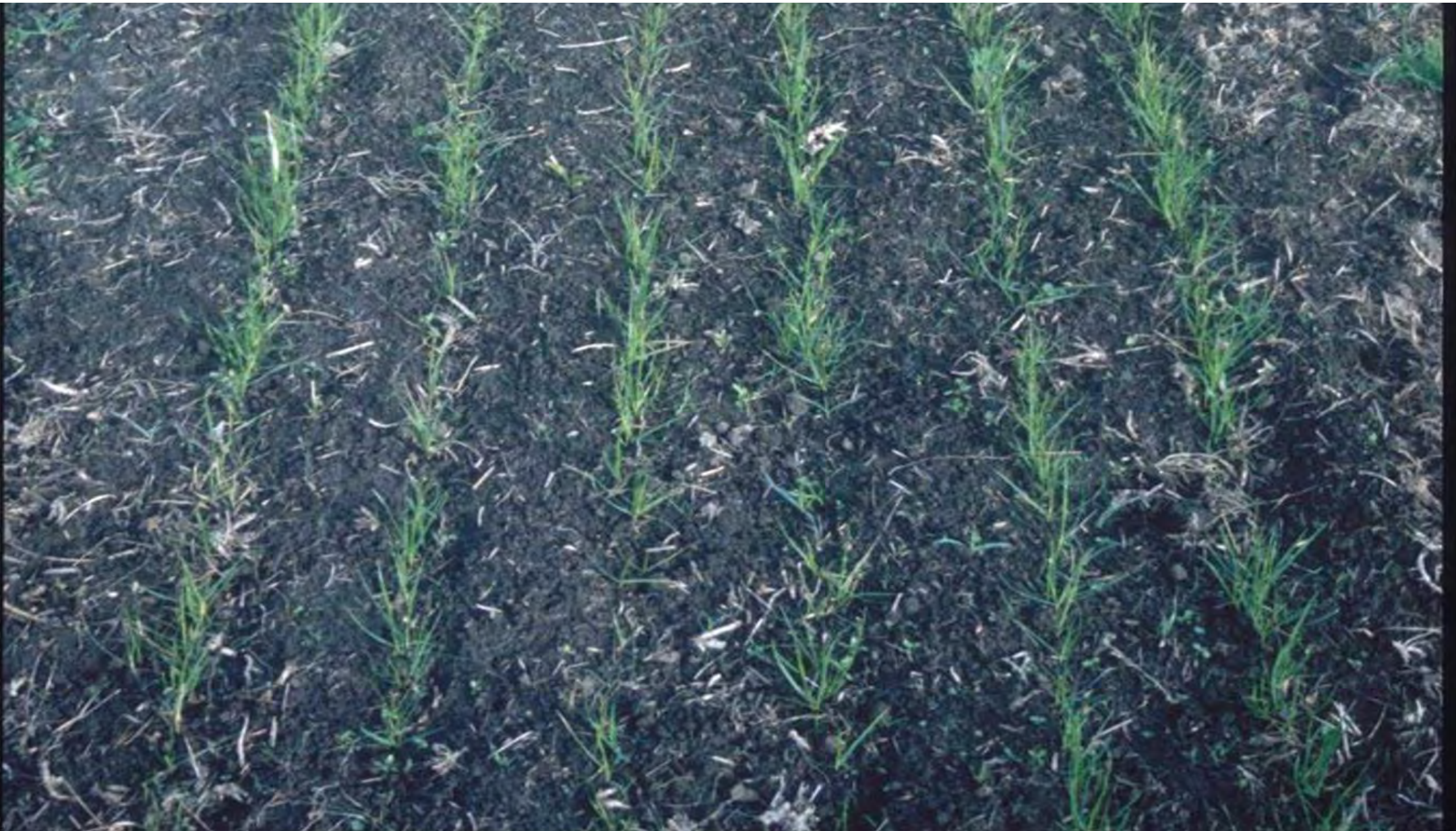
White clover

Photos: A Black
Lincoln University

Ryegrass sowing rate

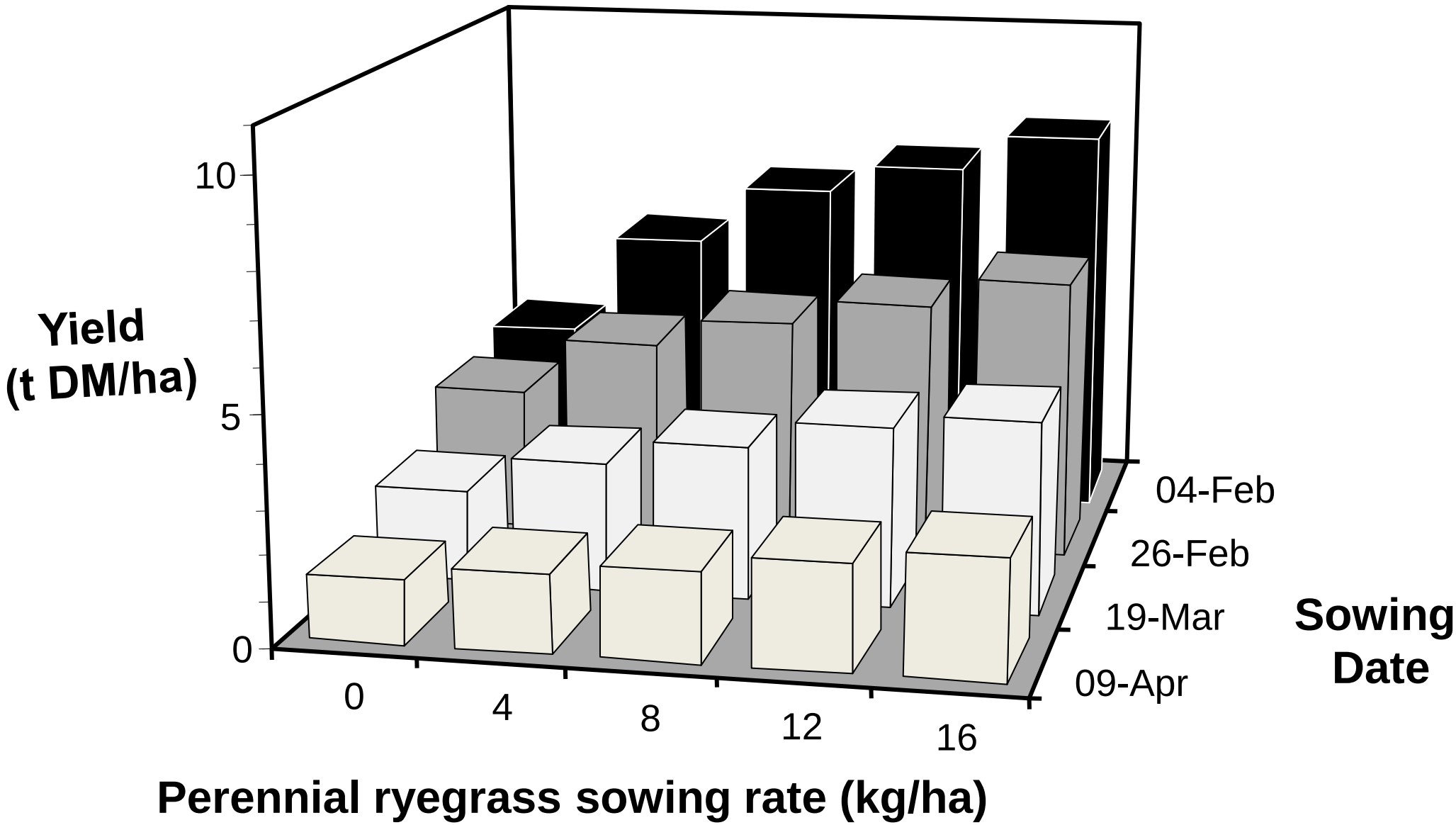
White clover @ 4 weeks

Perennial ryegrass @ 4 weeks



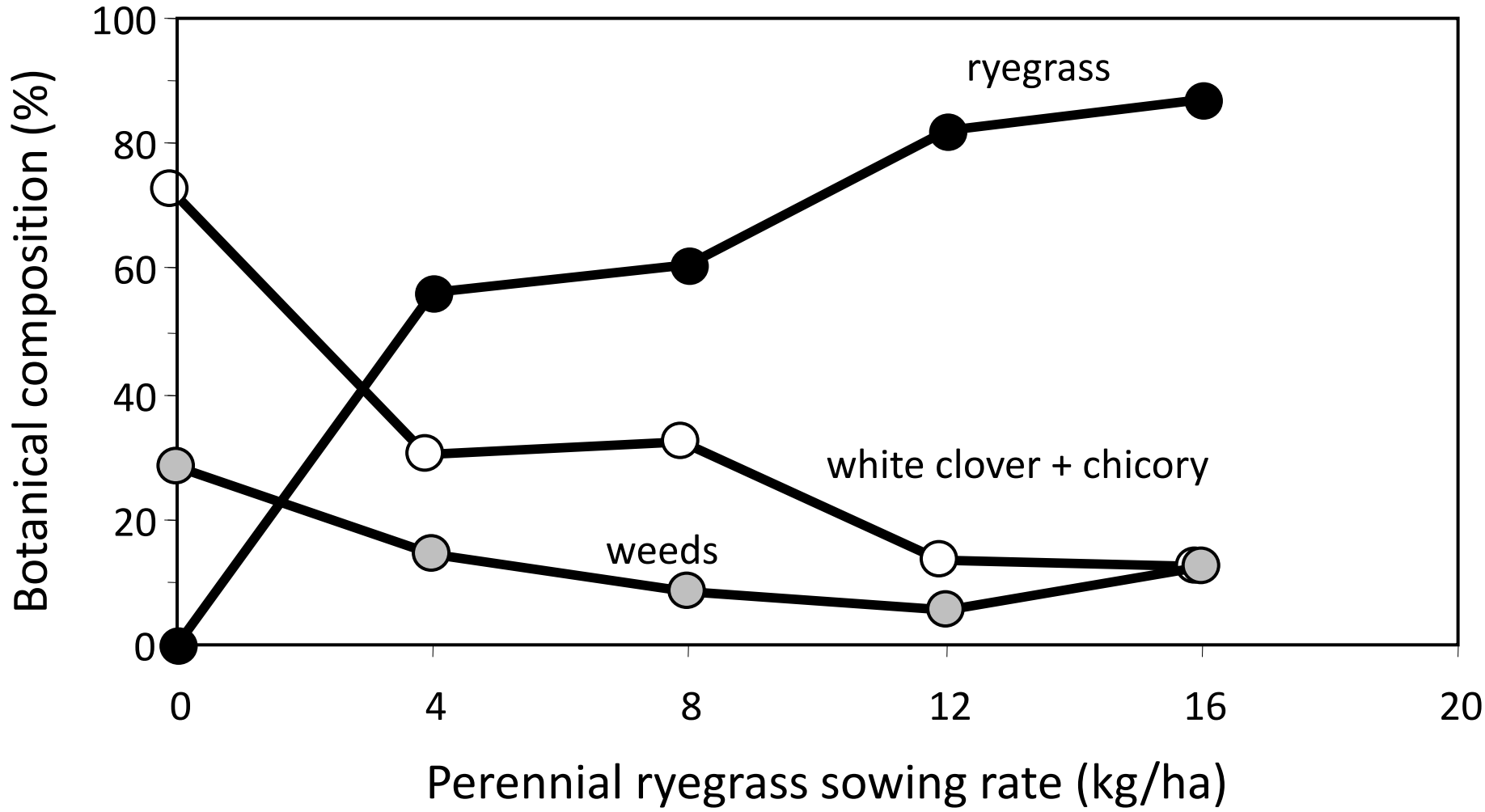
Italian ryegrass @ 4 weeks

Total yield in Year 1 (25/9)



Source: Dumbleton, 1997

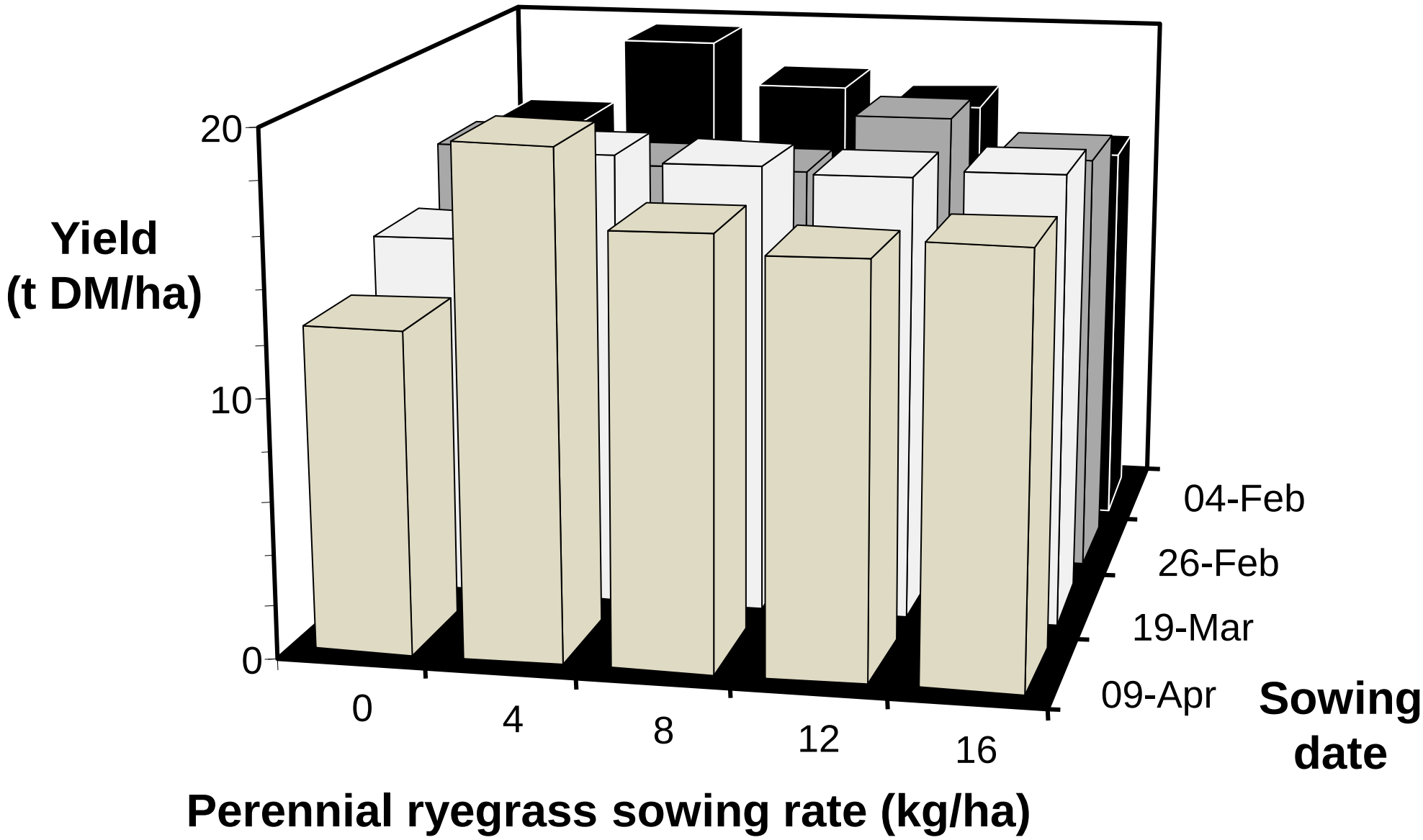
Botanical composition



Source: Dumbleton, 1997

20% white clover

Total yield in Year 2



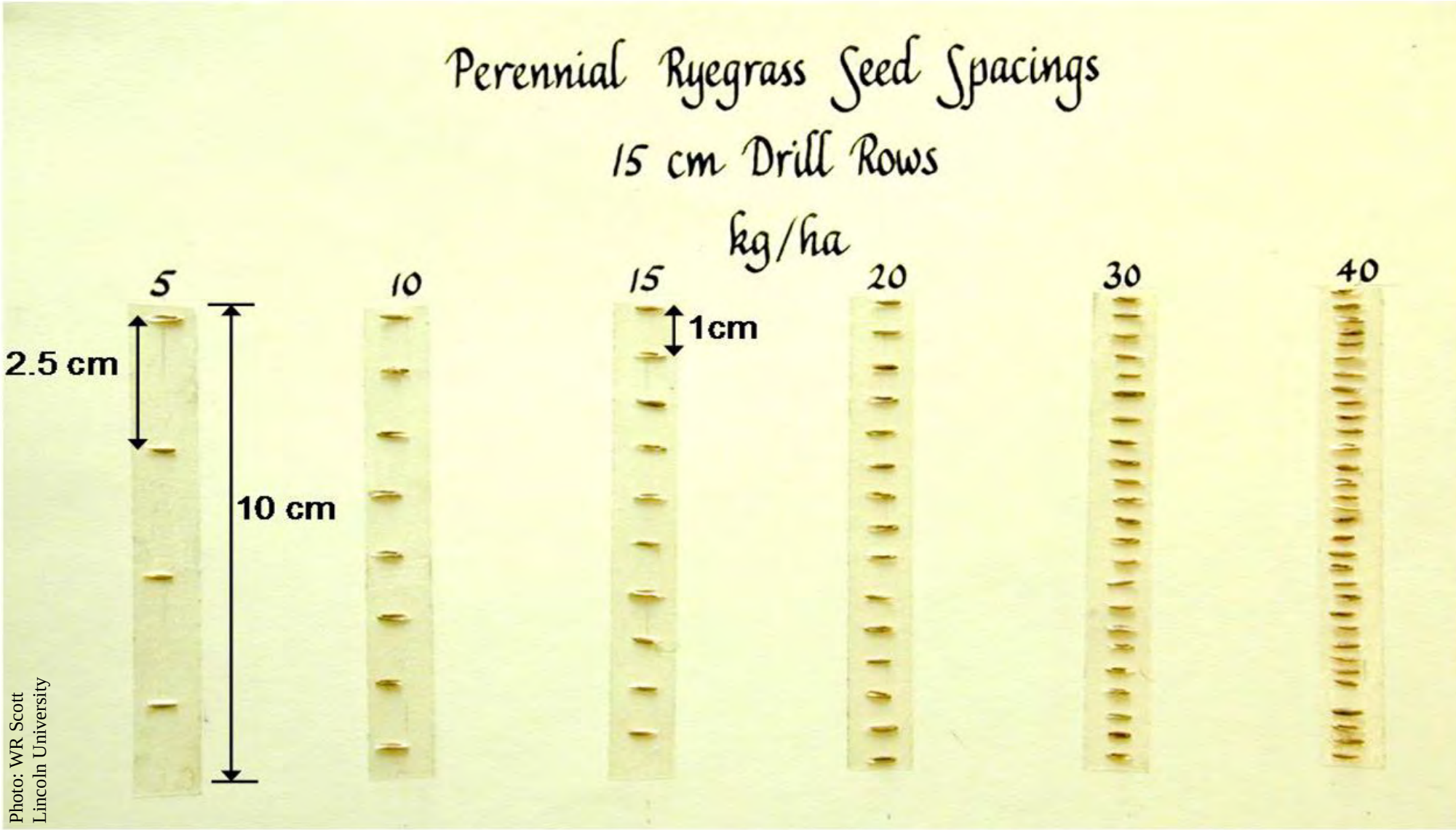
(Source: Nicholls 1998)

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

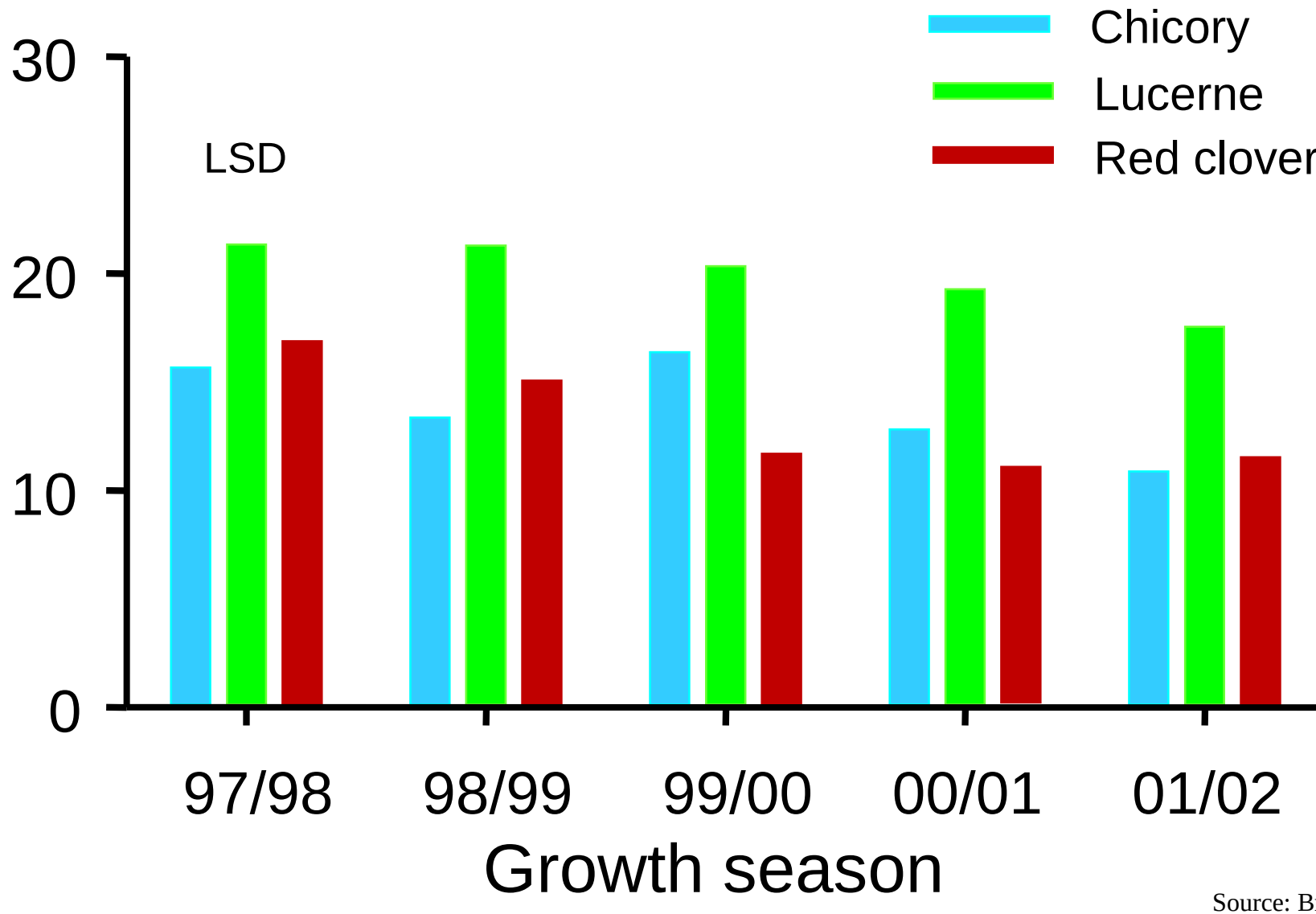
Sowing rates



Summary: White clover

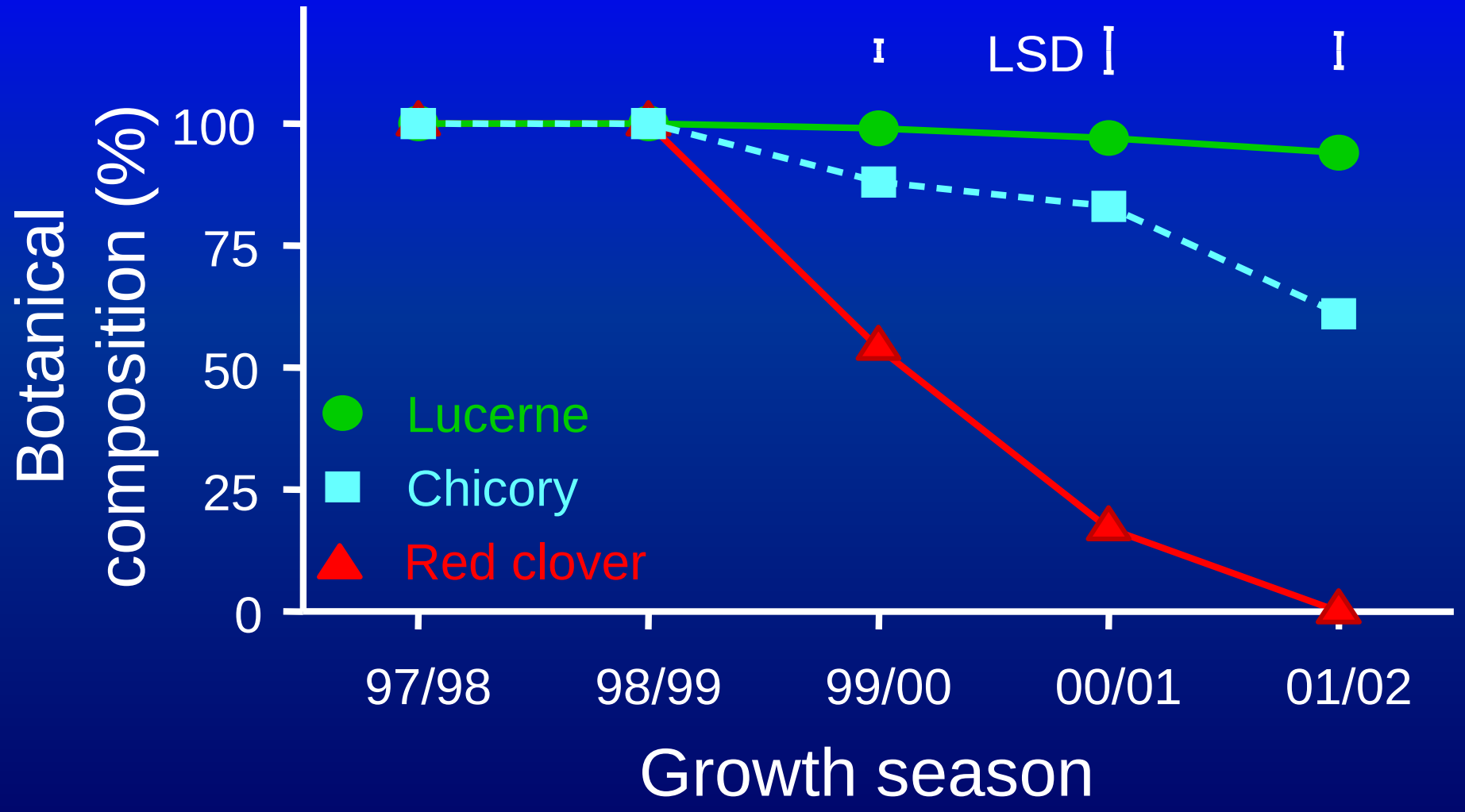
- Autumn sowing
    - soil temperature >14°C
- Drilled with 8-10 kg/ha ryegrass in a well prepared seed bed!
- Nutrients (P) maintained
- Manage for white clover (18 months) and each spring!

Annual dry matter yields



Source: Brown *et al*. 2005

Persistence



Source: Brown & Moot 2004

Ryegrass/clover vs. Lucerne

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

Supplied: P Kemp

Chicory seedling survival after first grazing

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

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

Supplied: P Kemp

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%

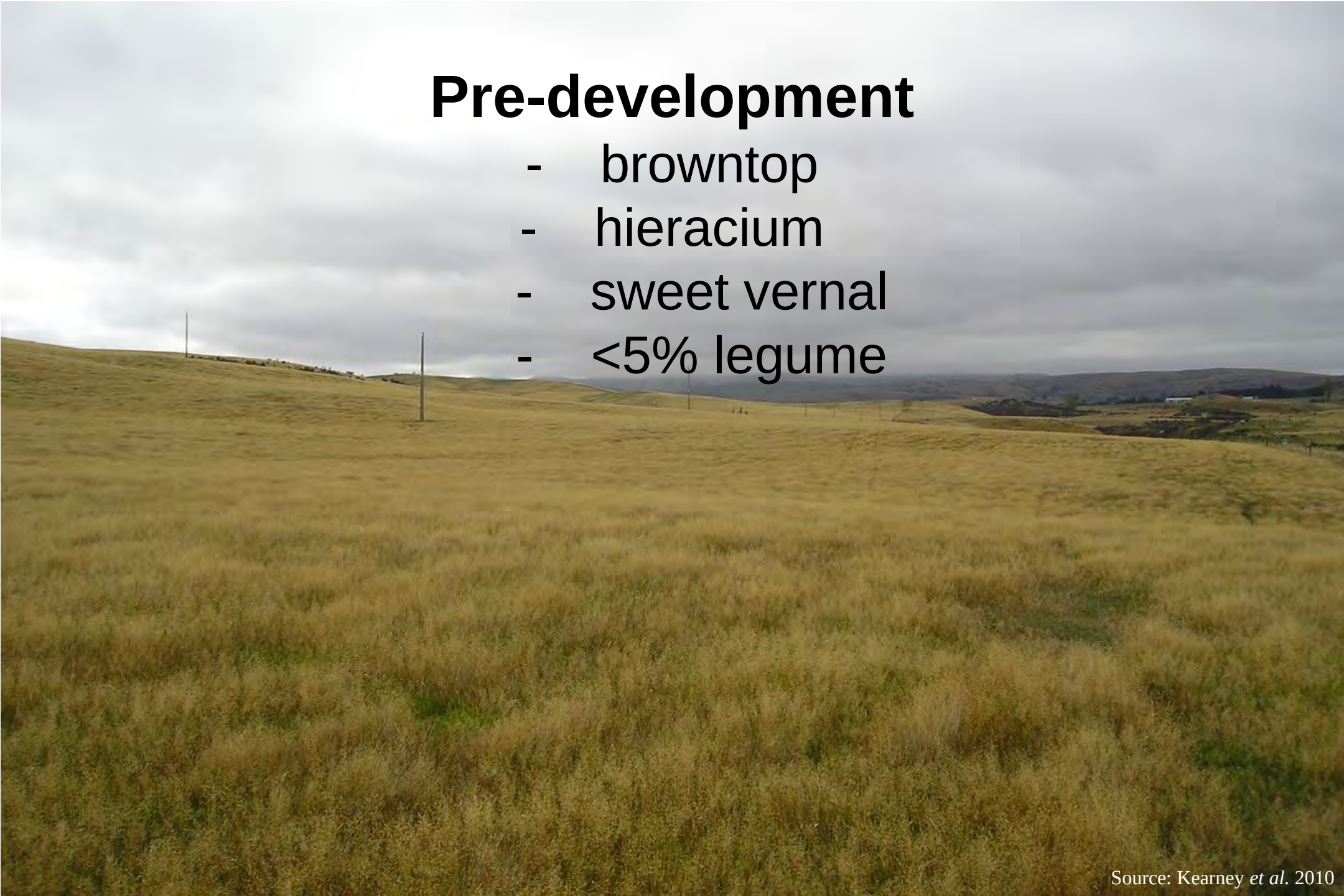
R = Resistant = (31-50%)
S = Susceptible

Adapted from : Dunbier & Easton 1982

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

Source: Kearney *et al.* 2010

Lime and Fertiliser Application

Lime 3-5 ton/ha

Fertiliser 250-500kg/ha

Source: Kearney *et al*. 2010

Typical 0.15 m soil test results for pre (2008) and post (2010) fertiliser applications from three Central Otago farms.

	pH	Olsen P (µg/ml)	Potassium (QTU)	Sulphur (µg/g)	Aluminium (mg/kg)
Pre-Development (2008)					
Hills Creek	5.2	10	5	14	2.6
Huntleigh	5.2	10	5	1	6.3
Styx	5.2	13	13	3	5.7
Post-Development (2010)					
Hills Creek	5.8	19	9	31	0.9
Huntleigh	6.0	18	4	25	1.5
Styx	6.1	29	13	23	1.1

Source: Kearney *et al.* 2010

Photo: V Fasi
Lincoln University

Lucerne root

~8 months after sowing
> 1.5 m length

Photo: D Hollander
Lincoln University

Autumn Spraying

- Timing is Critical
- Most important tool
- Glyphosate, granstar, penetrant

Key Results

- Conserve soil moisture
- Kill mass root systems

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

Source: Kearney *et al.* 2010

Pasture growth

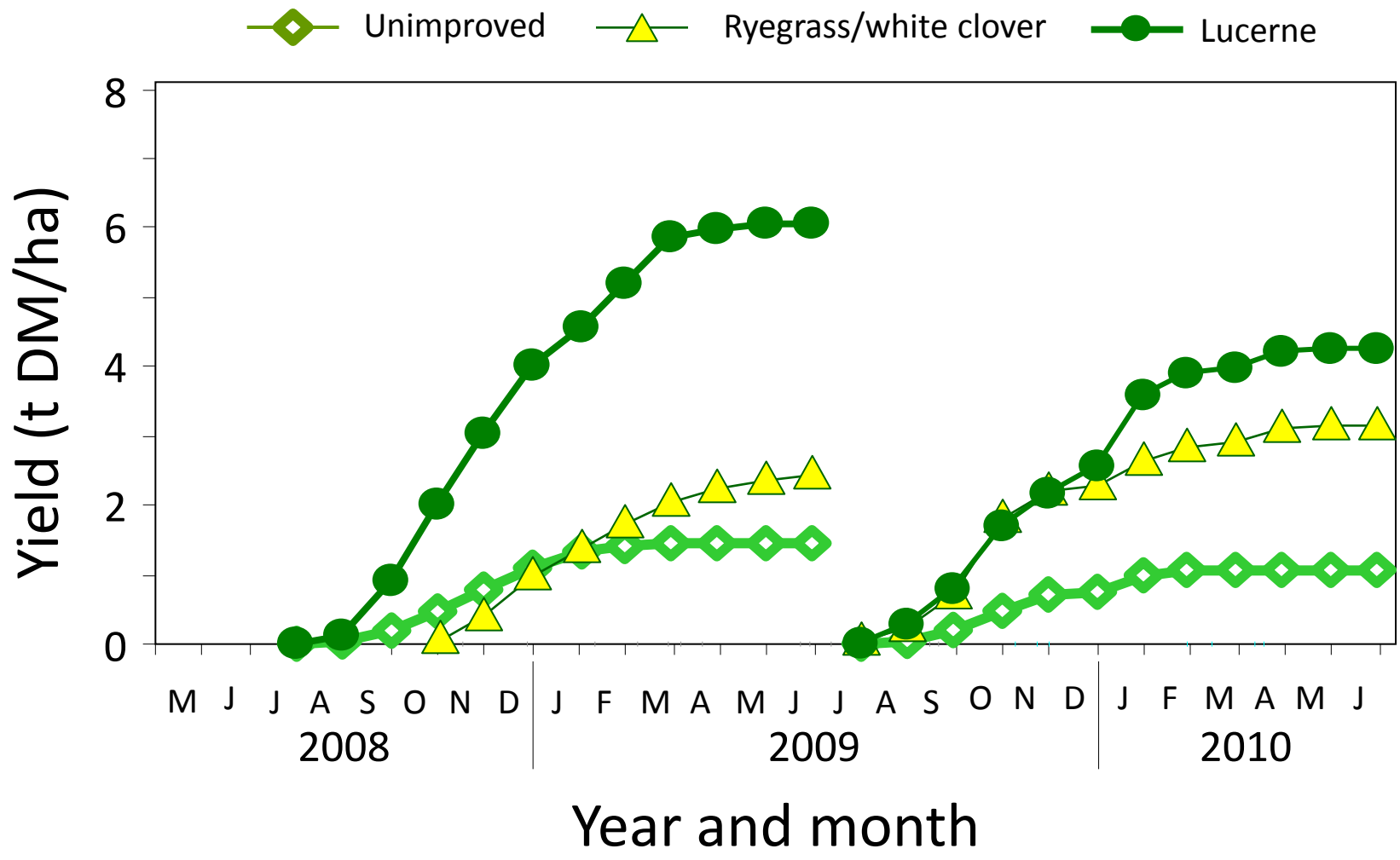


Photo: V Fasi (LU)
Lees Valley

Seasonal grazing management

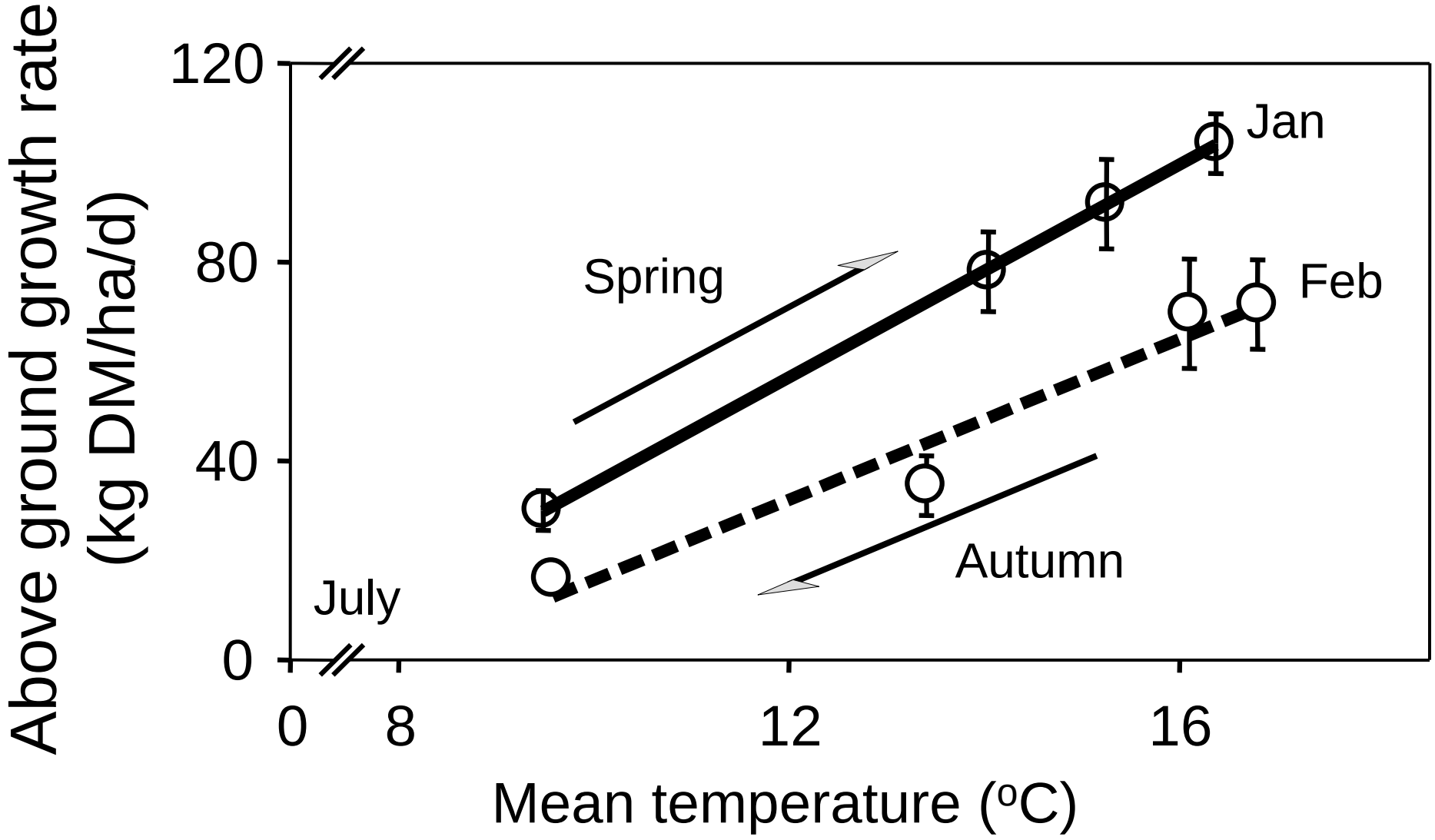
Spring

- 1st rotation aided by root reserves to produce high quality vegetative forage.

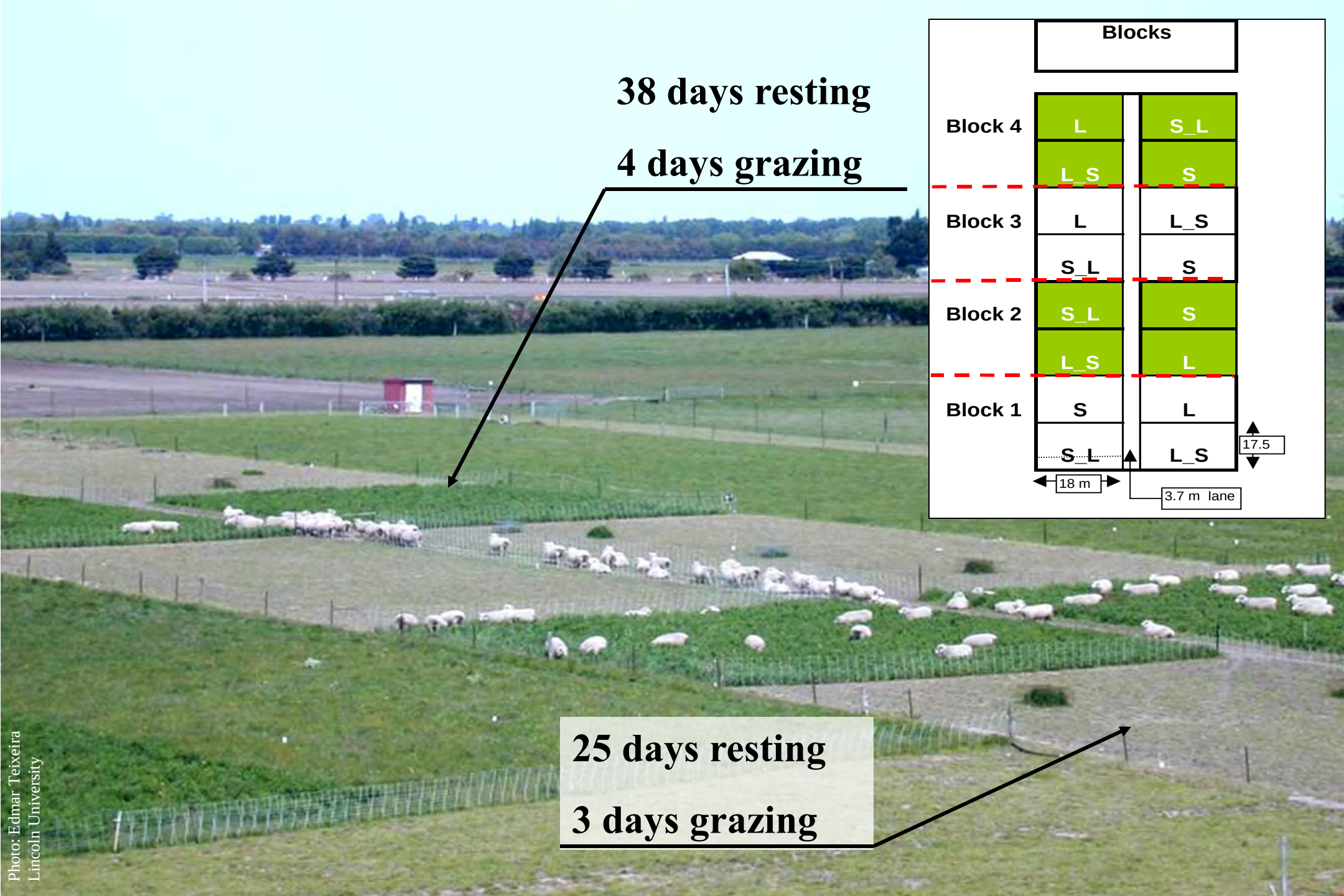
- can graze before flowers appear (~1500 kg DM/ha) ideally ewes and lambs but

Never lamb on or set stock lucerne

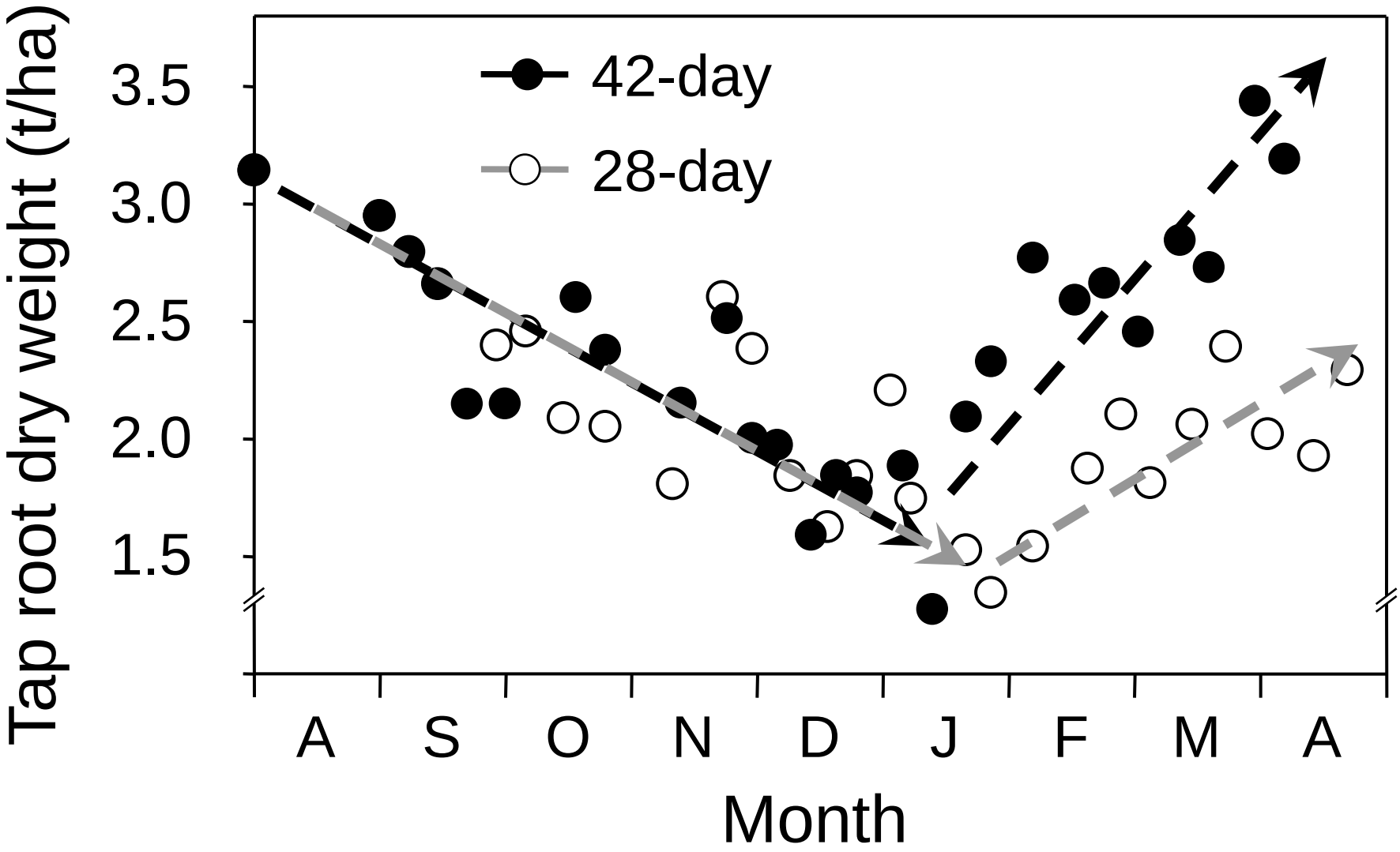
Vegetative growth



Source: Moot *et al*. 2003


38 days resting
4 days grazing
25 days resting
3 days grazing
Blocks
Block 4
Block 3
Block 2
Block 1
L
S_L
L_S
S
17.5
18 m
3.7 m lane
Photo: Edmar Teixeira
Lincoln University

Partitioning to roots



Source: Moot *et al*. 2003

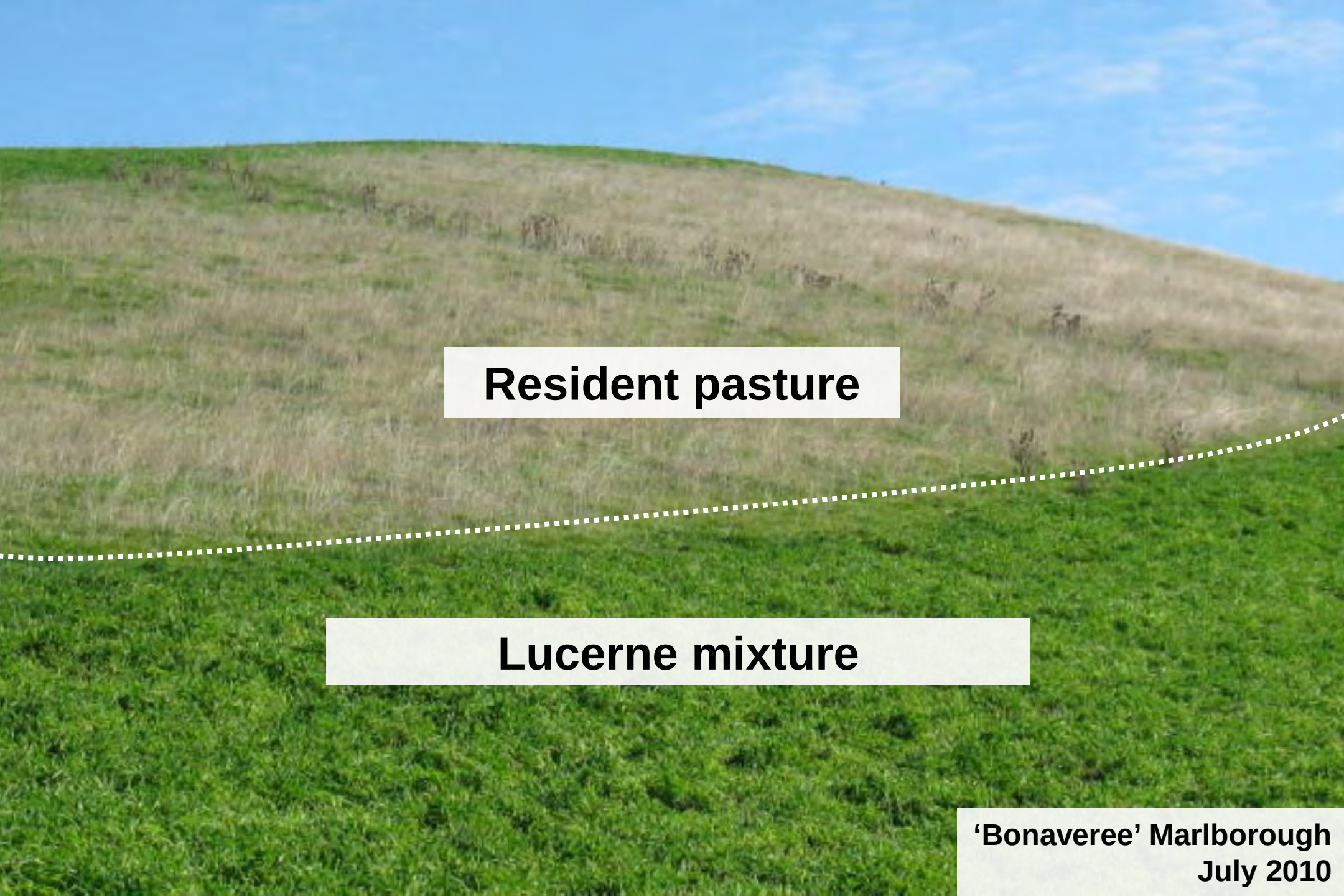

Photo: Edmar Teixeira
Lincoln University
20 15 10 5 0
0 5 10 15 20 25 30 35 40 45

Doug and Fraser Avery “Bonavaree”

Seasonal grazing management

Spring/summer (Nov-Jan)

- Priority is stock production (lamb/beef/deer)
- graze 6-8 weeks solely on lucerne
- 5-6 paddock rotation stocked with one class of stock (7-10 days on)
- allowance 2.5-4 kg DM/hd/d – increase later in season



‘Bonaveree’ Marlborough
July 2010

‘Bonaveree’ Marlborough
July 2010

Maximize reliable spring growth – high priority stock

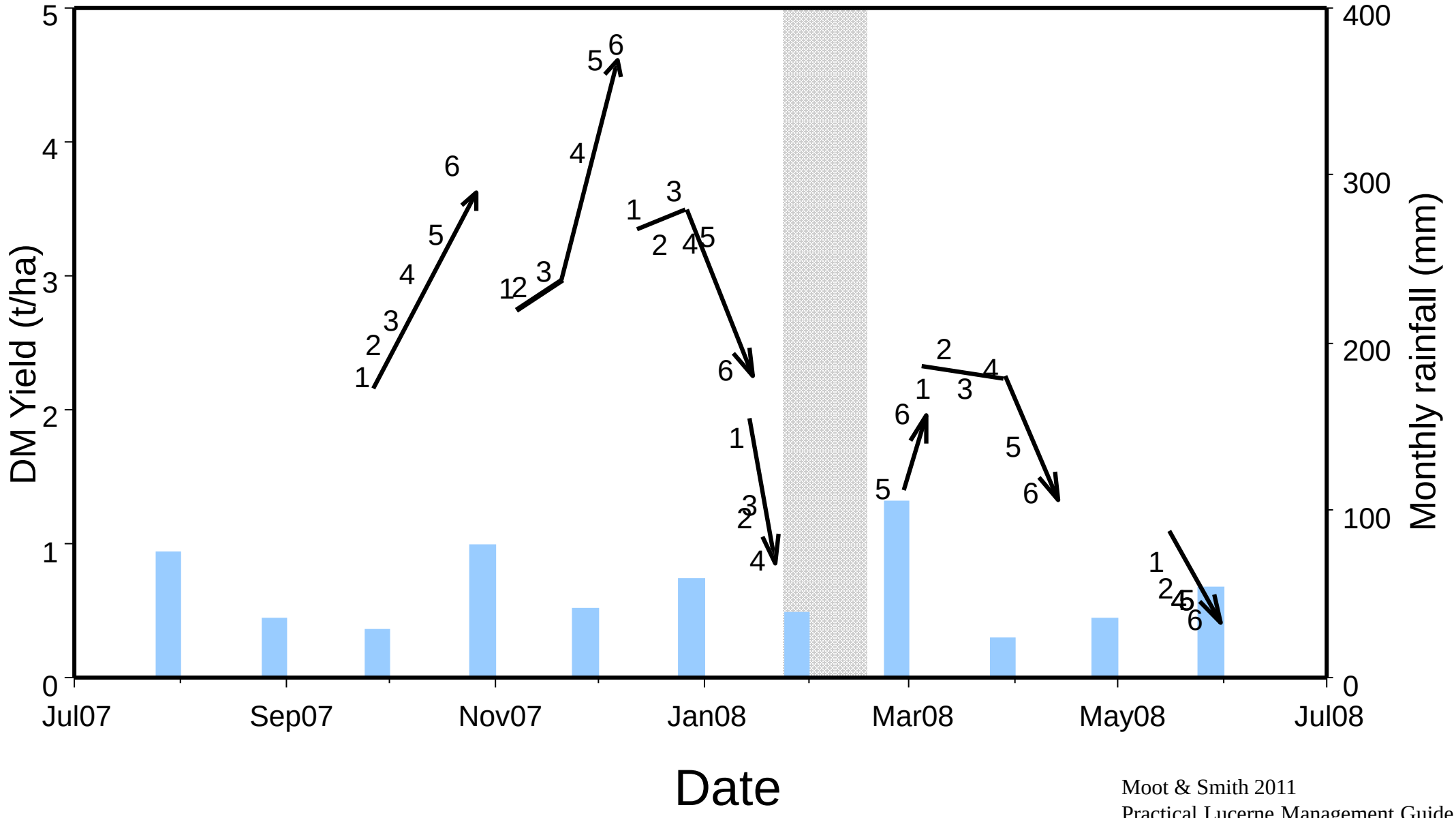
Rotation 1 Pre-graze
Plot 1 (21/9/07)
2.3 t DM/ha
20-25 cm tall

Photo: M Smith
Lincoln University

Rotation 2 Pre-graze
Plot 1 (2/11/07, 38 d)
2.9 t DM/ha
35-40 cm tall

Photo: M Smith
Lincoln University

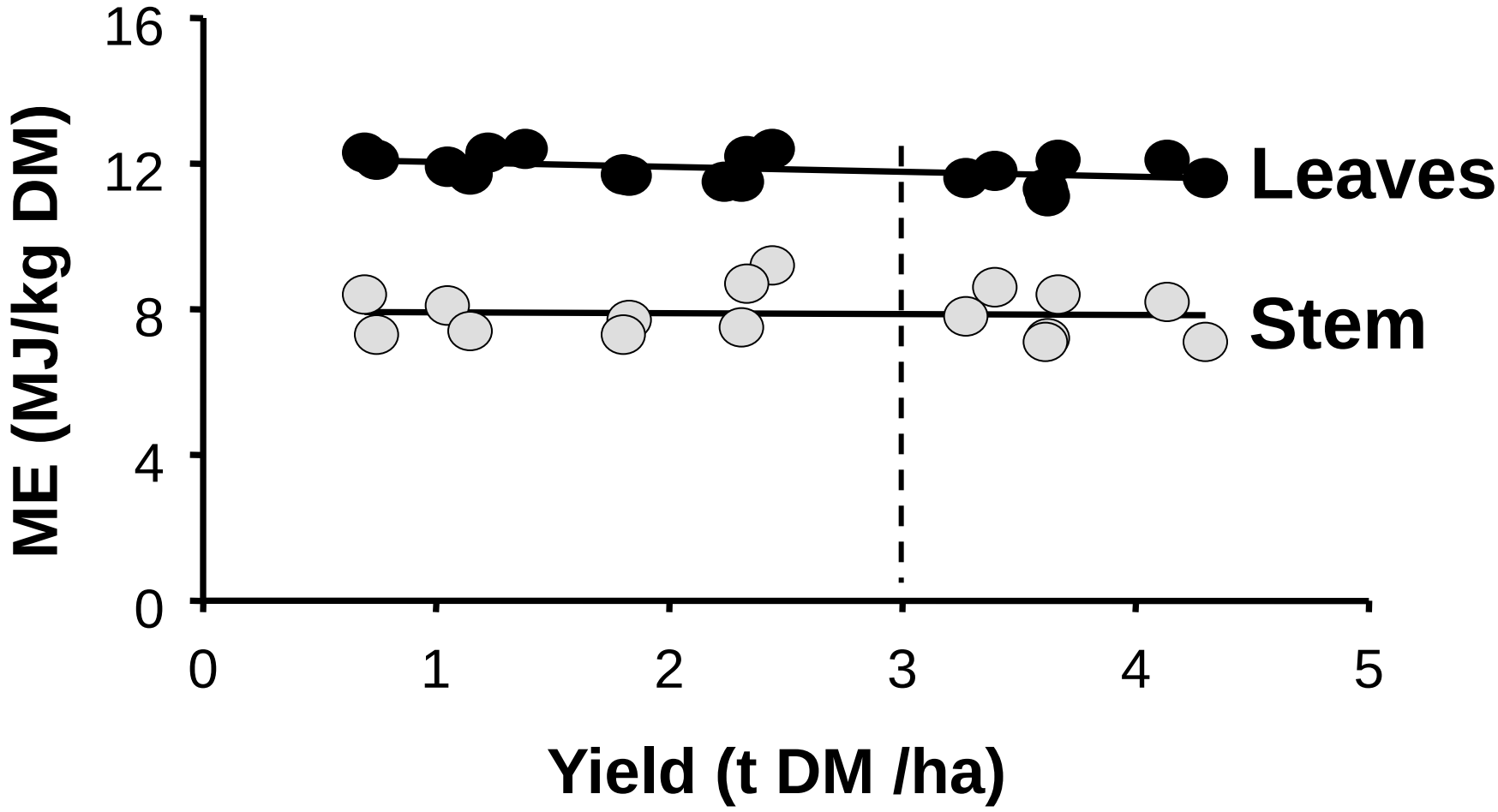
Grazing Rotations at Lincoln University



Moot & Smith 2011
Practical Lucerne Management Guide

5th September 2011 – Cave Sth Canterbury

Metabolisable energy of lucerne



Source: Brown & Moot 2004

Photo: Bonaveree

Photo: Bonaveree

Photo: DJ Moot
Lincoln University

Rotation 4 Pre-graze
Plot 6 (28/2/08) **2.0 t DM/ha produced in 51 d**

Post-graze (4/3/08) **0.6 t DM/ha**
UTILISATION = **70%**

Creating a net of opportunity

Any autumn rain grows high quality feed

Photo: Bonaveree

Seasonal grazing management

Late autumn/winter (*May-July*)

- hard grazing once growth stops (frost)
  $\Rightarrow$ decrease aphid population

- spray for weeds 10-14 days after winter graze

  - grazing/spraying early July
  - nodes developing at low temperatures

3. Animal health

- **Redgut:** problem on high quality feeds – fibre
- **Bloat:** cattle more than sheep – capsules
- **Na def.** (0.03%): salt licks/fence-line weeds/pasture
- Require 0.11% Na - sheep/beef/dairy (13%)

3. Animal health (cont'd)

- **Clostridial bacteria:** vaccinate
- **Cobalt:** vitamin B12 injection
- **Worm haven:** Camping on small area – river edge?
- **Leaf spot in autumn:** avoid flushing on older lucerne
  - new regrowth or tops only are O.K.

Forest conversion 100 000 ha

Ewe hoggets grown on lucerne 54 kg ave

Corriedale 2th flushed on wilting lucerne


Lucerne (is not grass!!!)
- flushing at Bonaveree
04.03.2009

4. Conservation (high protein)

- Hay – first cut in spring is heaviest
- Crimper/conditioner
  - need rapid moisture loss from stems
- Leaves are the nutritious part
  - bale with dew in evening
- Silage – wilted/chopped
  - inoculant/pasture added to help fermentation

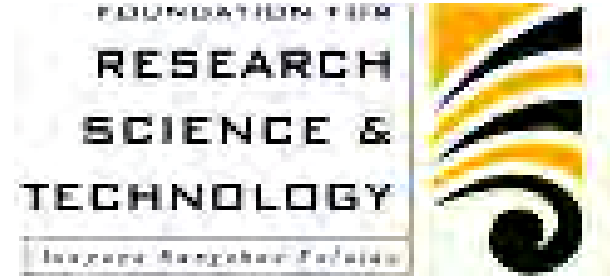
Continuous conservation without prolonged autumn flowering will decrease stand persistence

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 and herbs have a key role to play in pastoral farming for deer, beef, and sheep.

Acknowledgements

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



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Lucerne: agronomy and grazing management

Professor Moot gave this presentation at:

Glenary

On:

30 Nov 2011