CAVE

29 August 2013

Lincoln University

Te Whare Wānaka o Aoraki

CHRISTCHURCH·NEW ZEALAND

LUCERNE

agronomy and grazing management

Dr Derrick Moot

Professor of Plant Science

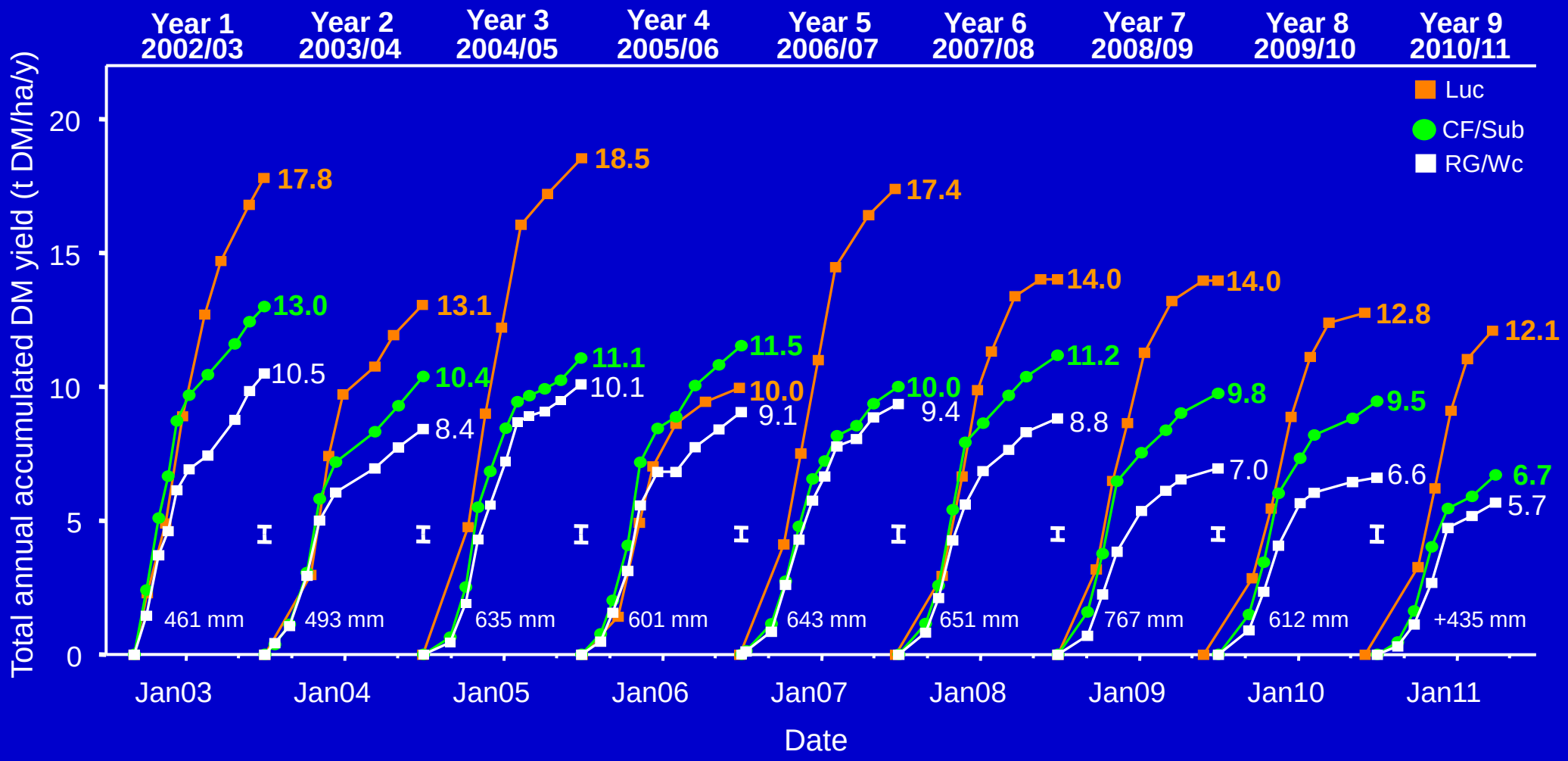
New Zealand's specialist land-based university


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

‘MaxClover’

‘MaxClover’ Total DM Yields

(to 30 March 2011)

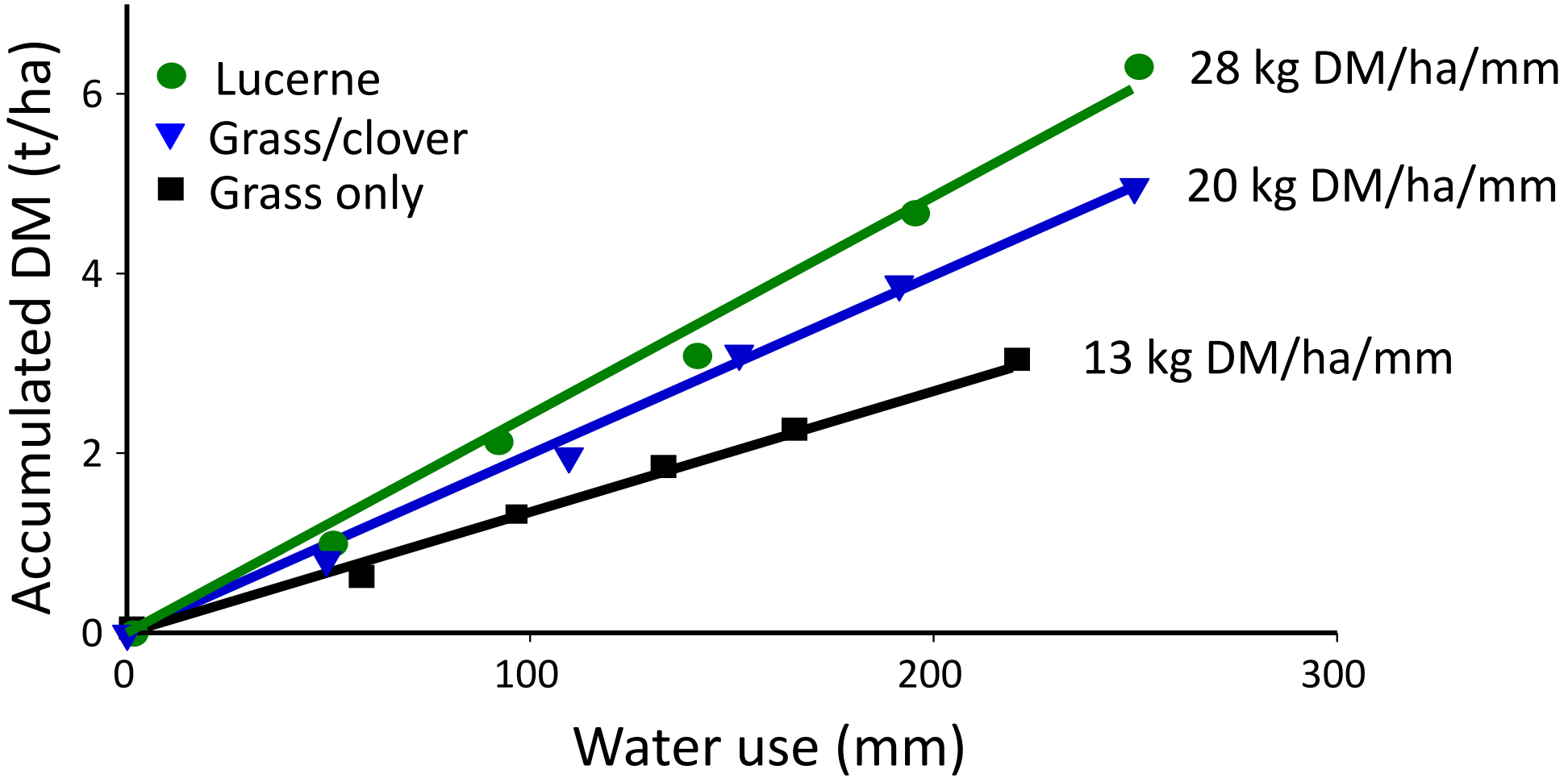


RG/Wc pastures

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

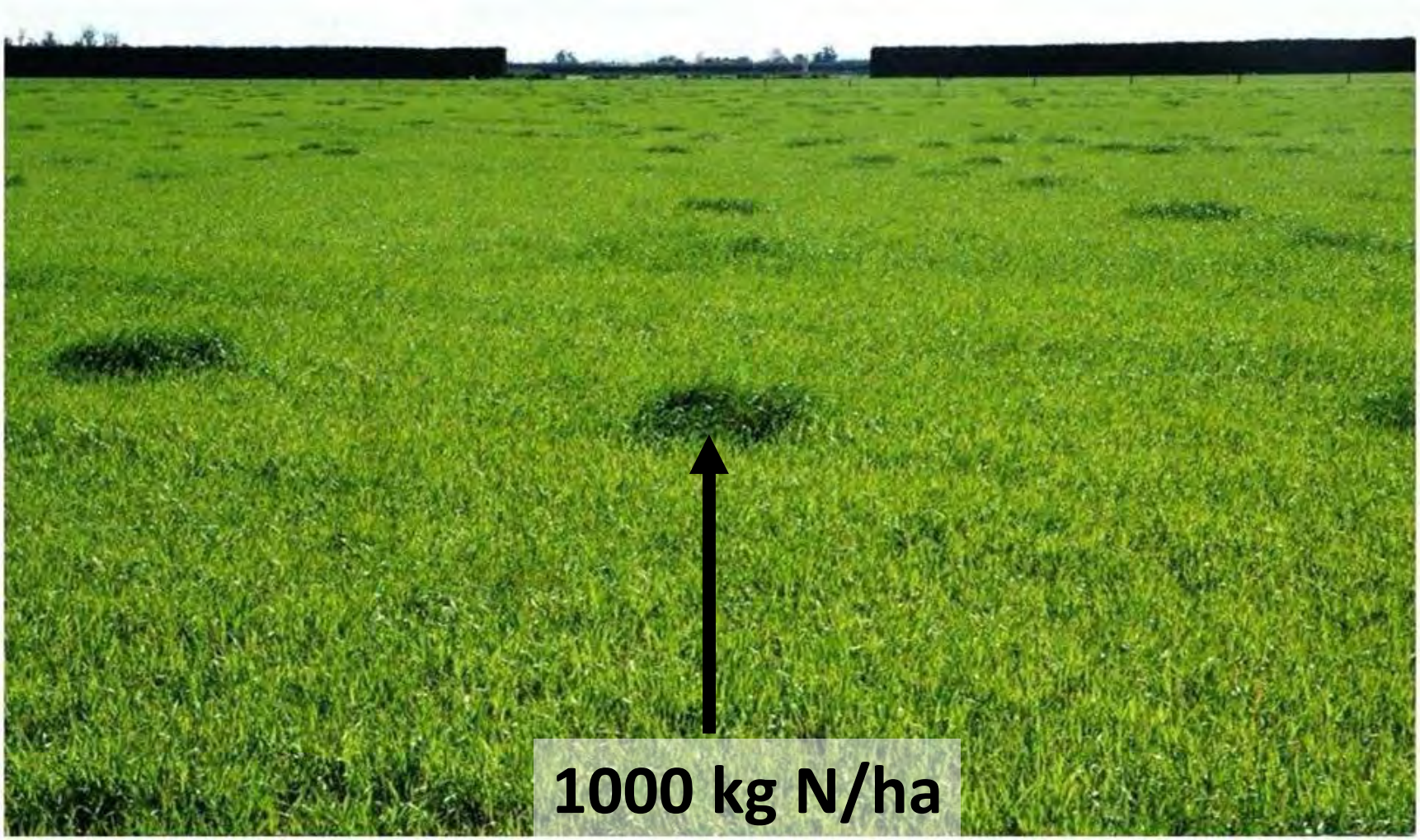
Source: Mills & Moot 2010

Spring WUE

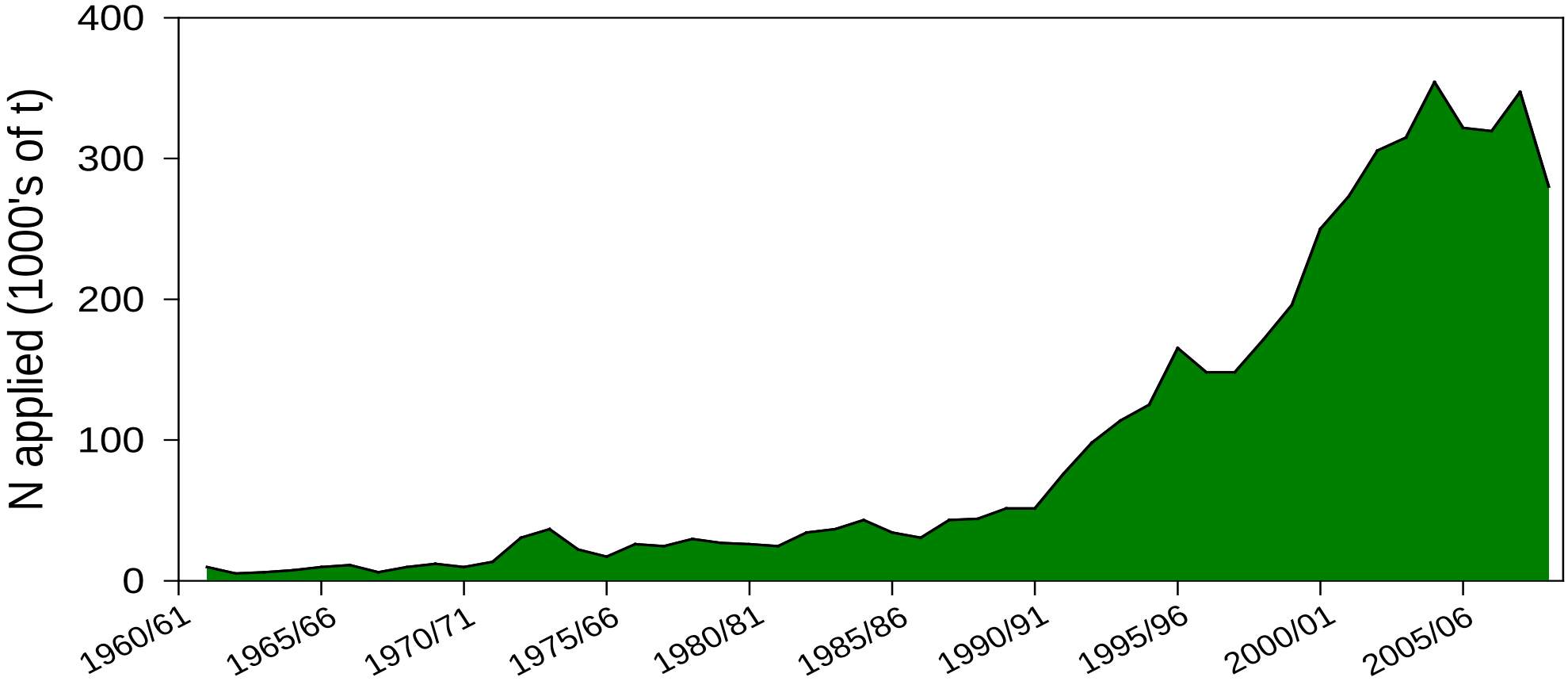


Source: Moot *et al.* 2008

Nitrogen deficient pasture



Nitrogen fertiliser use



Source: New Zealand Fertiliser Manufacturers' Research Association

Ryegrass/clover vs. Lucerne

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
GrasslandsTorlesse	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
PA = Pea aphid
SAA = Spotted alfalfa aphid
BW = Bacterial Wilt
SN = Stem nematode
PRR = Phytopthora root rot
VW = Verticillium wilt
LD = Leaf diseases

D = Dormant
HR = 50%+ resistant
R = Resistant = (31-50%)
SD = Semi-dormant
MR = 16-30%
S = Susceptible

Adapted from: Dunbier & Easton 1982

1. Lucerne establishment

Soils
- deepest free draining soils
- pH 6.0 – 7.0
- RG/Wc fertility

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

Un/successful methods

- full cultivation
- direct drilling after pasture
- direct drilling after crops
- oversowing on riverbed
- oversowing on hill country
- undersown barley
- undersown rape
- spring sown
- autumn sown

Trial design

Established 2007 LU – Templeton silt loam

Coated 'Grasslands Kaituna' lucerne.

Four sowing dates

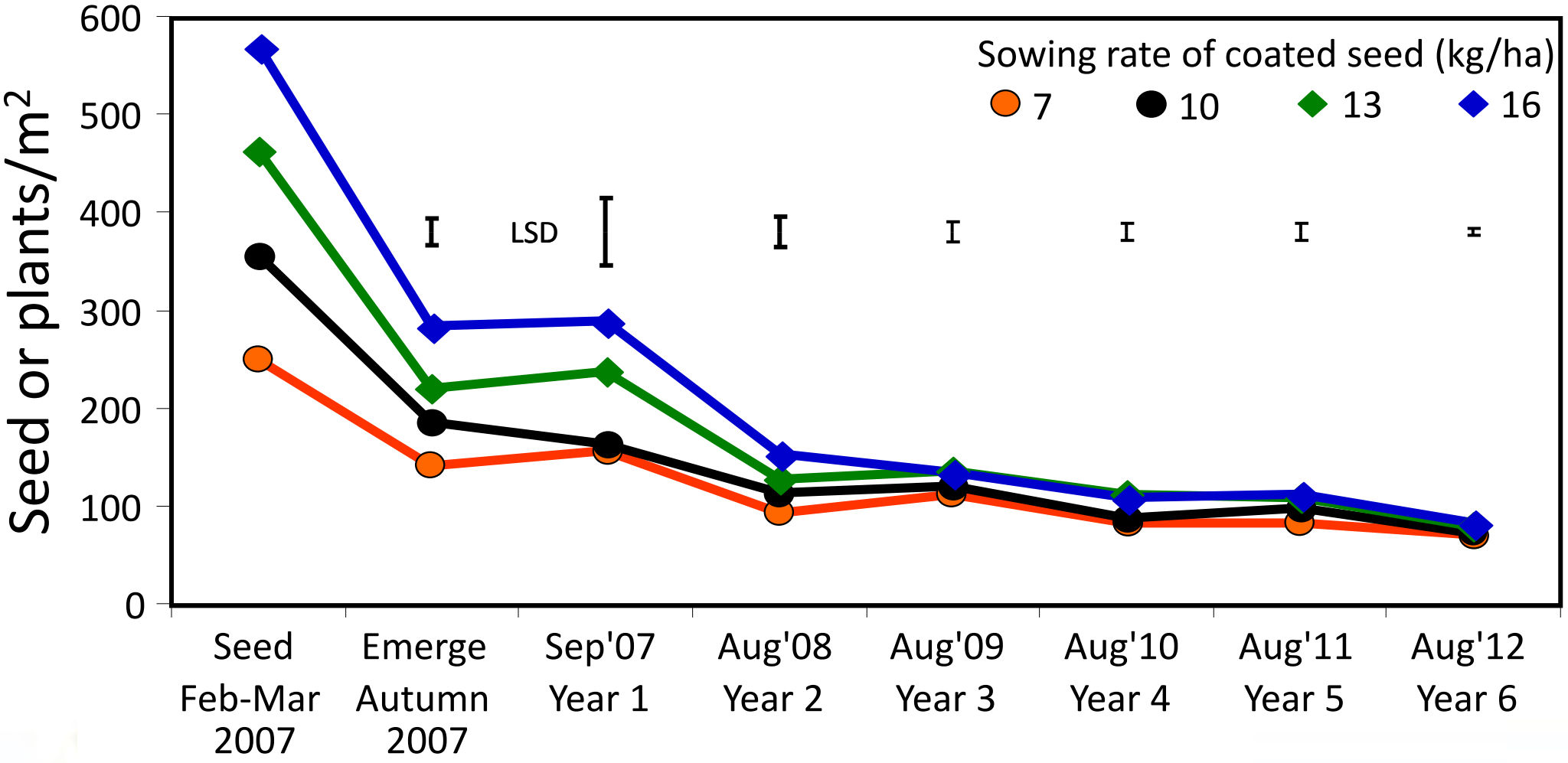
- **21 February,**
- **2 March,**
- **16 March and**
- **30 March**

Four sowing rates

- **Equivalent to bare seed @ 7, 10, 13 and 16 kg/ha**

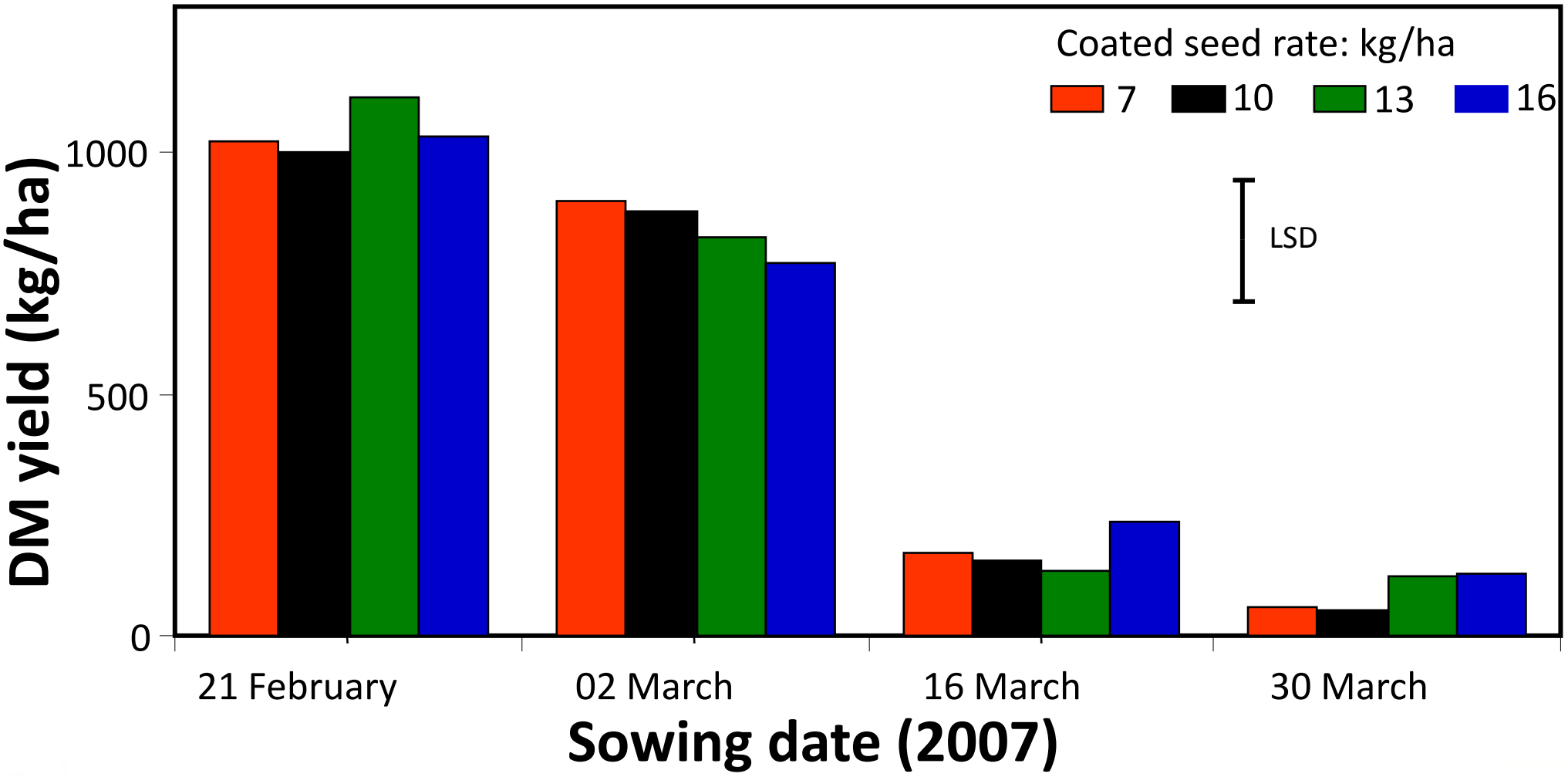
Source: Moot *et al*. 2012

Sown seed & plant population over time



Source: Moot *et al.* 2012

Seedling lucerne yield to early June

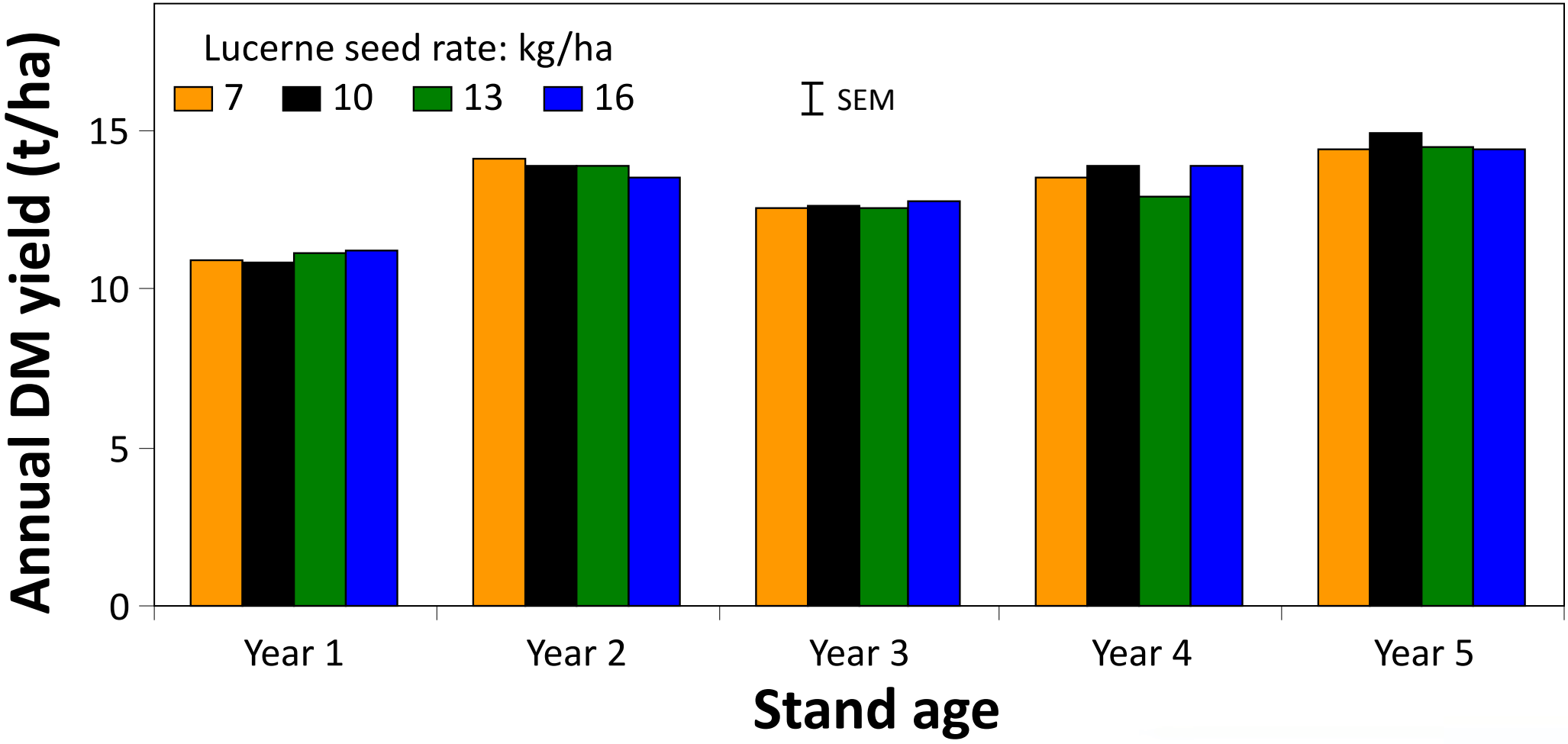


Source: Moot *et al*. 2012

Weeds present @ 09 October 2007 (Year 1)

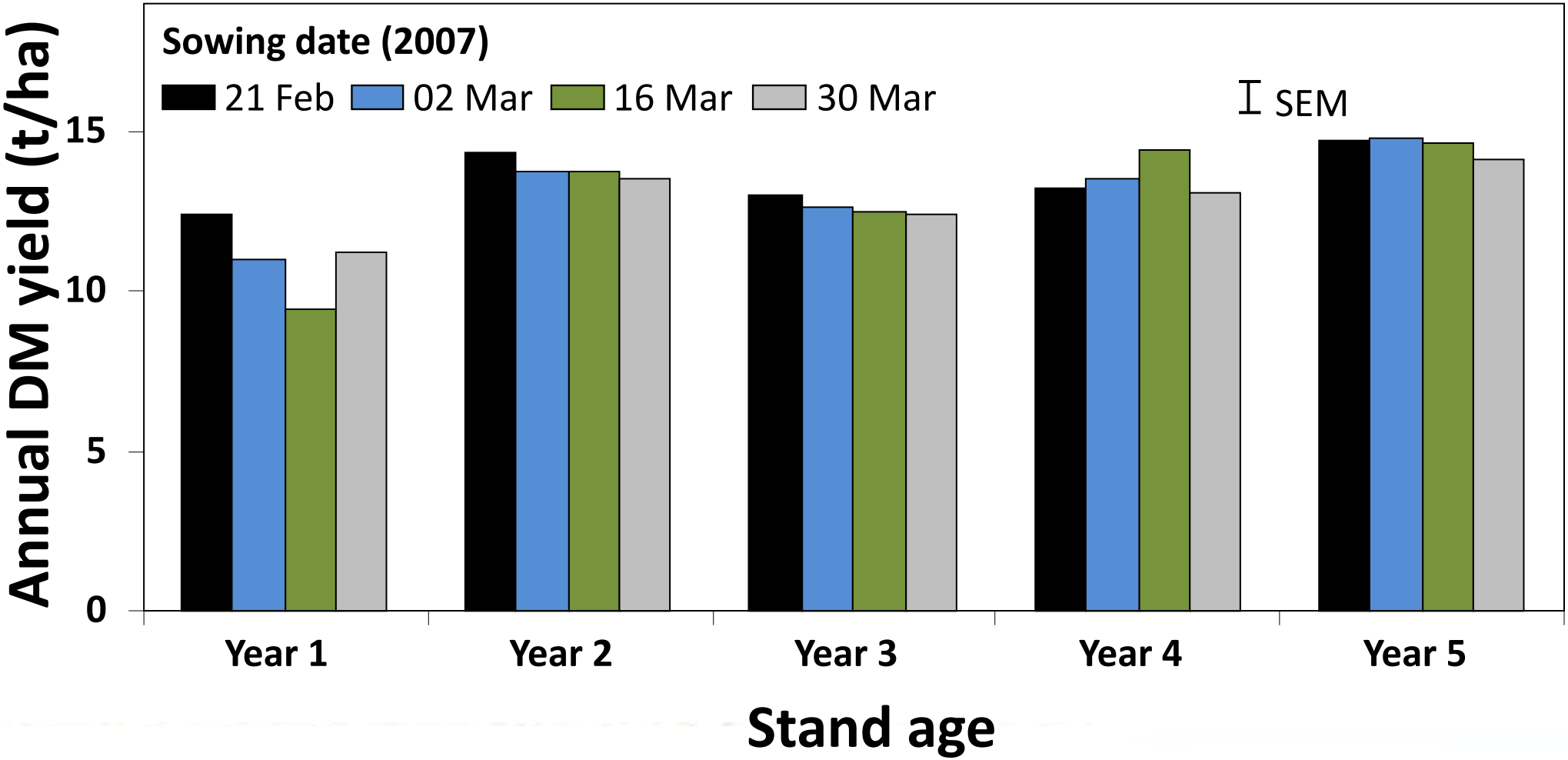
Sown 21 Feb 2007 **Sown 30 Mar 2007**

Annual yield in relation to sowing rate



Source: Moot *et al.* 2012

Annual yield in relation to sowing date



Source: Moot *et al*. 2012

Establishment

Seed Treatments:	Sowing Dates:
ALOSCA®	21 Oct 2010
Coated seed	9 Nov 2010
Peat slurry	8 Dec 2010
Bare seed	13 Jan 2011
	3 Feb 2011

Source: Wigley *et al*. 2012

New Zealand's specialist land-based university

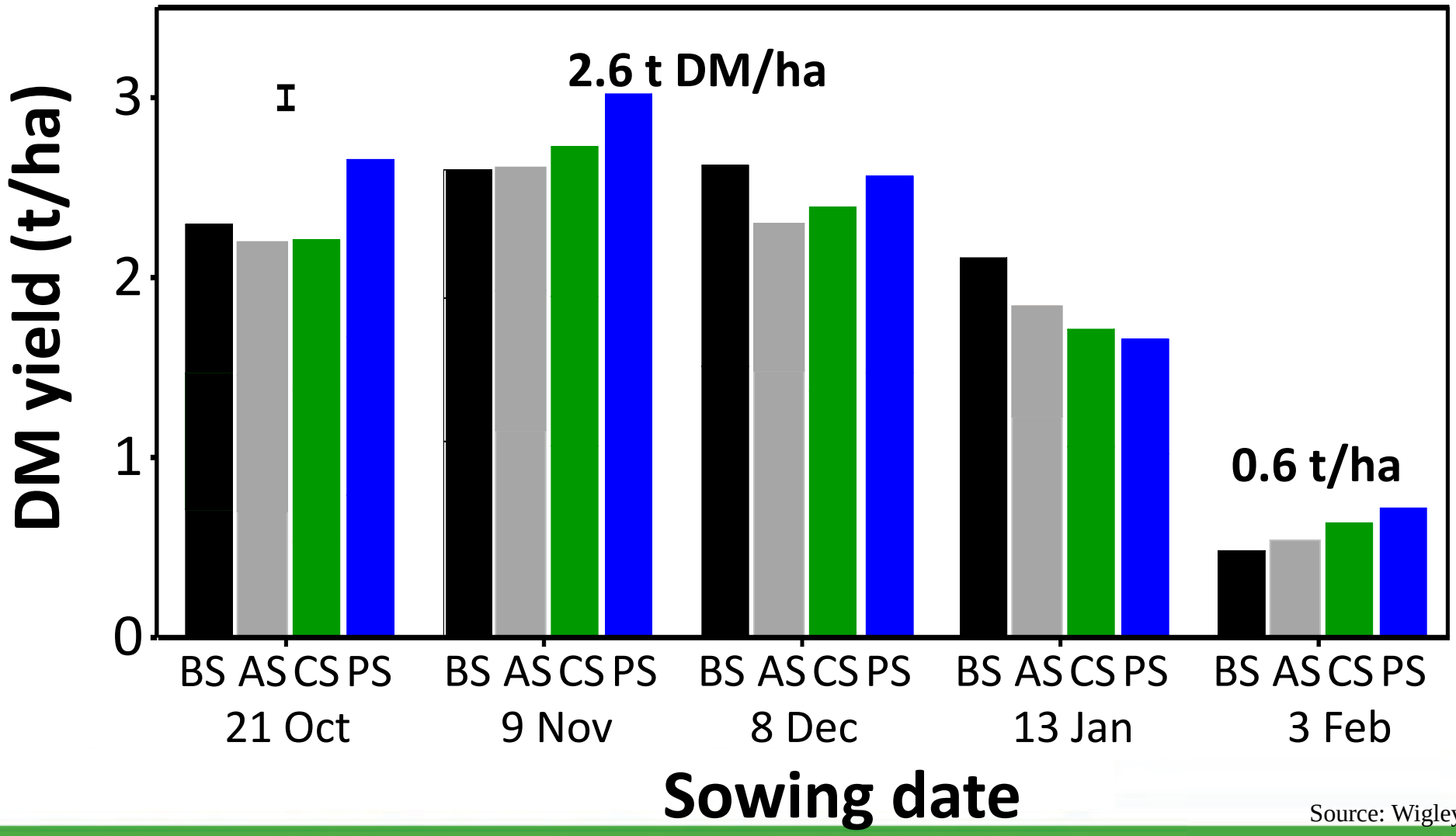
Emergence populations

Coated seed	300 plants m^2
ALOSCA®	200 plants m^2
Peat Slurry	
Bare seed	

Source: Wigley *et al*. 2012

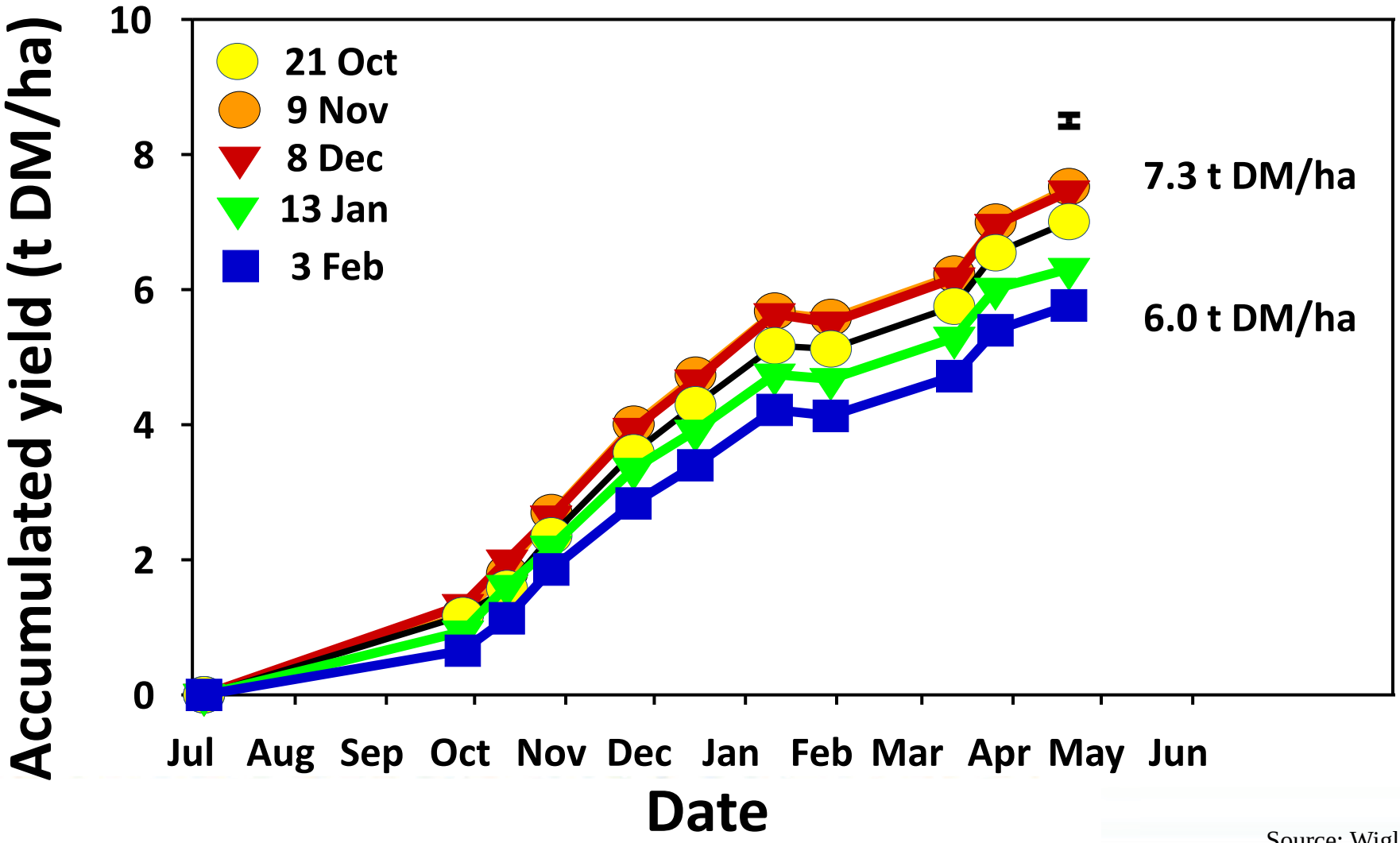
DM yield in Year 0

(Sowing – 30th June 2011)



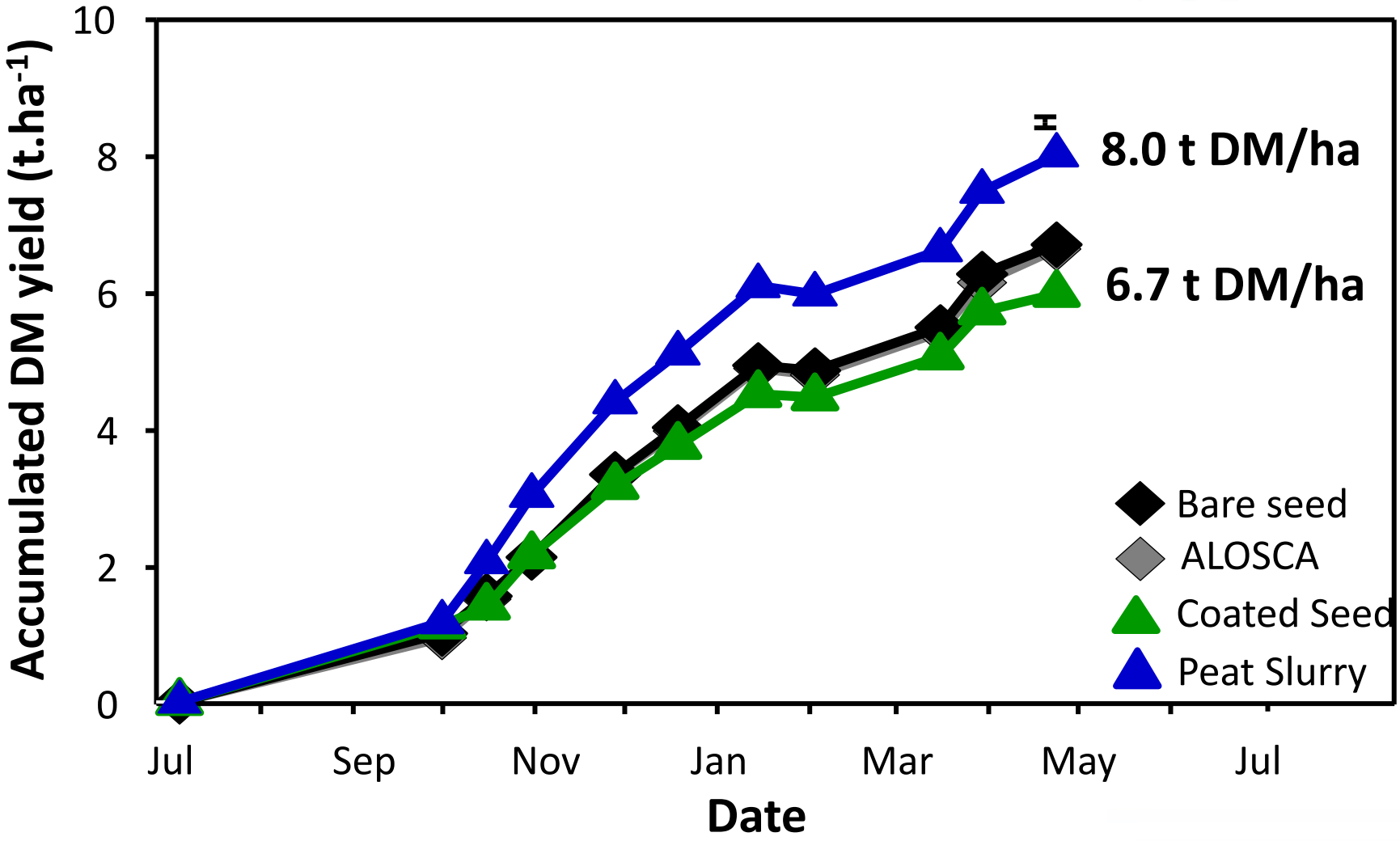
Source: Wigley *et al.* 2012

Effect of sowing date on yield in Year 1



Source: Wigley *et al*. 2012

Effect of seed treatment on yield in Year 1

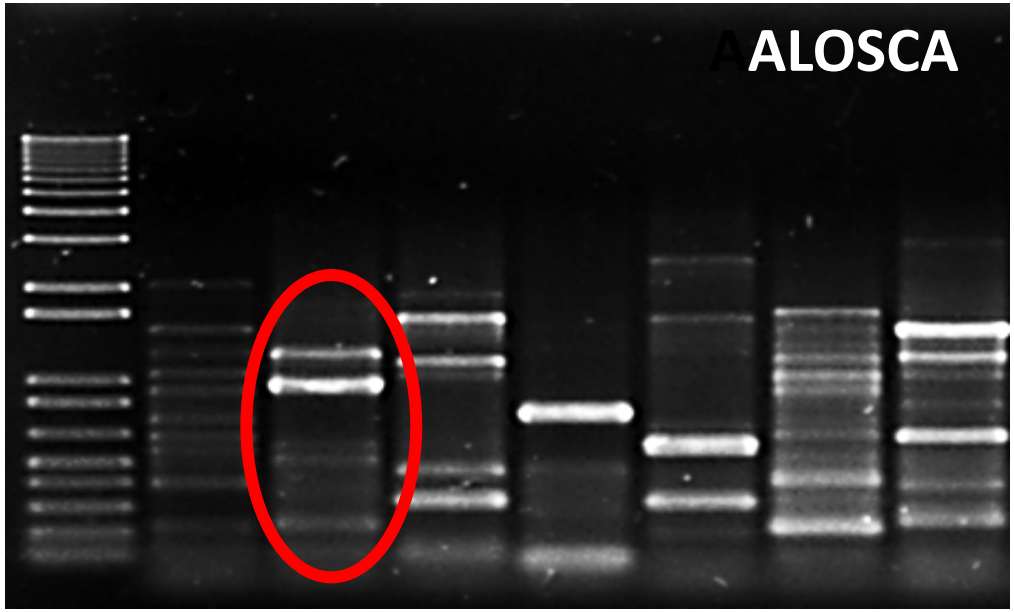


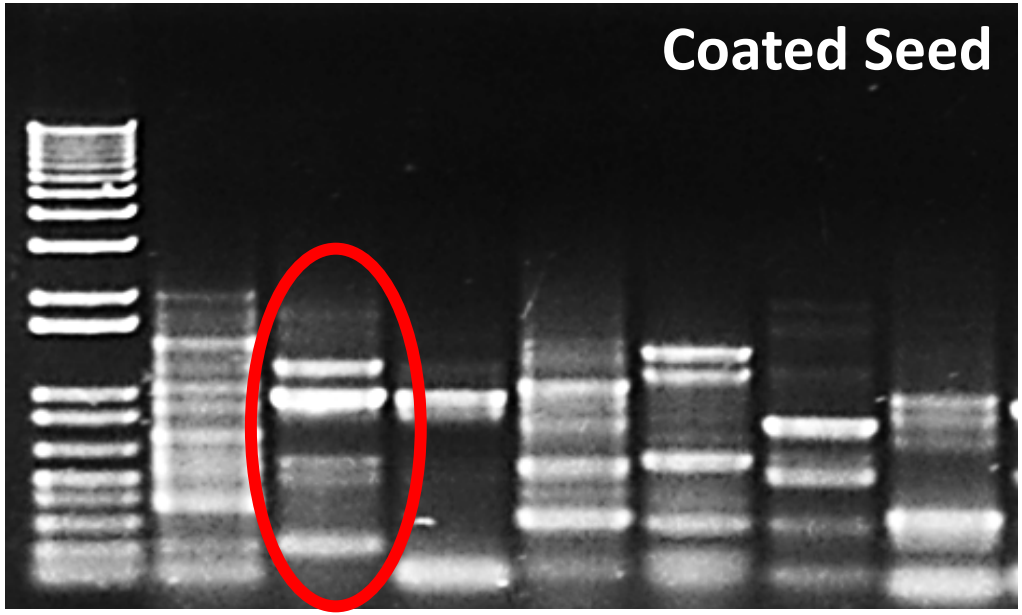
Source: Wigley *et al*. 2012

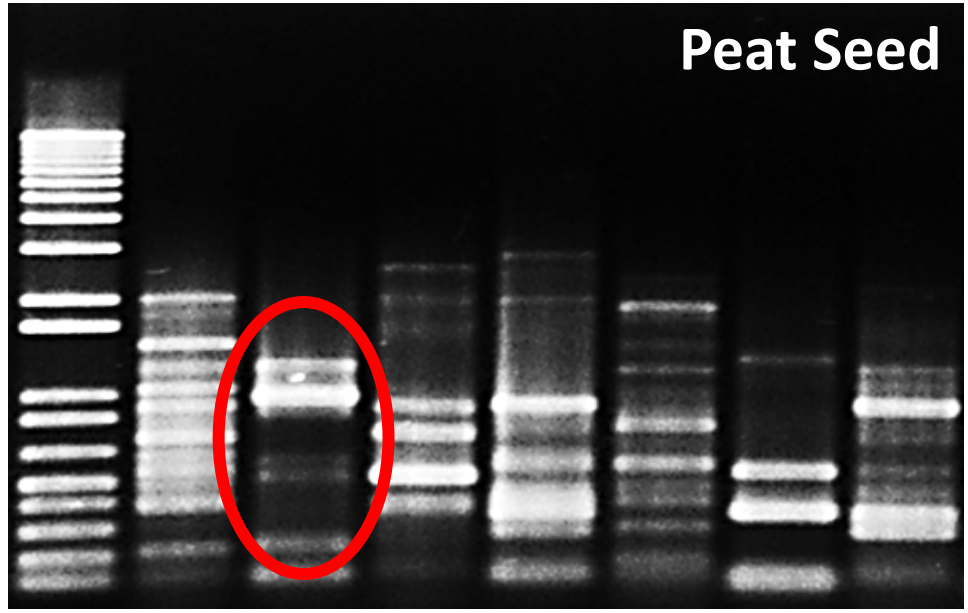
Ensifer meliloti in commercial inoculants

Source: Wigley 2011

E. meliloti in nodules







Source: Wigley 2011

Frequency of Rhizobia

(%)

	Treatment			
Genotype	**Bare seed**	**AS**	**CS**	**PS**
***Rhizobium* sp.**	57	54	22	18
Ensifer meliloti	0	9	45	42
***Rhizobium* sp.**	4	2	6	2
***Pseudomonas* sp.**	0	7	2	4
***Pseudomonas* sp.**	6	0	2	4
***Serratia* sp.**	4	9	0	0
***Rhizobium* sp.**	0	4	0	4

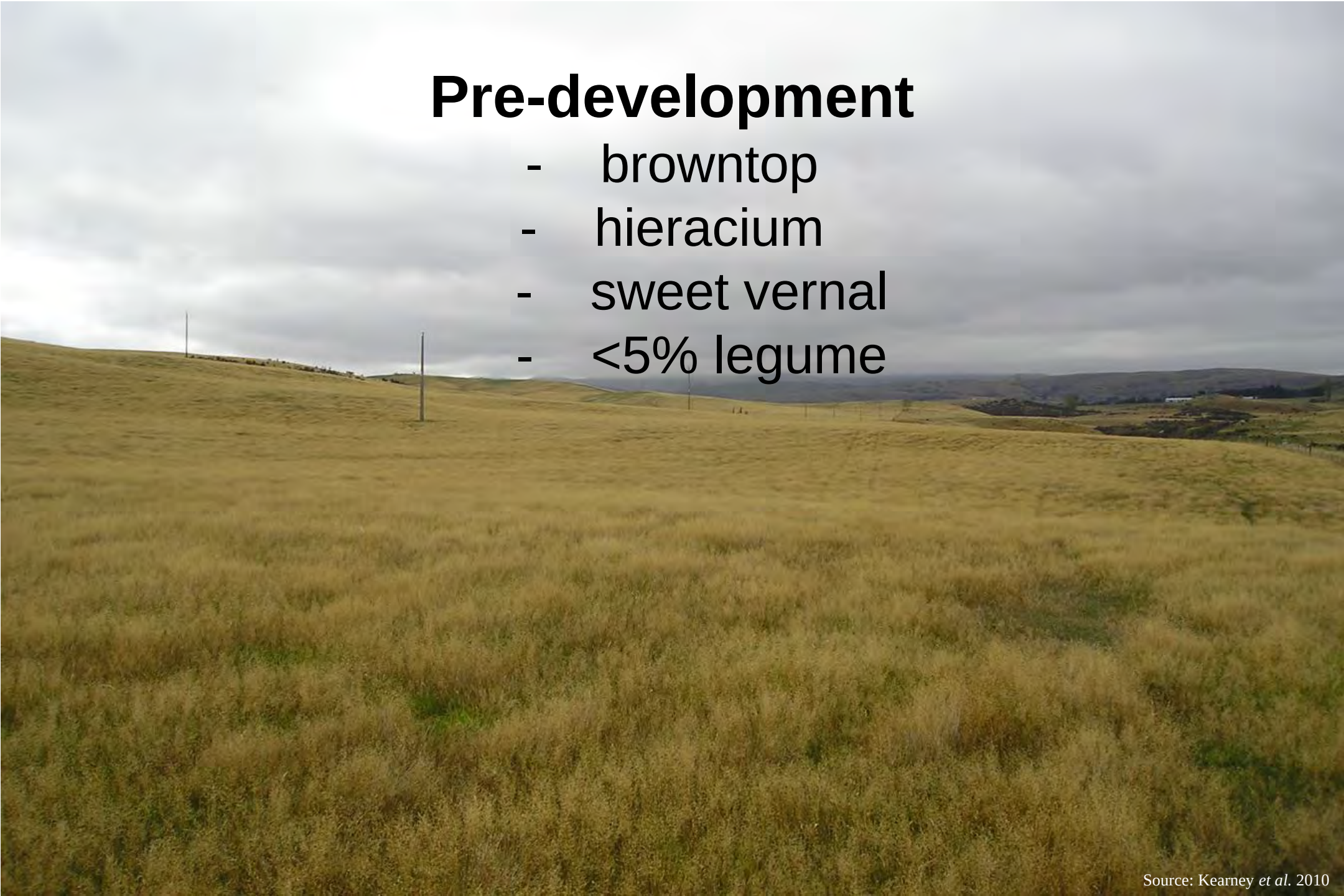
Source: Wigley 2011

Conclusions

- Adequate populations from all sowing rates and seed treatments

- Sowing after the longest day reduced the yield in Year 0 and Year 1

- Yield advantage from peat slurry treatment



Pre-development

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

Source: Kearney *et al.* 2010

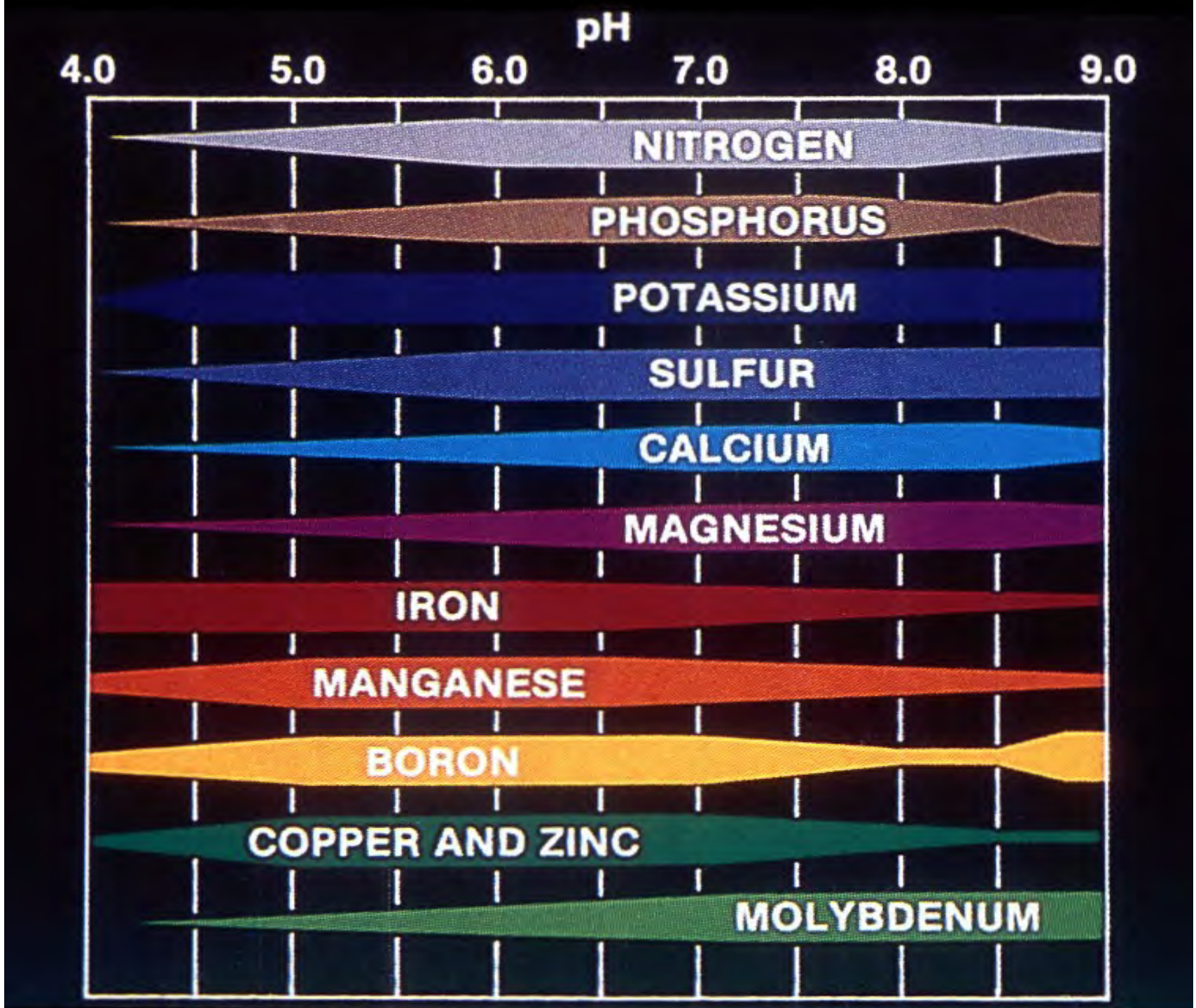
Source: Kearney *et al.* 2010

Lime and Fertiliser Application

Lime 3-5 ton/ha

Fertiliser 250-500kg/ha

Source: Kearney *et al.* 2010

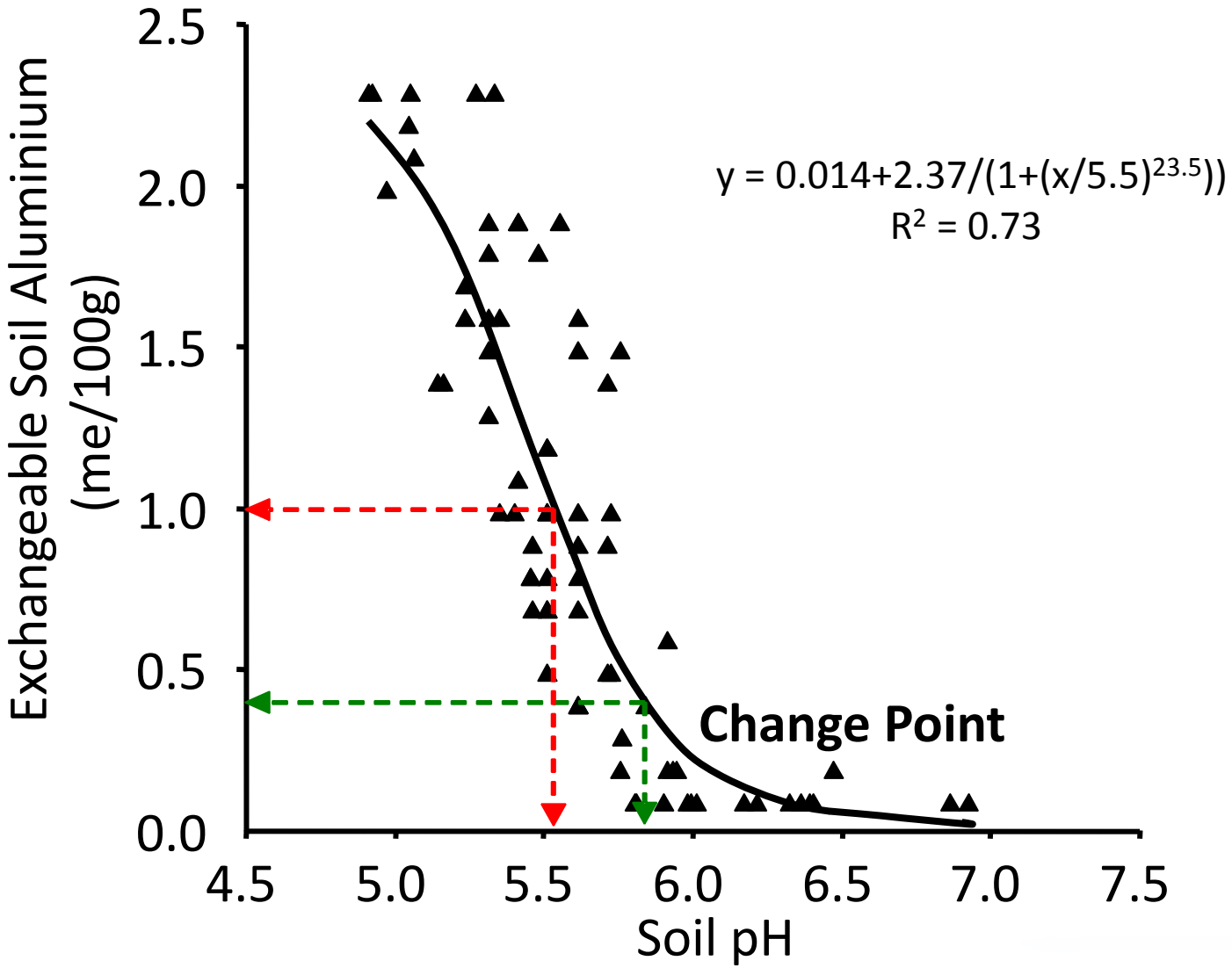

pH
4.0
5.0
6.0
7.0
8.0
9.0
NITROGEN
PHOSPHORUS
POTASSIUM
SULFUR
CALCIUM
MAGNESIUM
IRON
MANGANESE
BORON
COPPER AND ZINC
MOLYBDENUM

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

Pre-Development (2008)	pH	Olsen P (μg/ml)	Potassium (QTU)	Sulphur (μg/g)	Aluminium (mg/kg)
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

Soil pH & exchangeable Aluminium



Source: Moir & Moot, 2010

No Lime - Lucerne

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

<u>Key Results</u>

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

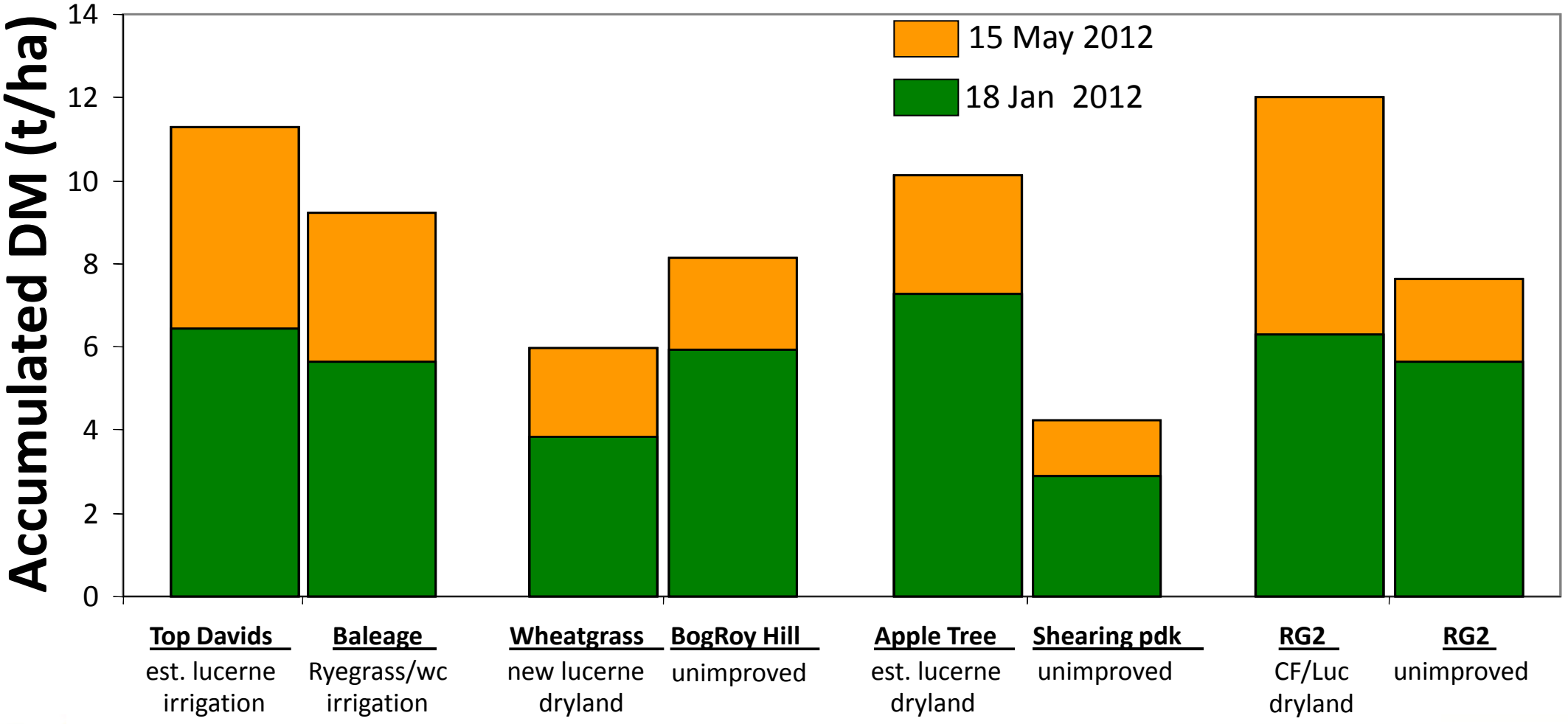
Source: Kearney *et al.* 2010


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

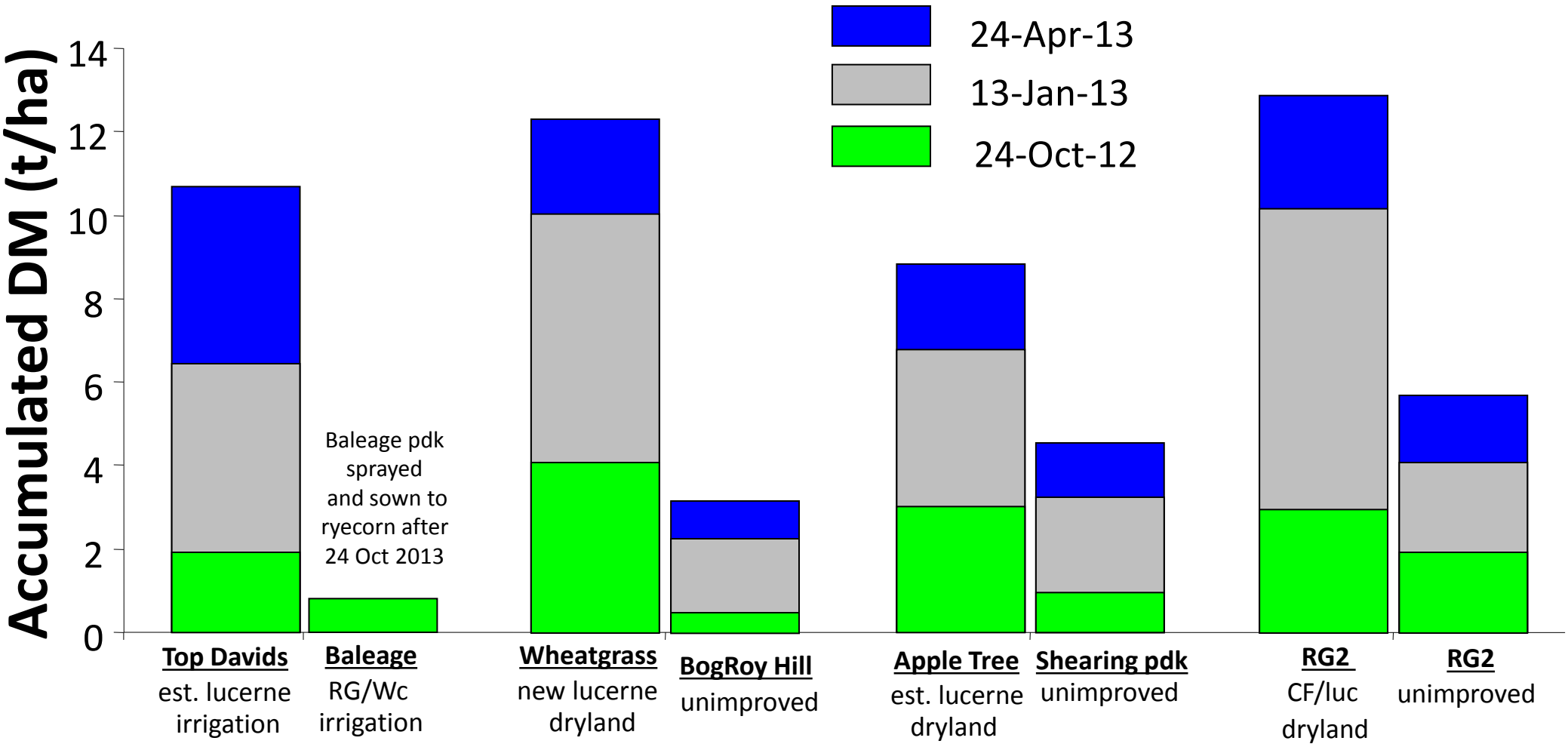

2011 10 16


2011 10 7

DM yield: Paired paddocks 2012



DM yield: Paired paddocks 2013




2011 10 7

Photo: V. Fasi
Lincoln University

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

Growing point at the top of the plant

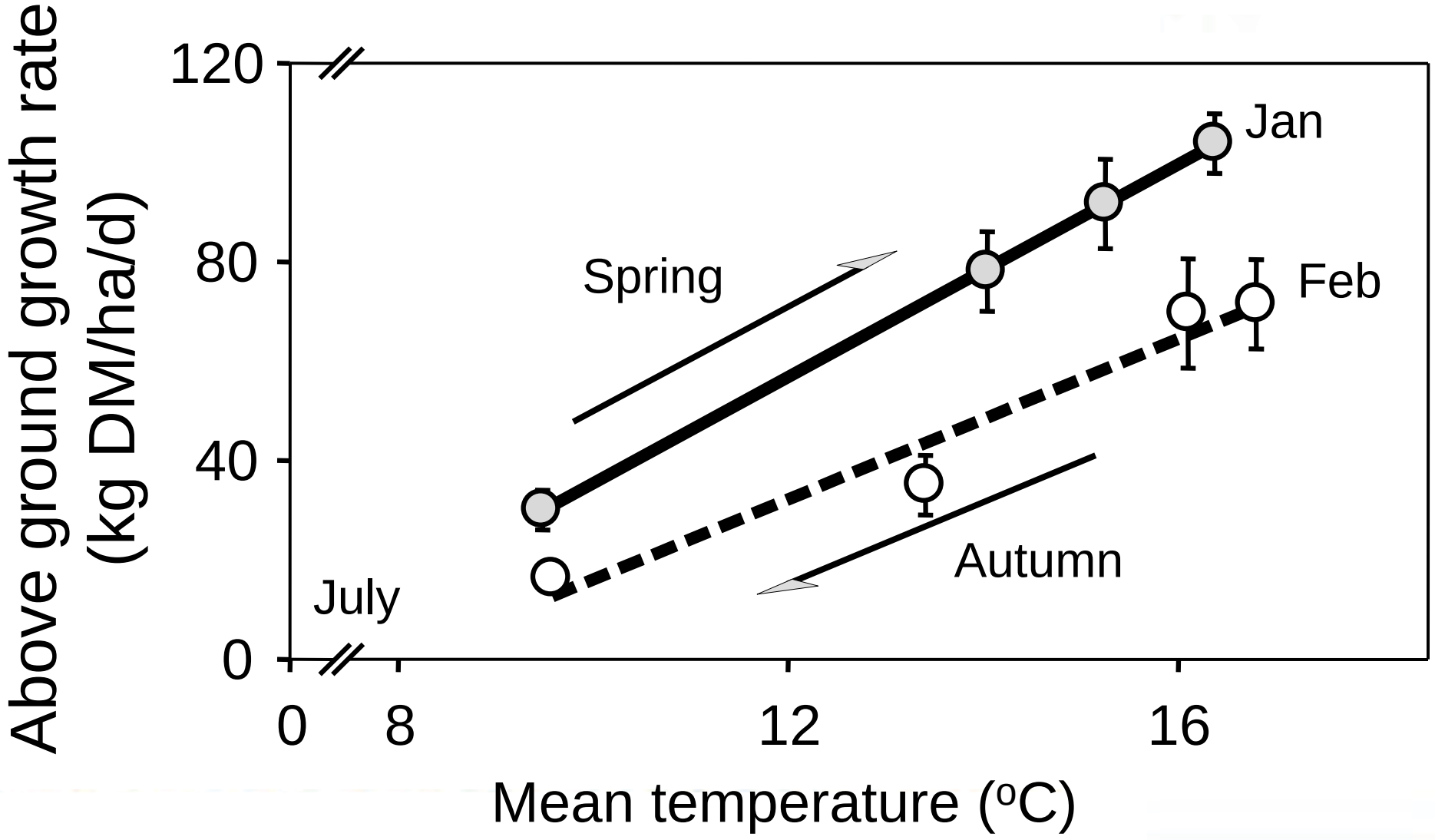

8 Aug 2001
cm
7
6
5
4
3
2
1
0


22 Aug 2001
cm
13
12
11
10
9
8
7
6
5
4
3
2
1


12 Sep 2001
cm
18
16
14
12
10
8
6
4
2
0


60 -
50 -
40 -
cm
30 -
20 -
10 -
0 -
3 Oct 2001

Vegetative growth



Source: Moot *et al*. 2003

Experiment 2

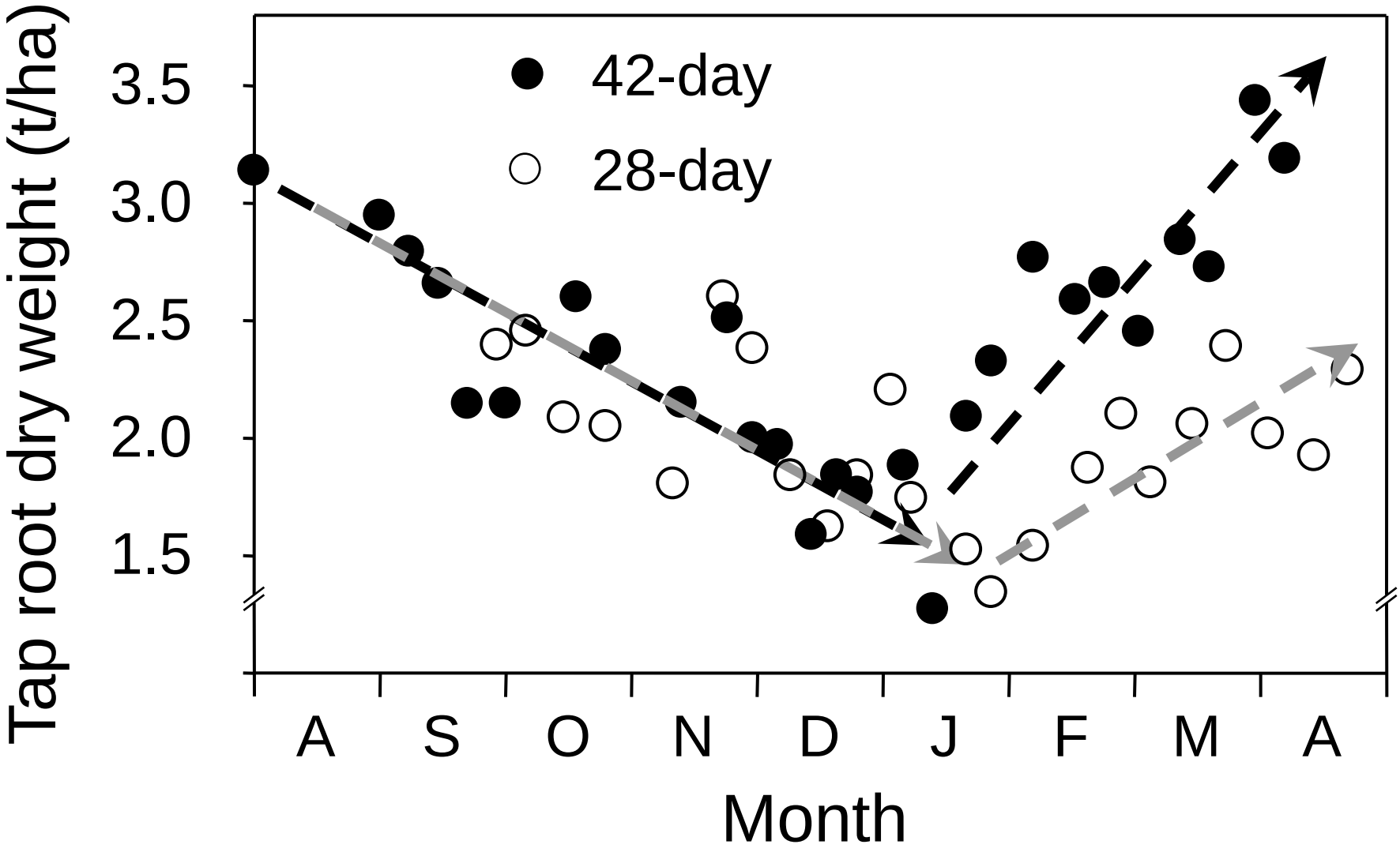
38 days resting

4 days grazing

25 days resting

3 days grazing

Partitioning to roots



Source: Moot *et al*. 2003

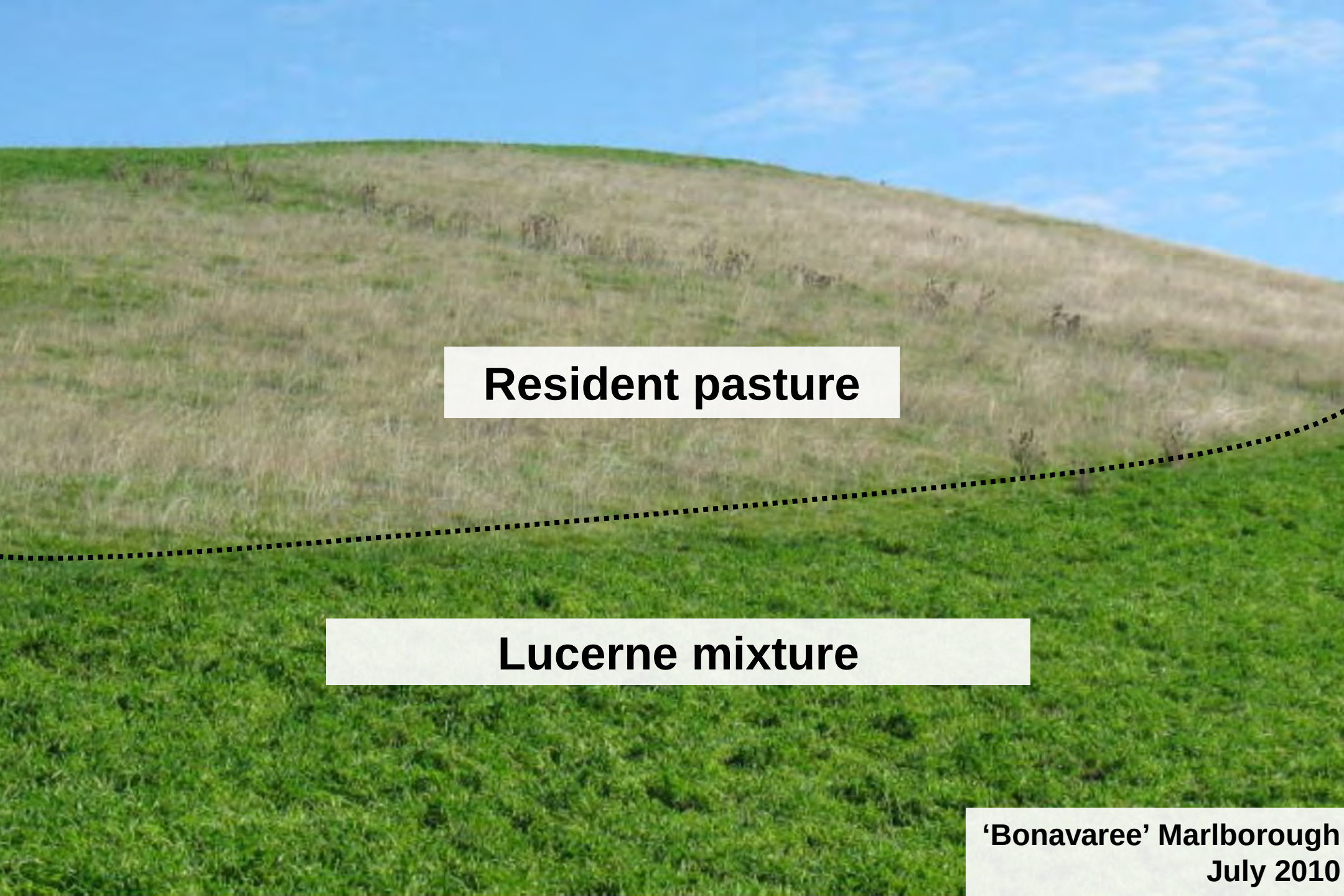
Doug and Fraser Avery “Bonavaree”

Where to plant

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 2.5-4.0 kg DM/hd/d – increase later in season



‘Bonavaree’ Marlborough
July 2010

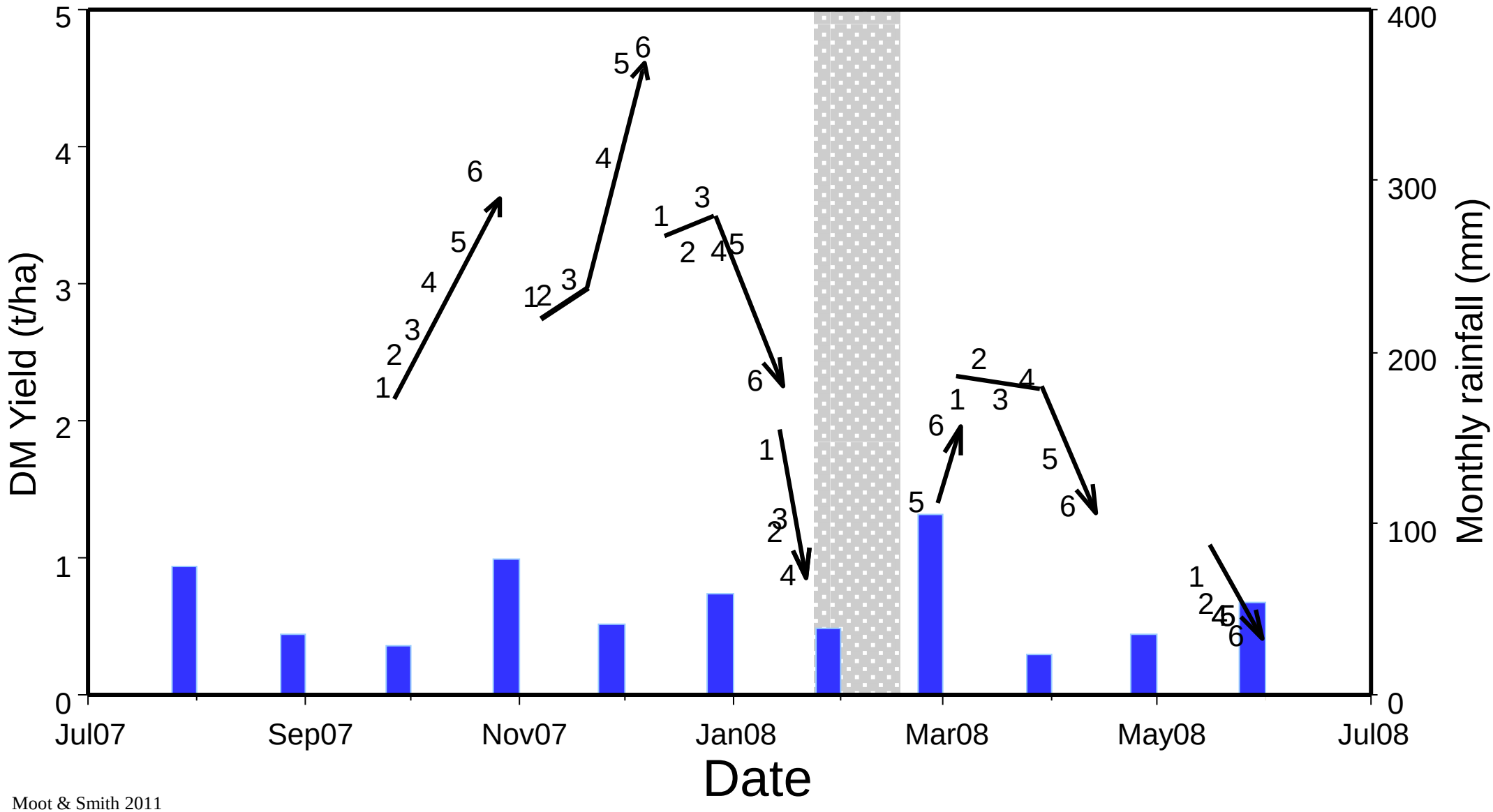

July 2010

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

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

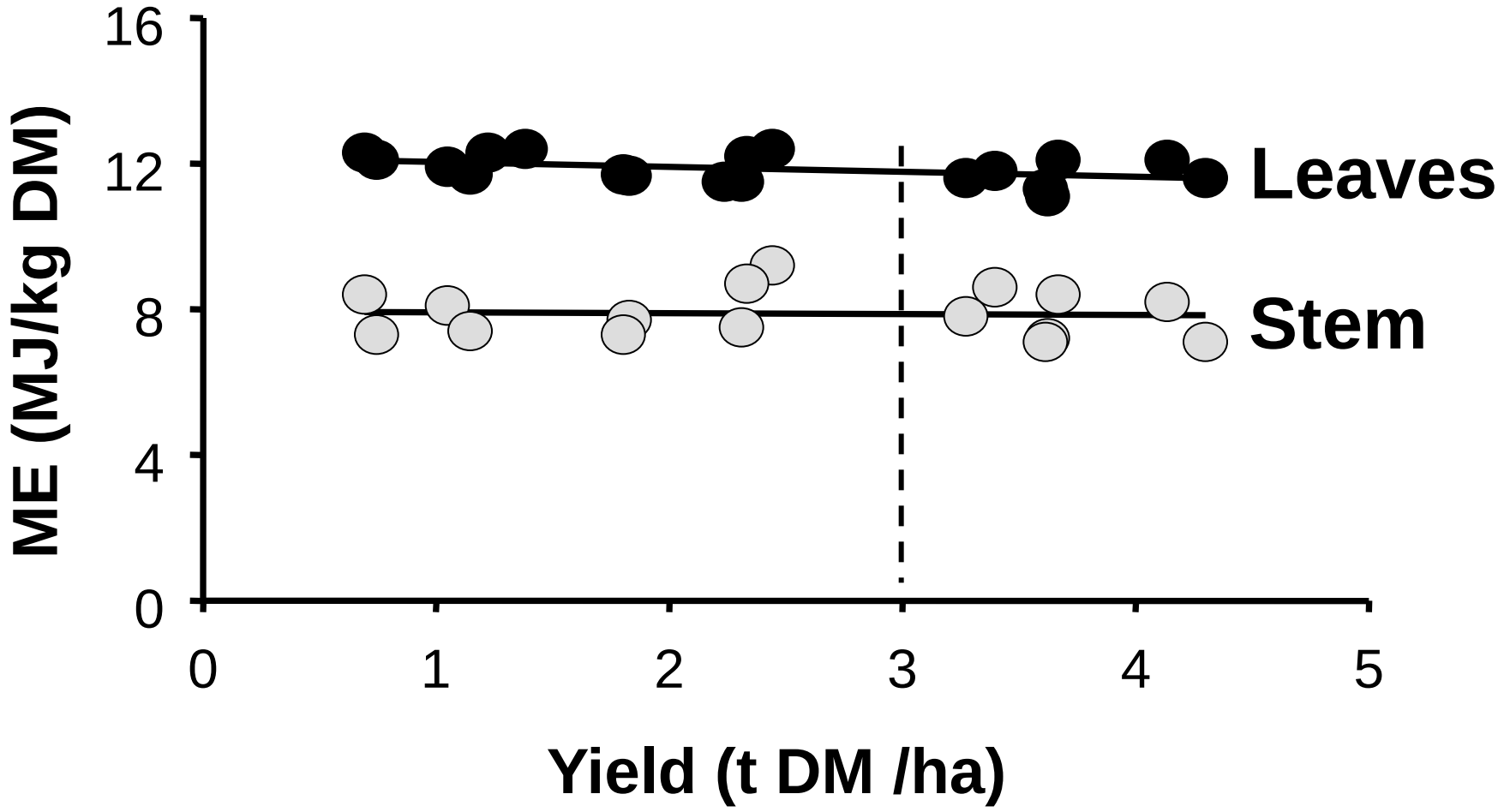
MaxClover



Moot & Smith 2011
Practical Lucerne Management Guide

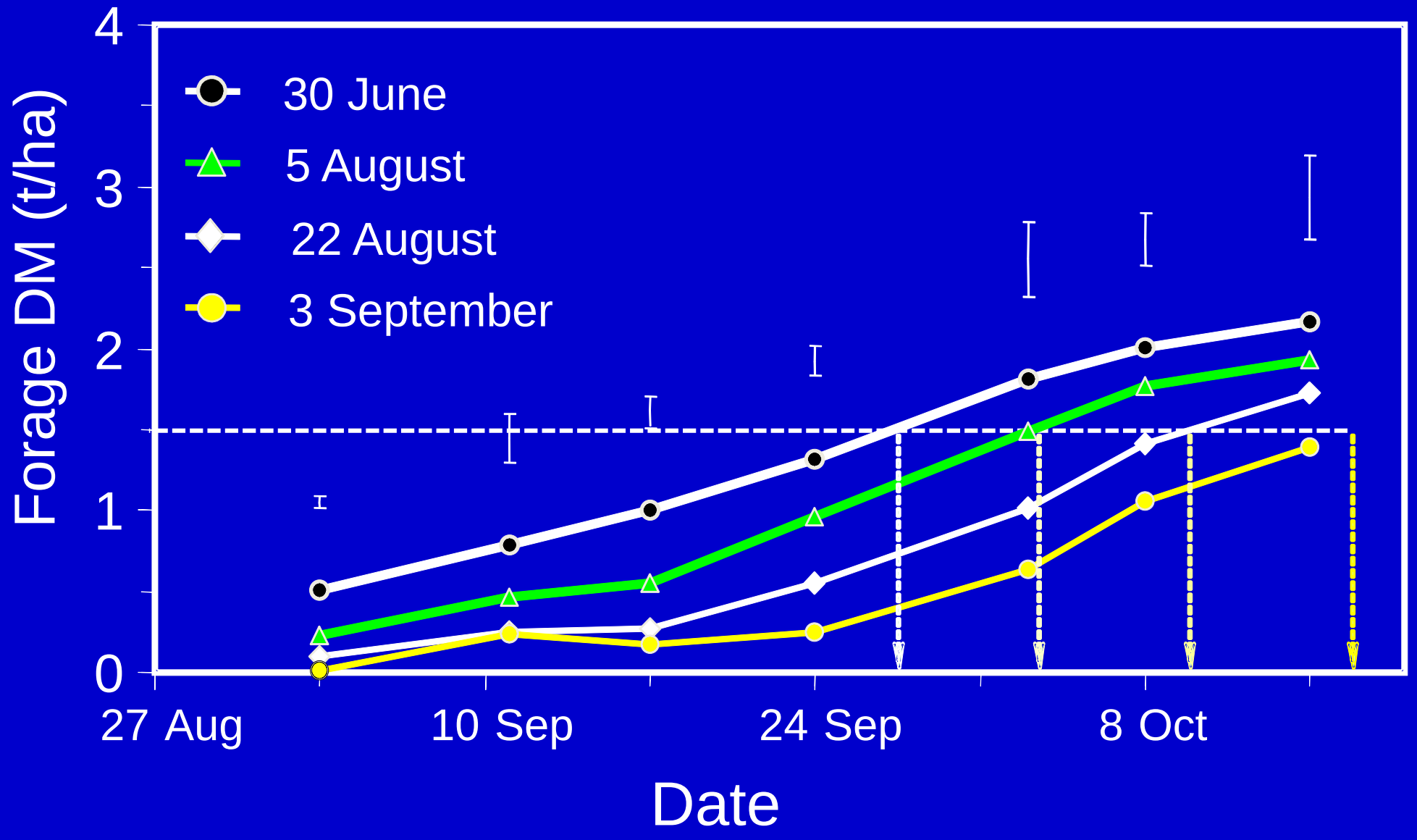
5th September 2011 – Cave Sth Canterbury

Metabolisable energy of lucerne

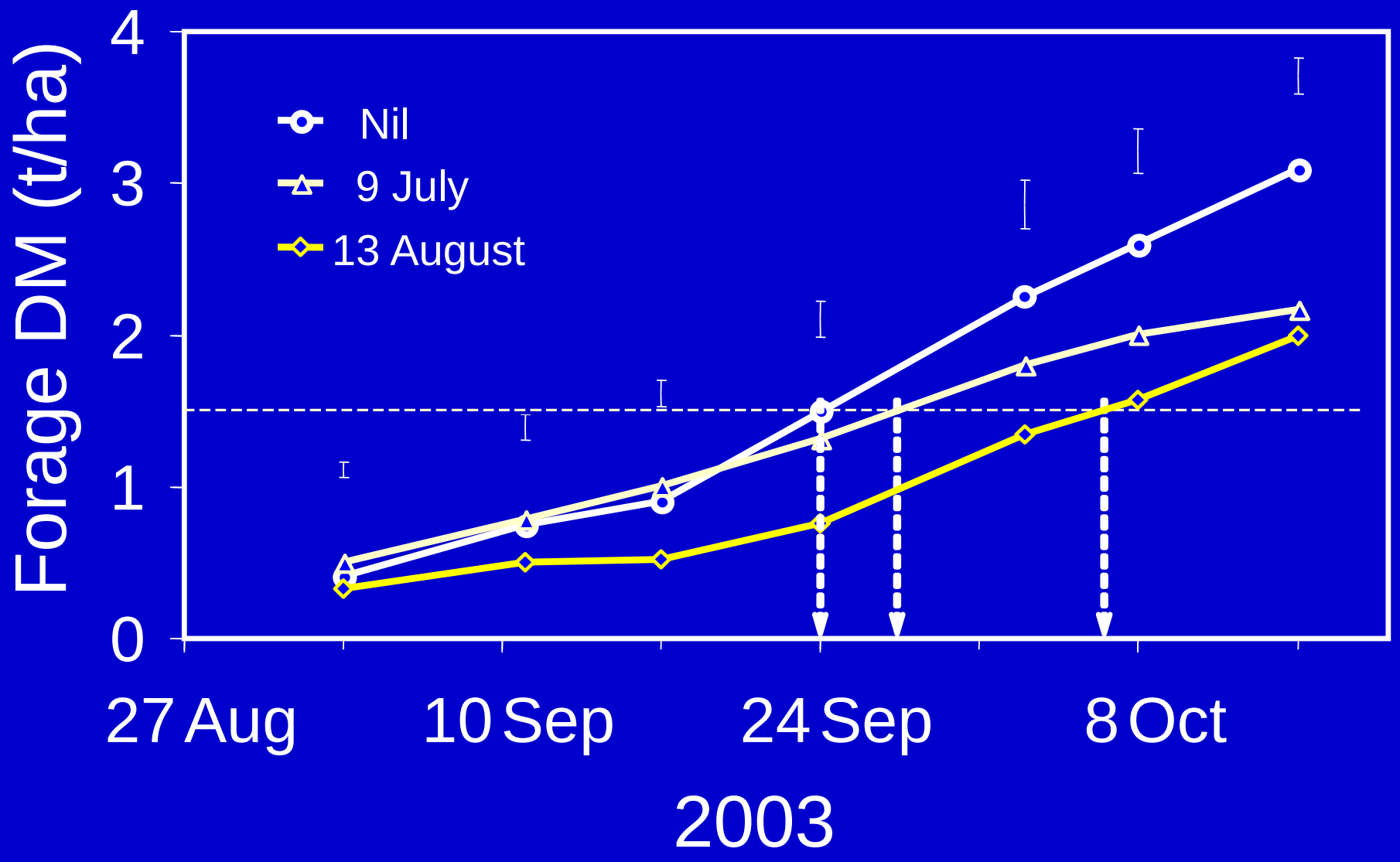


Source: Brown & Moot 2004

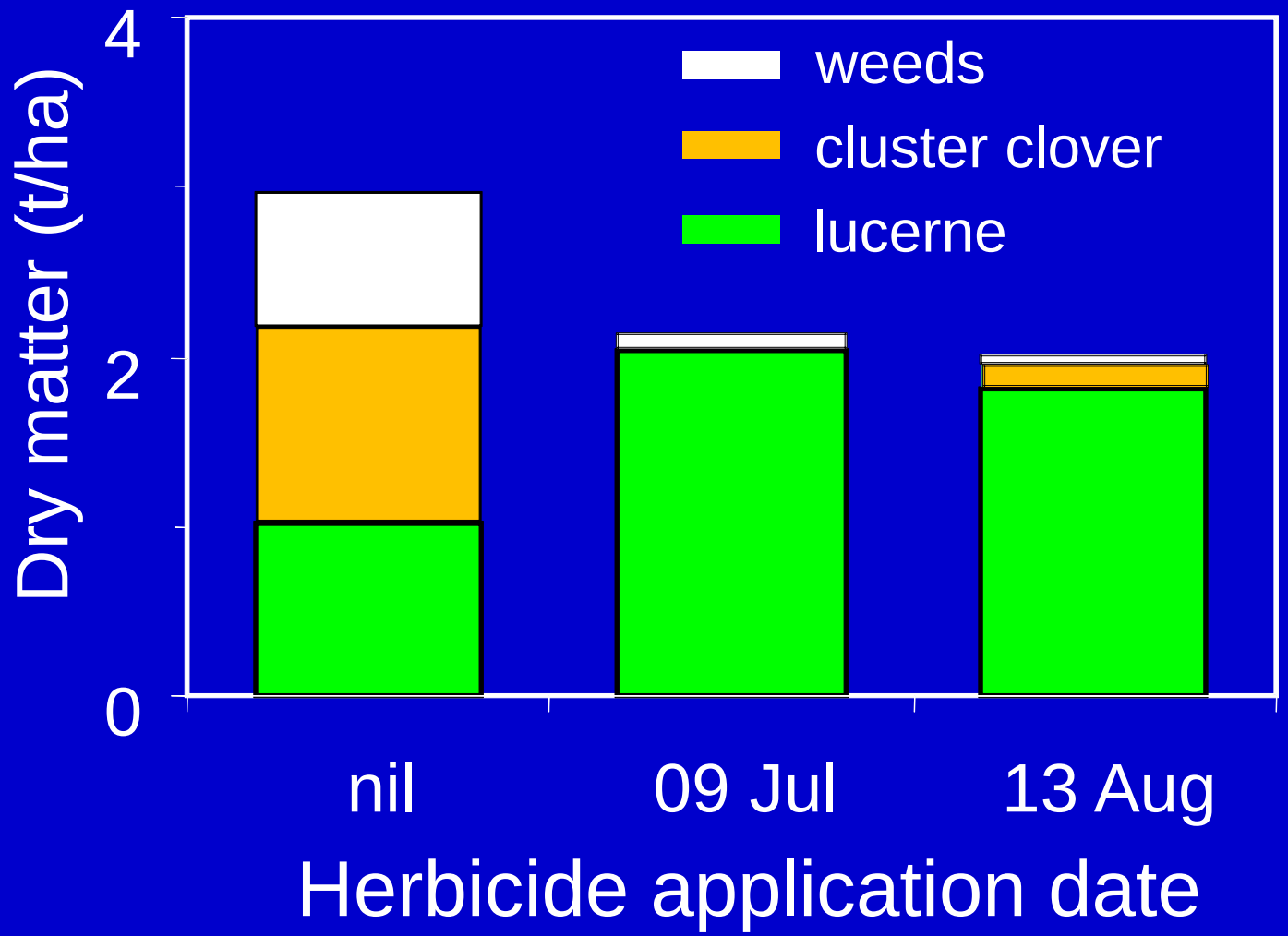
Timing of winter grazing



Timing of winter herbicide



Botanical composition 15 October



How to graze

Autumn = flowering plants

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

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

- **Clostridial bacteria:** vaccinate
- **Cobalt:** vitamin B12 injection
- **Worm haven:** Camping on small area – river edge?
- **Avoid flushing if:** leaf spots or flowering lucerne
  - new regrowth or tops only are O.K.

Which animals?

What else to feed

Ewe hoggets grown on lucerne 54 kg ave

Corriedale 2th flushed on wilting lucerne


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

Close up of a prairie grass and lucerne mixture

‘Bonavaree’ Marlborough
July 2010

‘Tama’ annual ryegrass overdrilled into runout lucerne (12 yrs)

‘Tama’ annual ryegrass overdrilled into runout lucerne (12 yrs)
- Close up -

Lucerne + cocksfoot

4. Fertilizer

- Higher requirement from cutting than grazing
  - 2% K = 20 kg/ha/t DM removed

- 50% K super = 80 kg/ha/t DM removed

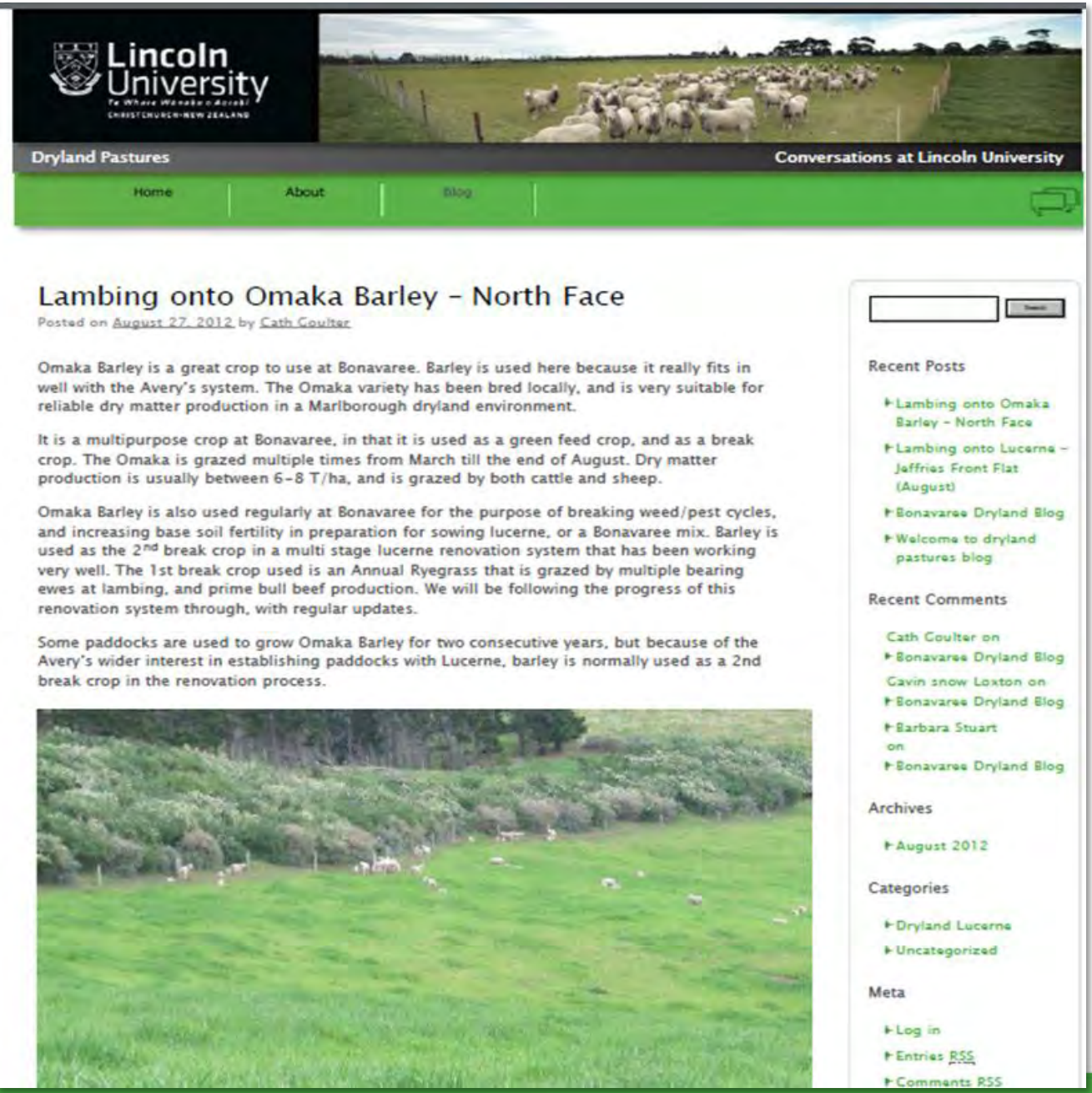
Or

- KCL = 40 kg/ha/t DM removed + P and S from super

Bonavaree production change over 10 years

	2002	2012	Change
Land area (ha)	1100	1800	↑64%
Sheep numbers	3724	4158	↑12%
M. A. Scanning (%)	140	190	↑36%
Lambing (%)	117	145	↑24%
Lamb weights (kg)	13.3	19	↑43%
Lamb sold (kg)	38324	74460	↑94%
Wool (kg)	18317	20869	↑14%
Sheep:cattle	70:30	50:50	

www.lincoln.ac.nz/conversation/drylandpastures



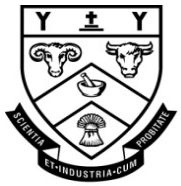
Lincoln University
Te Whare Wānaka o Aoraki
CHRISTCHURCH·NEW ZEALAND

The Blog……

- On-farm activity diary
- Slide shows, photos and video
- Ability for farmers to comment/question/query
- Farmers and researchers can respond

There is also a direct link to the Blog from the dryland website (www.lincoln.ac.nz/dryland) under "Related Links"
(Website holds FAQs and Field day handouts)

Acknowledgements



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

New Zealand's specialist land-based university

References

Brown, H. E. and Moot, D. J. 2004. Quality and quantity of chicory, lucerne and red clover production under irrigation. *Proceedings of the New Zealand Grassland Association*, **66**, 257-264.

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.

Kearney, J. K., Moot, D. J. and Pollock, K. M. 2010. Dryland lucerne production in Central Otago. *Proceedings of the New Zealand Grassland Association*, **72**, 121-126.

Mills, A. and Moot, D. J. 2010. Annual dry matter, metabolisable energy and nitrogen yields of six dryland pastures six and seven years after establishment. *Proceedings of the New Zealand Grassland Association*, **72**, 177-184.

Moir, J. and Moot D.J. 2010. Soil pH, exchangeable aluminium and lucerne yield responses to lime in a South Island high country soil. Proceedings of the New Zealand Grassland Association, **72**, 191-196.

Moot, D.J. 2012. An overview of dryland legume research in New Zealand. Crop and Pasture Science, **63**, 726-733.

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., Brown, H. E., Teixeira, E. I. and Pollock, K. M. 2003. Crop growth and development affect seasonal priorities for lucerne management. *In:* Legumes for Dryland Pastures (Ed. DJ Moot). Proceedings of a New Zealand Grassland Association. (Palmerston North New Zealand: New Zealand Grassland Association, 201-208 pp.

Moot, D.., Pollock, K.M., Lewis, B. 2012. plant population, yield and water use of lucerne sown in autumn at four sowing rates. Proceedings of the New Zealand Grassland Association, **74**, 97-102.

Moot, D.J. and Smith, M.C. 2011. Practical Lucerne Management Guide. 9 pp. Online: www.lincoln.ac.nz/dryland

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.

Wigley, K. 2011. Lucerne (*Medicago sativa* L.) establishment after inoculation with different carriers of *Ensifer meliloti* on five sowing dates. B.Ag.Sci (Hons) dissertation, Lincoln University, Canterbury. 94 pp. Online: http://hdl.handle.net/10182/4358.

Wigley, K.; Moot, D.J.; Khumalo, Q.; Mills, A. 2012. Establishment of lucerne (*Medicago sativa* L.) sown on five dates with four inoculation treatments. *Proceedings of the New Zealand Grassland Association,* **74**, 91-96.