Marlborough 28 March 2017

Annual Legume Options

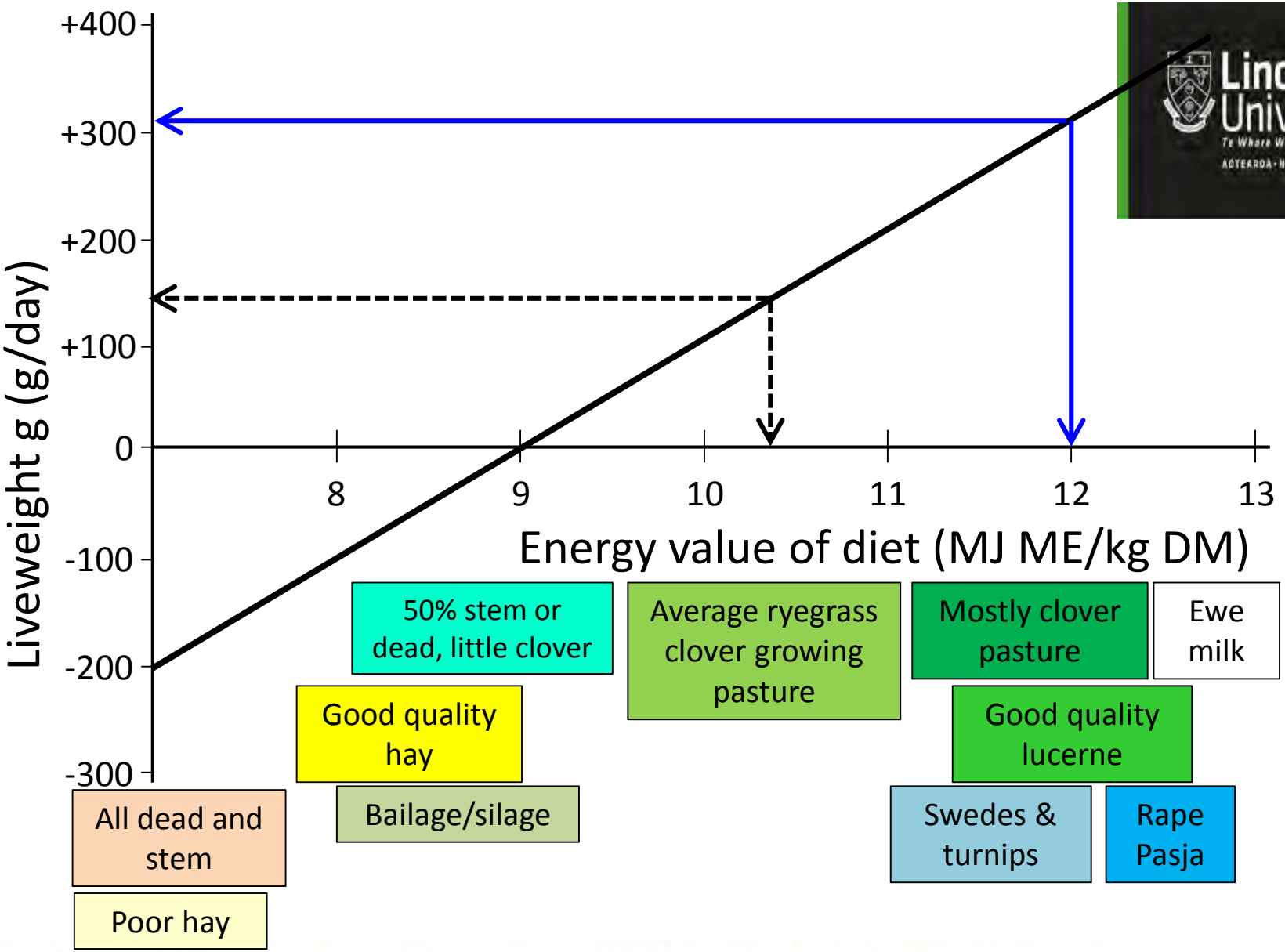
Professor Derrick Moot

New Zealand's specialist land-based university

Efficient pastures

- Limited water supply
- N to make plants grow!
- Meet animal demand (lactation)
- Minimize impact on air, soil, water
- Productive and profitable
- Socially acceptable

Legume dominant



Adapted from: Kerr 2000

Sheep prefer 70% legume, 30% grass

Photo: Jo Grigg
'Tempello' Marlborough

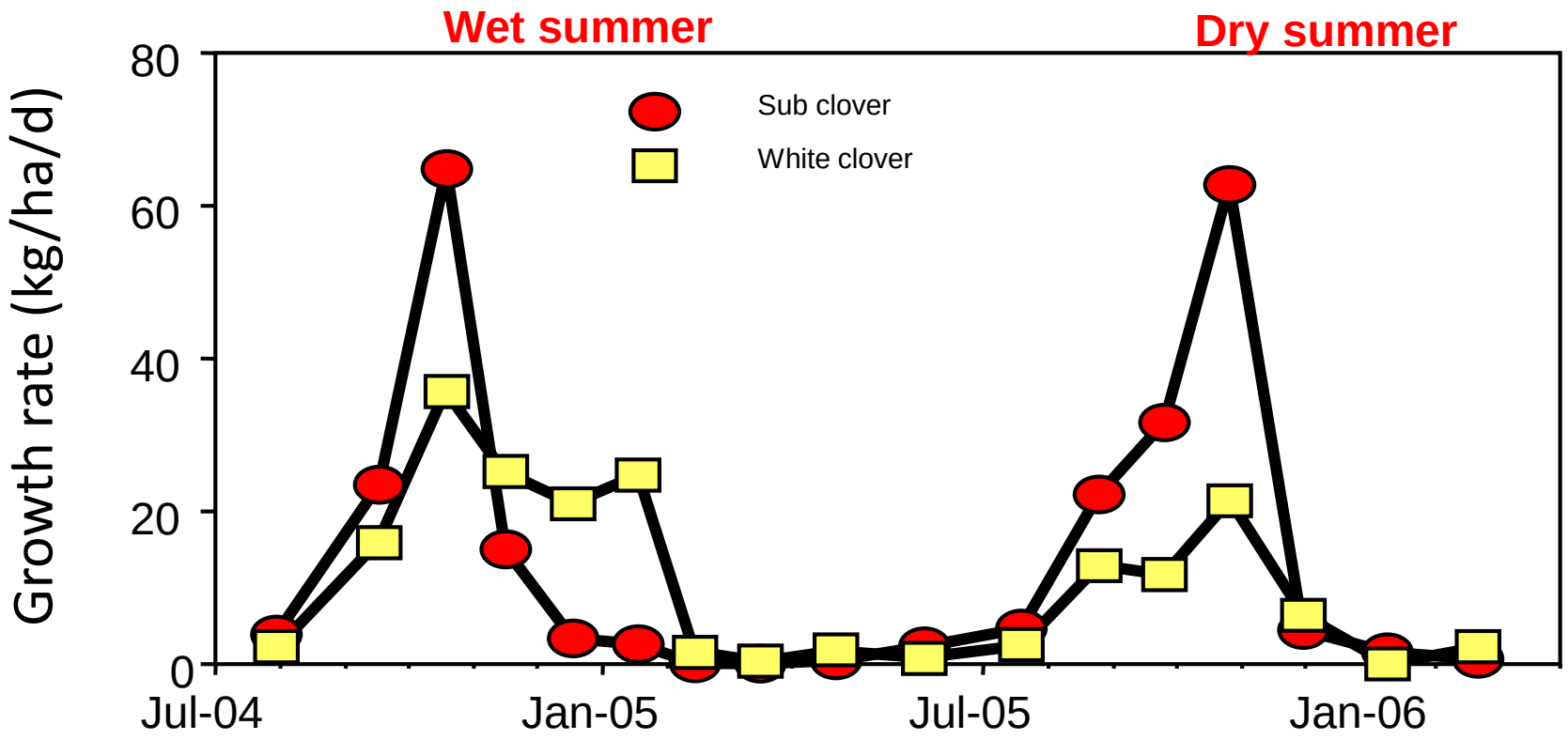
Photo: DP Monks
Lincoln University

Nitrogen fixation
25-30 kg N/t DM

Lucas *et al*. 2010

Sub clover dominant pasture 8 Oct 2015

Seasonal clover growth



Brown *et al*. 2006

Sub clover

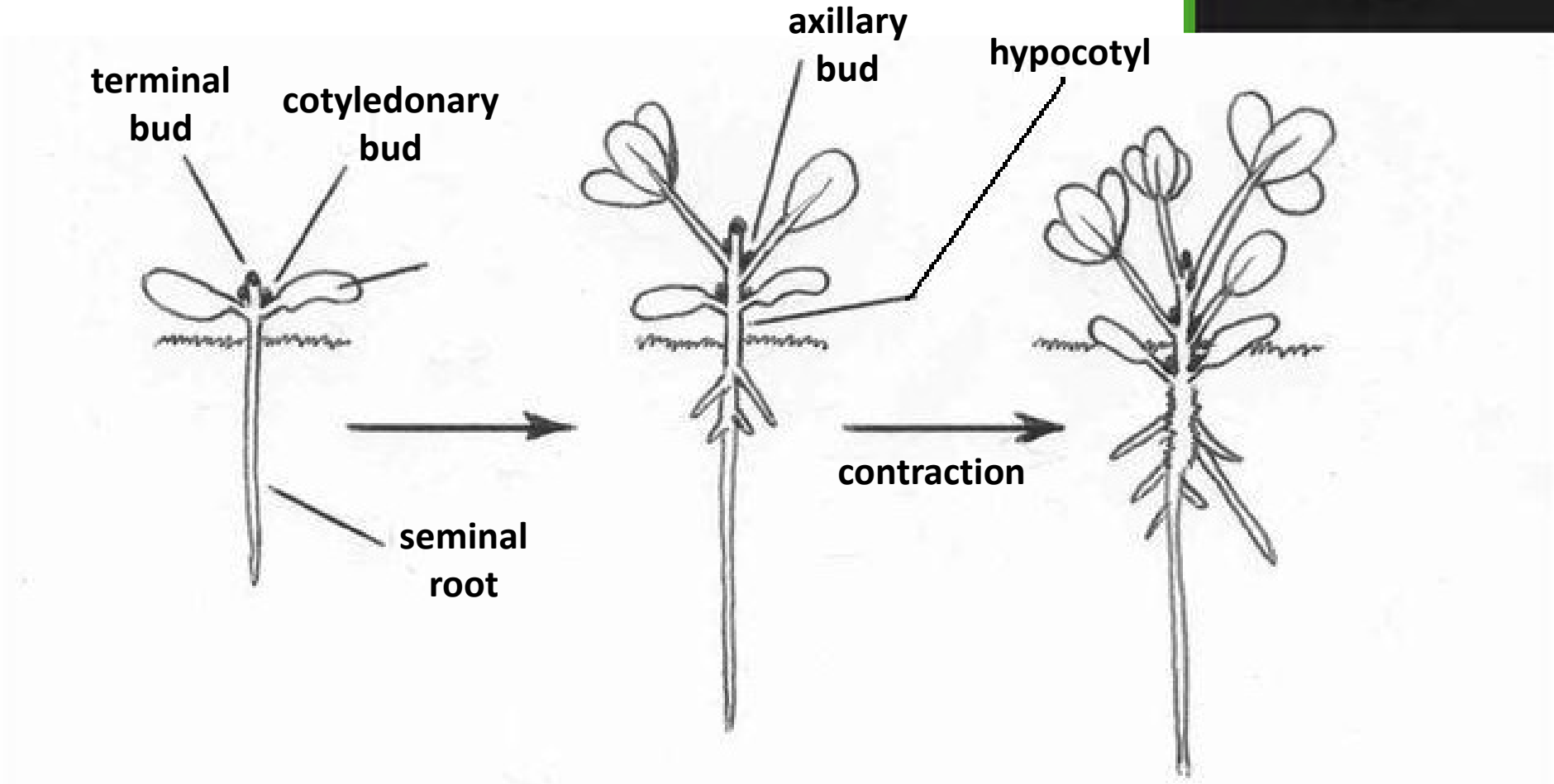
- **Best adapted legume for >4M ha of dryland in NZ.**
- **Environment is defined by the duration of the summer dry season rather than rainfall.**

- **Sub clover will thrive where:**
  - **white clover fails to persist**
  - **volunteer annual clovers are common (cluster/striated)**
  - **Olsen P >10, soil pH >5.4**

Subterranean Clover

- Large seed, 10x Wc therefore 10x sowing rate
- Winter annual – autumn sow soil temp. <11°C.
- Rapid but variable germination with rainfall from Jan-May
- When can seedlings be grazed in autumn?
- How to maximize summer seed set

Seedling Development



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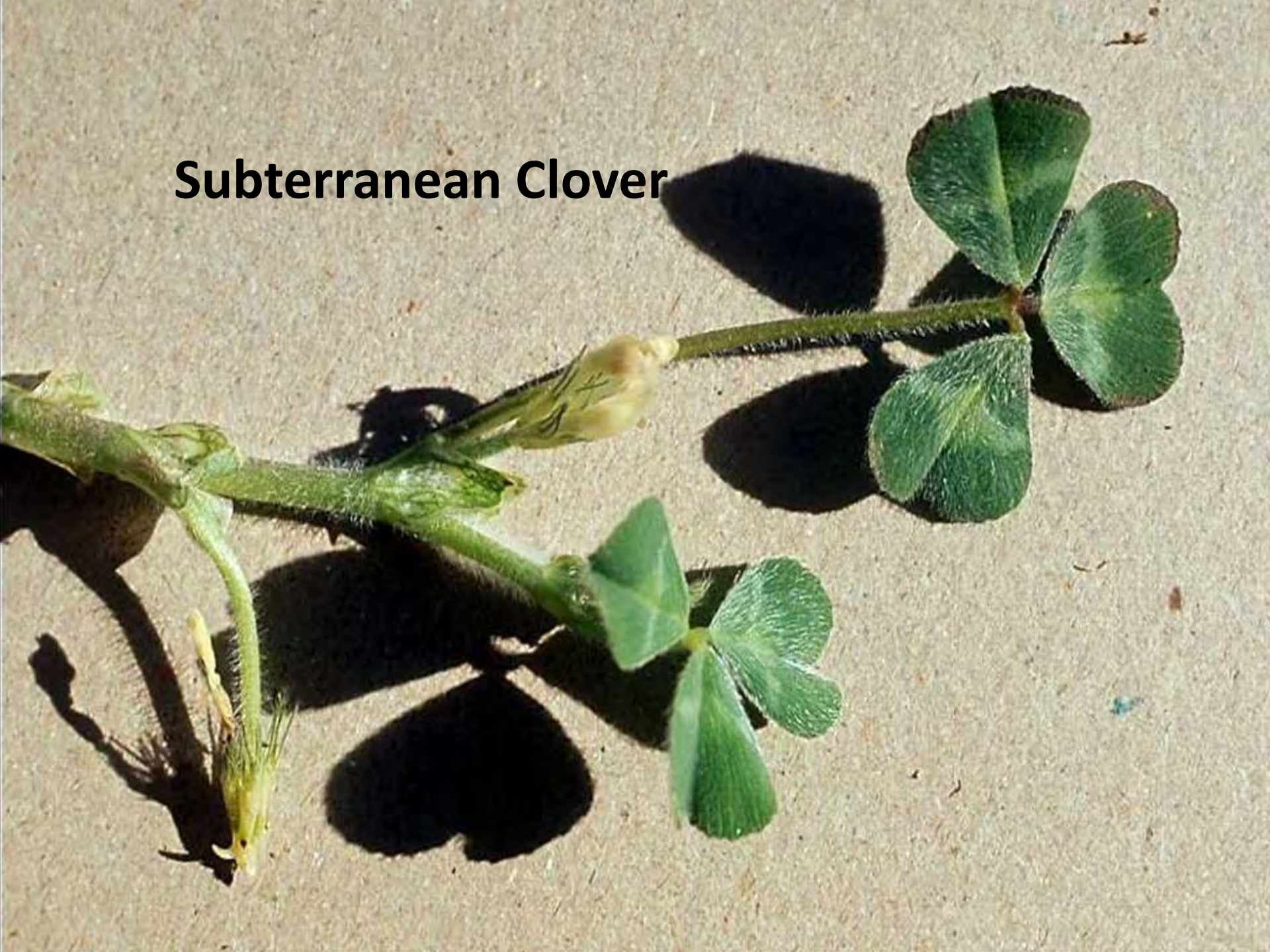
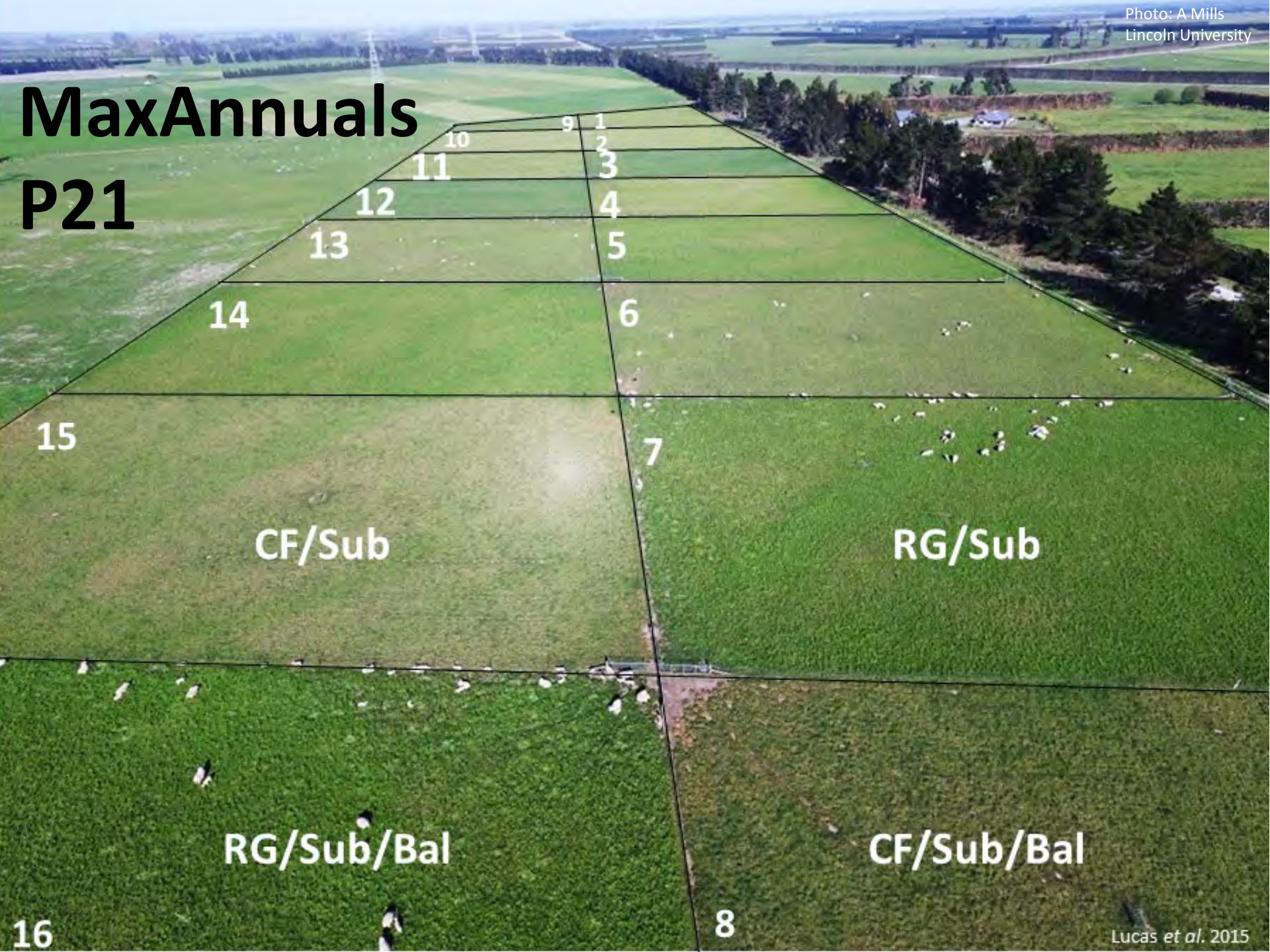
Thomas 2003

Photo: KM Pollock
Lincoln University


Subterranean Clover


MaxAnnuals
P21
Photo: A Mills
Lincoln University
9
1
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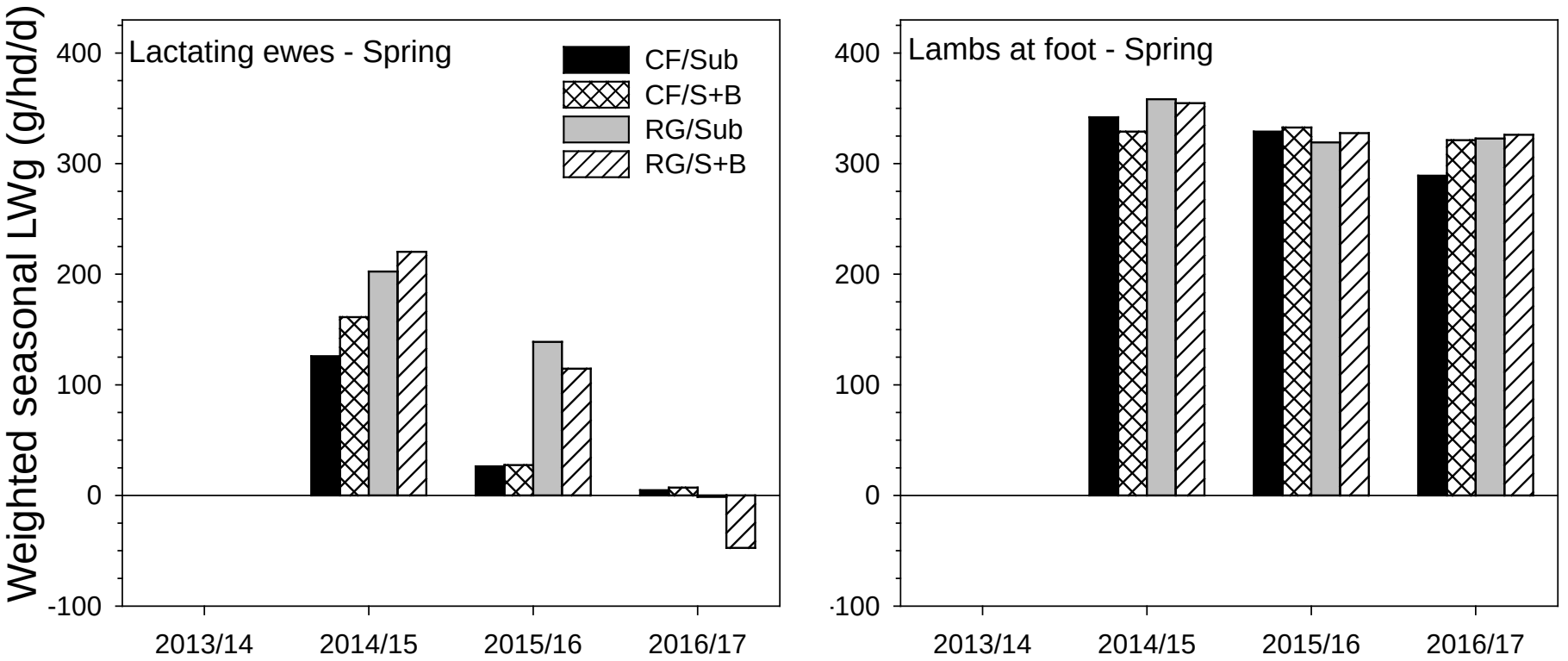
CF/Sub
RG/Sub
RG/Sub/Bal
CF/Sub/Bal
16
8
Lucas et al. 2015

MaxAnnuals



MaxAnnuals

Total Annual LWt production (kg LWt/ha)

Pasture	2013/14*	2014/15	2015/16	2016/Feb 2017**
CF/Sub	388	358	396	492
CF/S+B	383	367	415	538
RG/Sub	352	423	603	528
RG/S+B	322	412	569	485
Mean	361	391	496	511
SEM	26.8	18.5	75.7	22.3
P	ns	ns	ns	ns

* = early close for reseeding; ** = partial year.

Note: 2015/16 orthogonal contrast shows RG pastures outperformed CF pastures ($P<0.05$).

Sub 4 Spring

- Limited NZ knowledge with “newer” cultivars.
- Interpret Australian results for NZ environments.
- Allow for climatic and site variation by sowing mixtures of sub clover cultivars.
- Sow 10 kg seed/ha total sub clover
  - 5 kg/ha of each cv in autumn.

Sow complementary mixtures

- “Older” proven with a “newer” cultivar
- Mid flowering with late flowering

Lucas *et al.* 2015

Suggested Combinations

- 5-6 month dry
  'Woogenellup' +'Narrikup'
- 4 month dry
  'Denmark' + 'Narrikup'
- 3 month dry
  'Denmark' + 'Leura'
- Wet soils –
  add 'Napier'
- Early spring feed
  add 'Antas'

- Hardseededness of 1-2 preferred: more information needed

Lucas *et al*. 2015

Direct drill before rain

Initial population for seed build up

Photo: DJ Moot
Lincoln University

Autumn Management in later years

(200 seedlings/m^2 in pasture)

- High strikes after extended hot periods
  - –bare ground for seedlings to establish in
  - –high temperatures break dormancy
- January rains are often false break
  - –seedlings die (March is usual)
- Amount of cover in autumn is crucial

Photo: DJ Moot
Lincoln University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Lincoln University

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Photo: Derrick Moot
Lincoln University
9/3/2017

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Photo: Derrick Moot
Lincoln University
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Californian thistle

Photo: Derrick Moot
Lincoln University


Photo: Derrick Moot
Lincoln University
Yarrow


Photo: Derrick Moot
Lincoln University


Photo: Derrick Moot
Lincoln University


Photo: Derrick Moot
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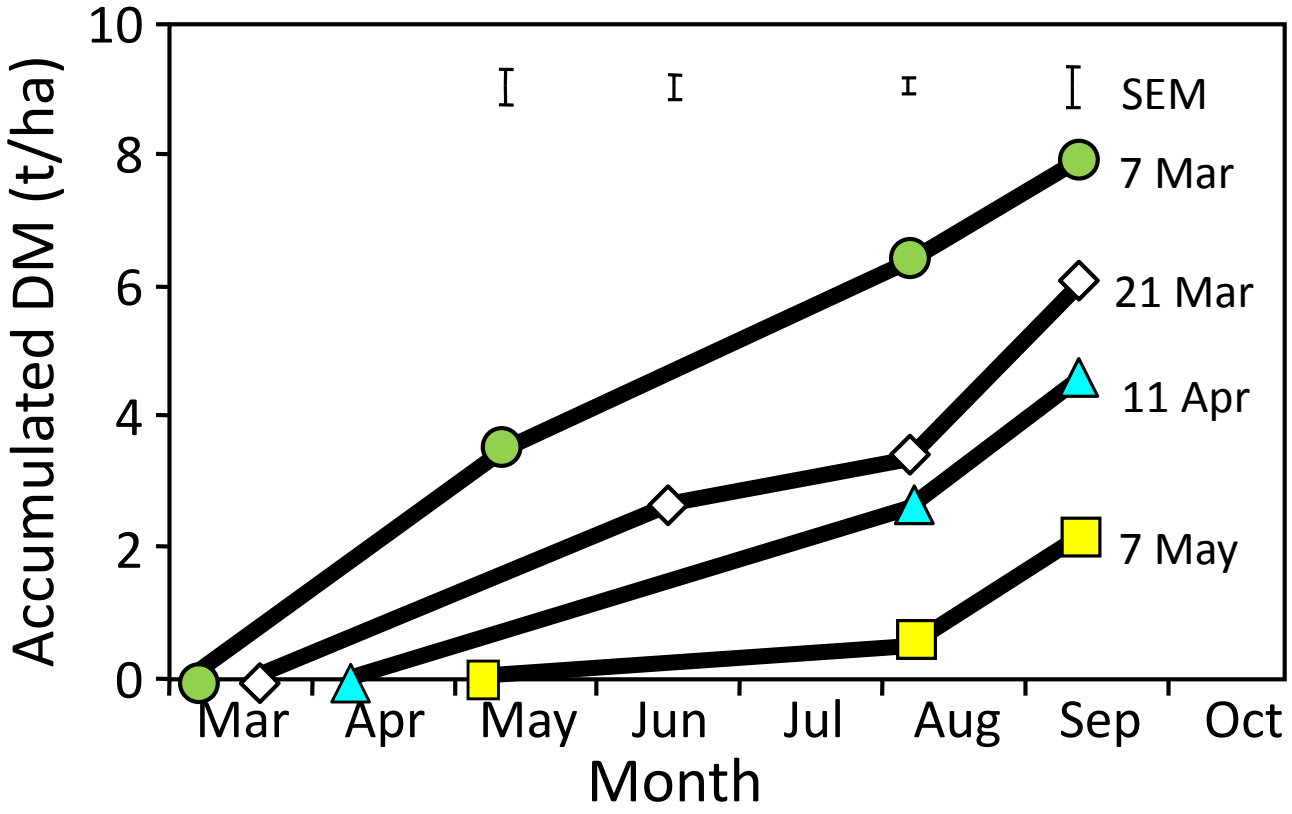
seedling

Costello & Costello 2003

Seedling density is what gives fast recovery

Costello & Costello 2003

Dry matter yields



Takes several years to build seed reserves

Costello & Costello 2003

Pasture Mix

- 10 kg subterranean clover
  –early and late flowering cultivars
- 1 kg Cocksfoot

- Hill country = 10 kg/ha sub. alone
- Or manage for the sub that is there

‘Cefalu’ arrowleaf

‘Bolta’ balansa

‘Prima’ gland

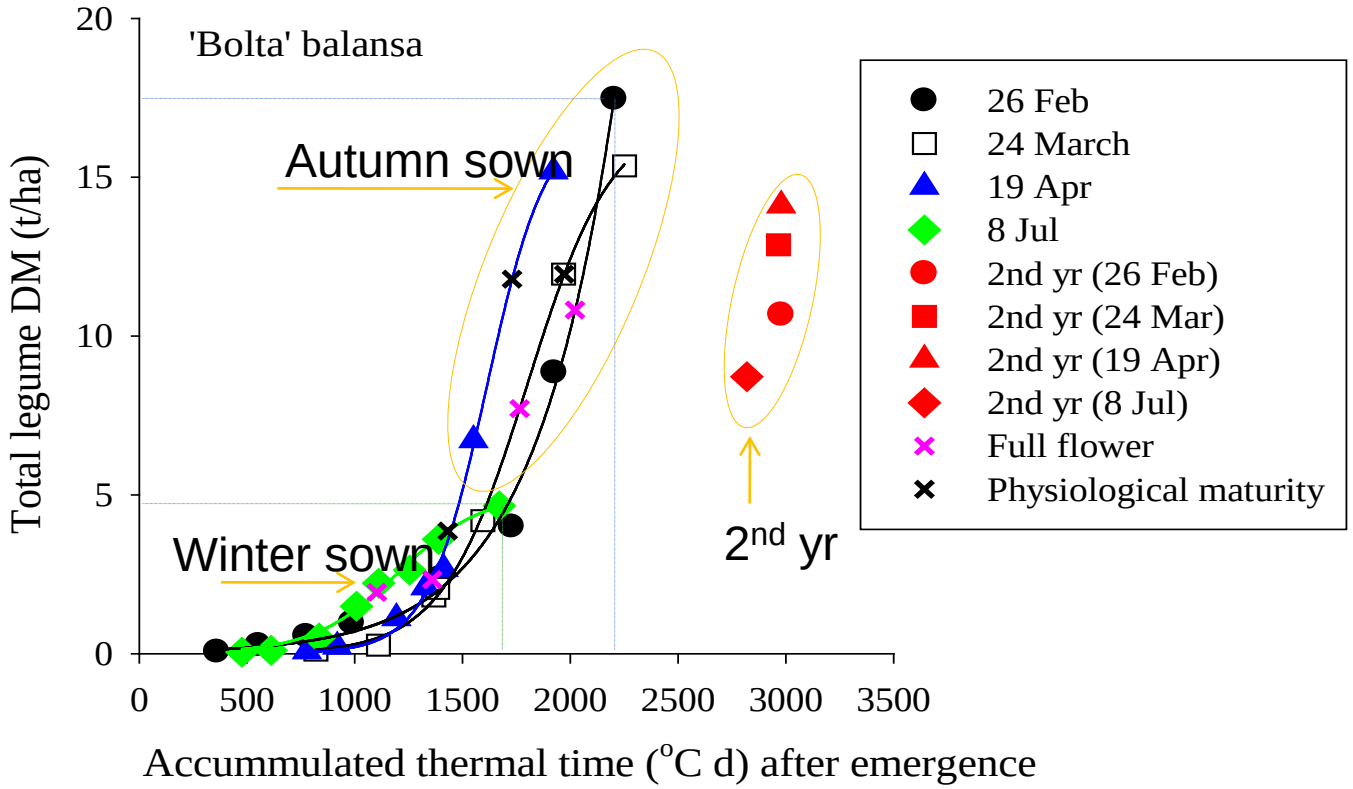
‘Mihi’ Persian

Nori *et al.* 2015a; 2015b

Establishment of annual clover
Important to reseed !!

Photo: DJ Moot
Lincoln University

Total dry matter production (t/ha)



Dry matter production (t/ha)

	1st yr (Total)	2nd yr (Full flower)
Species	**26-Feb-10**	**Mean**
‘Cefalu’ arrowleaf	9.4	0.5 **Hardseed!!**
‘Bolta’ balansa	17.5 **Wohoo!!**	11.6
‘Prima’ gland	7.8 **Matured too quickly!!**	2.9
‘Mihi’ Persian	12.5	8.3

Seed maturity

‘Cefalu’ arrowleaf

‘Bolta’ balansa

‘Prima’ gland

‘Mihi’ Persian

Nori *et al.* 2015b

Gland clover

Grigg 2013

Grigg 2013

Lincoln University
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Arrowleaf clover flowering January 2011

- **Flowering ‘Arrotas’ arrowleaf clover in January of its first summer.**
- **Sowing rate of 6 kg/ha – 2-3 kg/ha is probably enough.**
- **Seed should be mature around mid February.**

“once on lucerne - 2000 litres extra milk ”

October 2016

Photo: DJ Moot
Lincoln University

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Te Whare Wānaka o Aoraki
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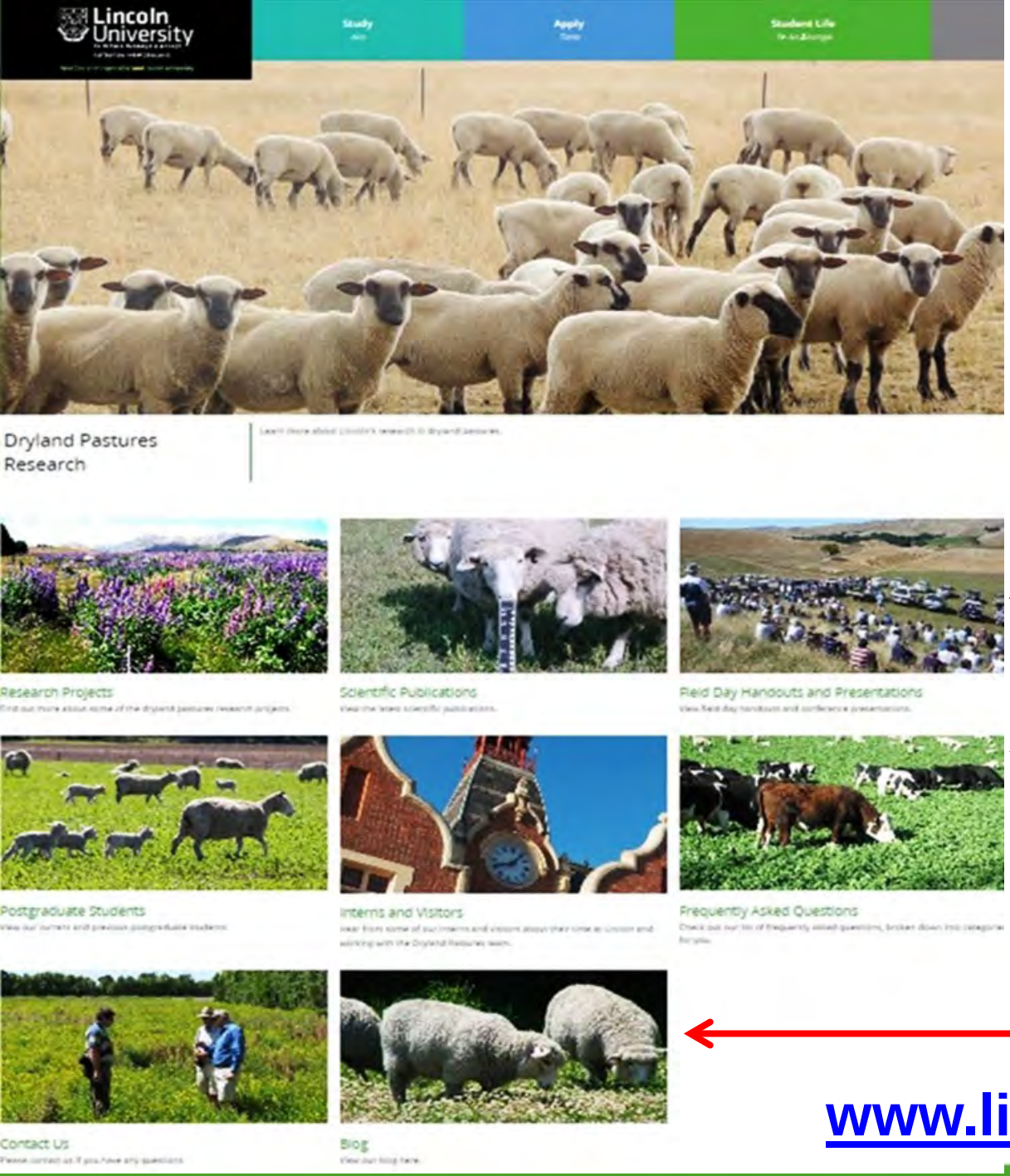
Conclusions

- Legumes provide nitrogen for water use efficiency
- Annual legumes grow earliest in spring
- Sub clover is often dormant in dryland pastures
- Managing the seed bank to regenerate annuals
- Top flowering clovers – more difficult to maintain
- Many cultivars available from Australia
- Check lucerne for foliar fungi



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Website

Handouts & presentations

FAQs

Direct link to Blog

www.lincoln.ac.nz/dryland

References

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