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Lincoln University

Te Whare Wānaka o Aoraki

AOTEAROA • NEW ZEALAND



Taupo, 13 September 2017

Dryland pastures

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New Zealand's specialist land-based university



Dryland Pastures Research

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View the latest scientific publications.



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Direct link to Blog

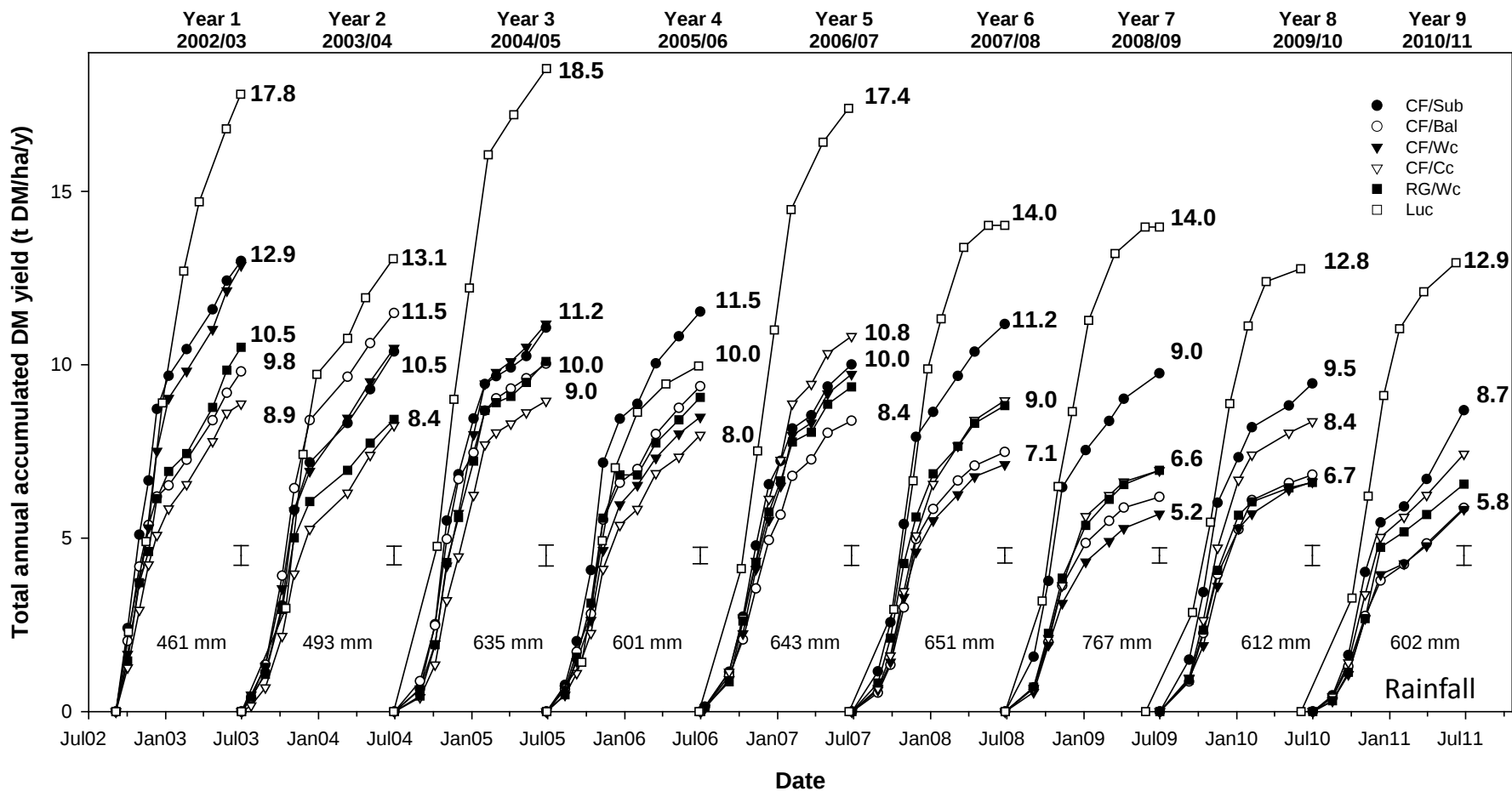
www.lincoln.ac.nz/dryland



RG/Wc
Lucerne
CF/Sub
CF/Balansa
CF/Cc
CF/Wc

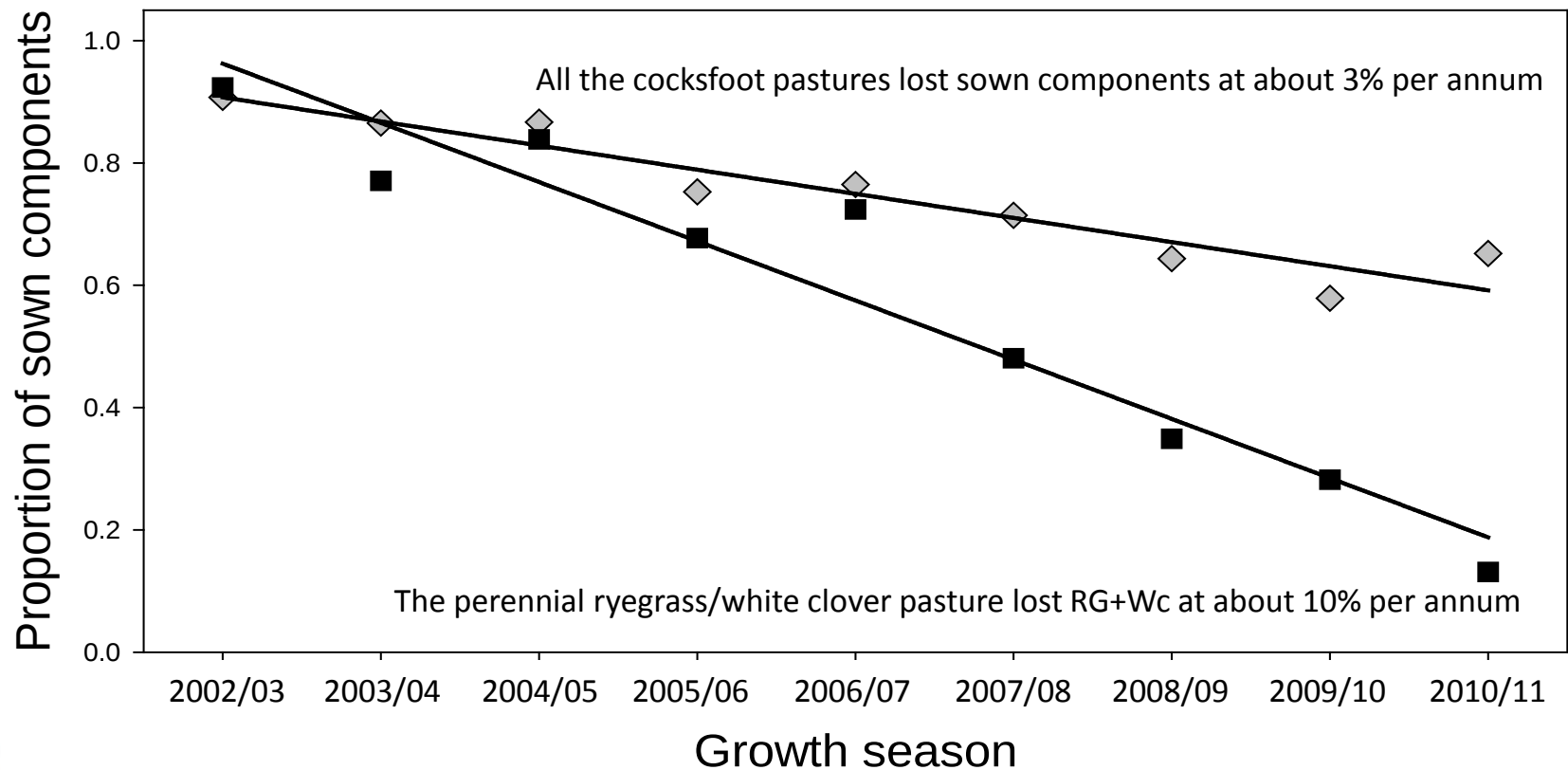
The 'MaxClover' Grazing experiment in paddock H19 at Lincoln University

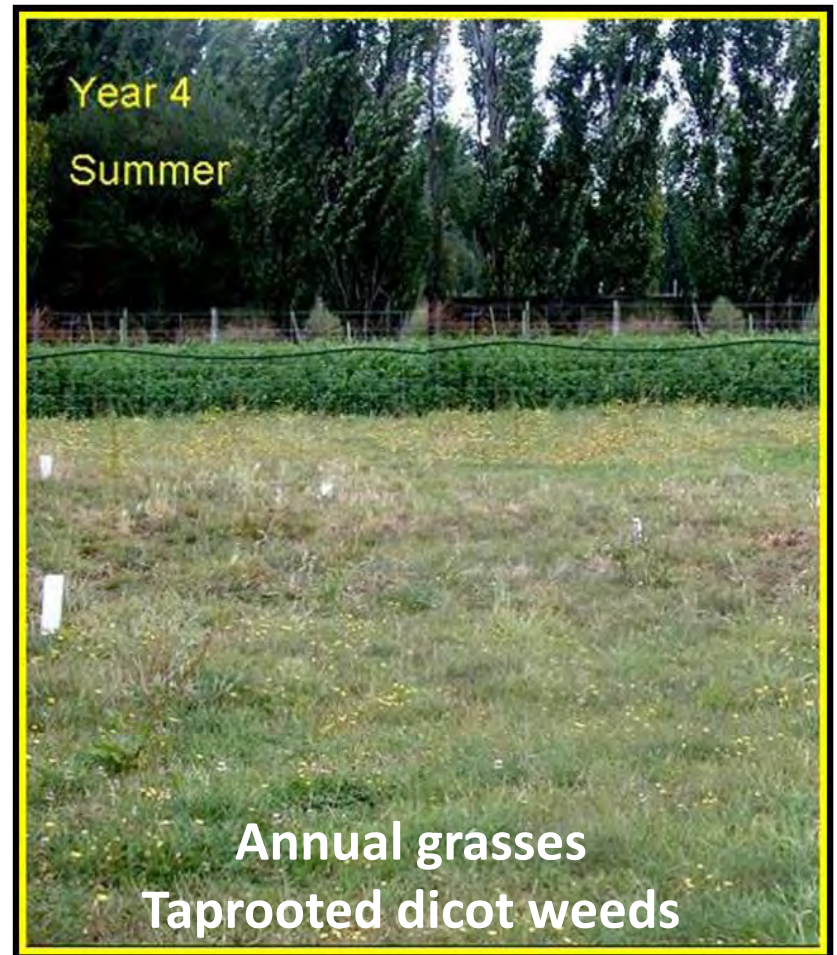
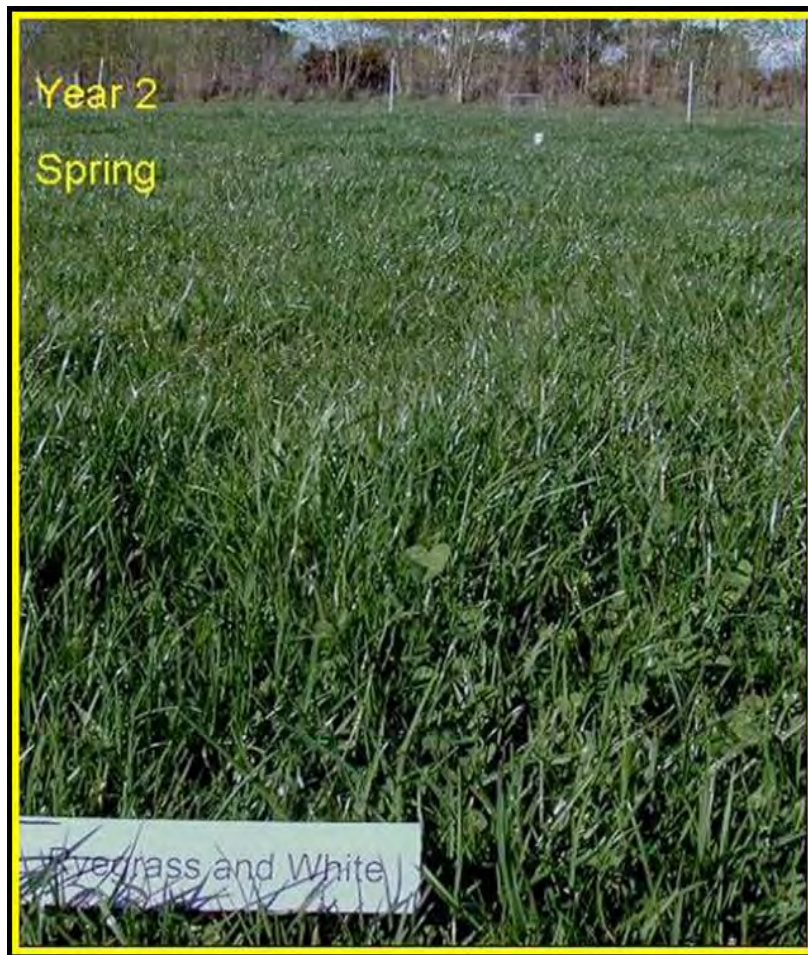
Total annual accumulated dry matter production



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Change in the proportion of originally sown pasture components (grass + clover) over time



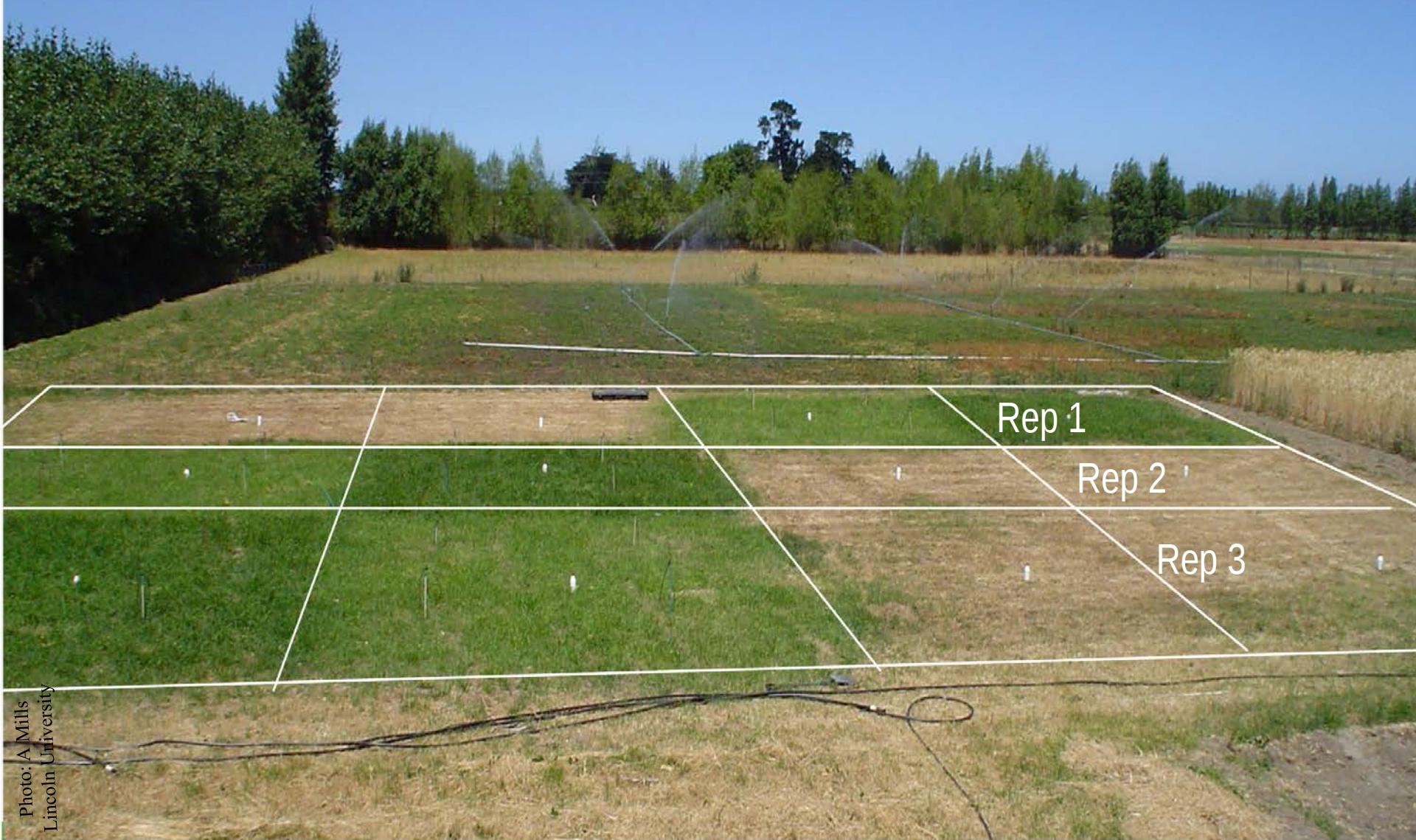


Unsown species <5% in Year 1>45% in Year 6

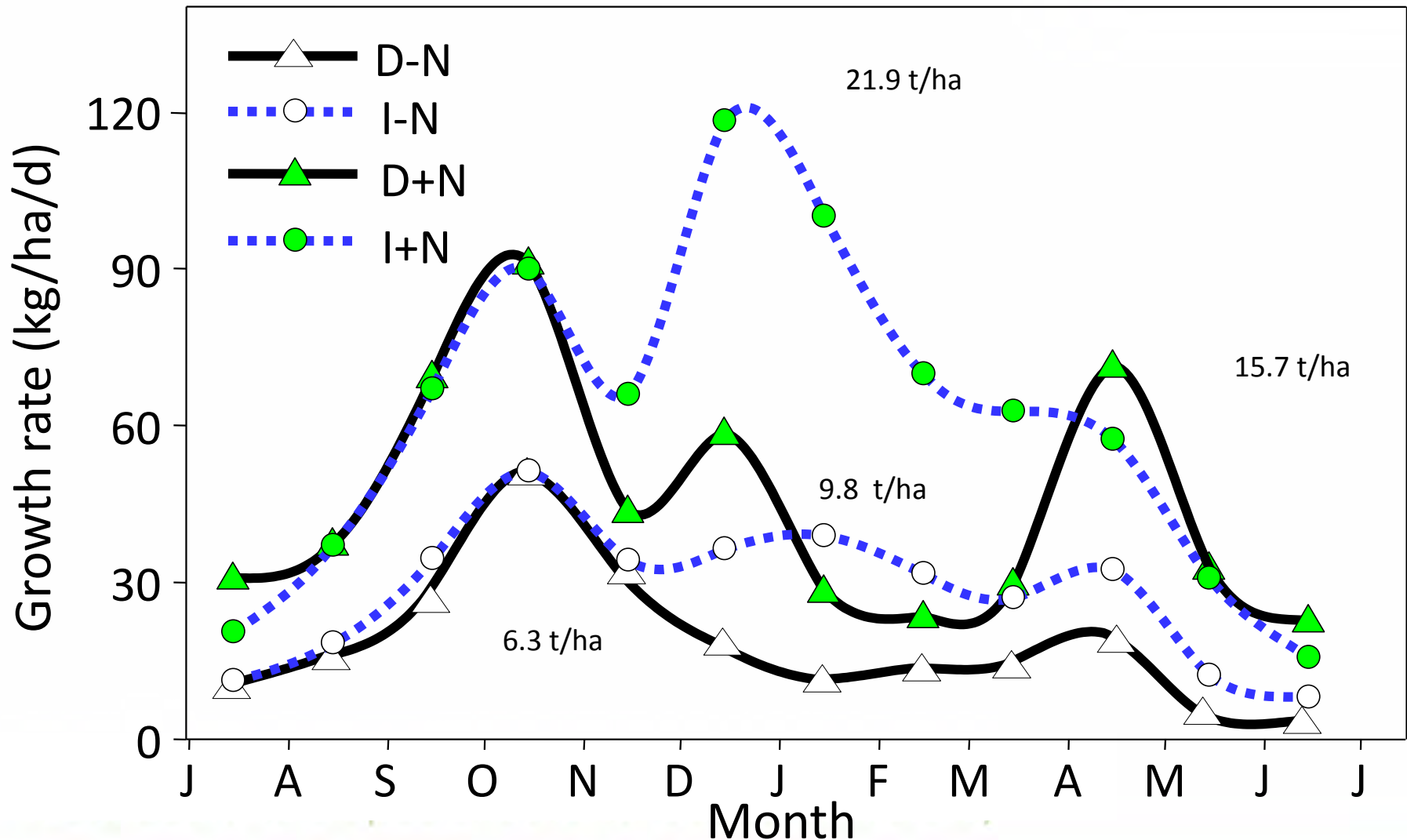
RG/Wc pastures

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Experiment site



Growth rates (2 year means)

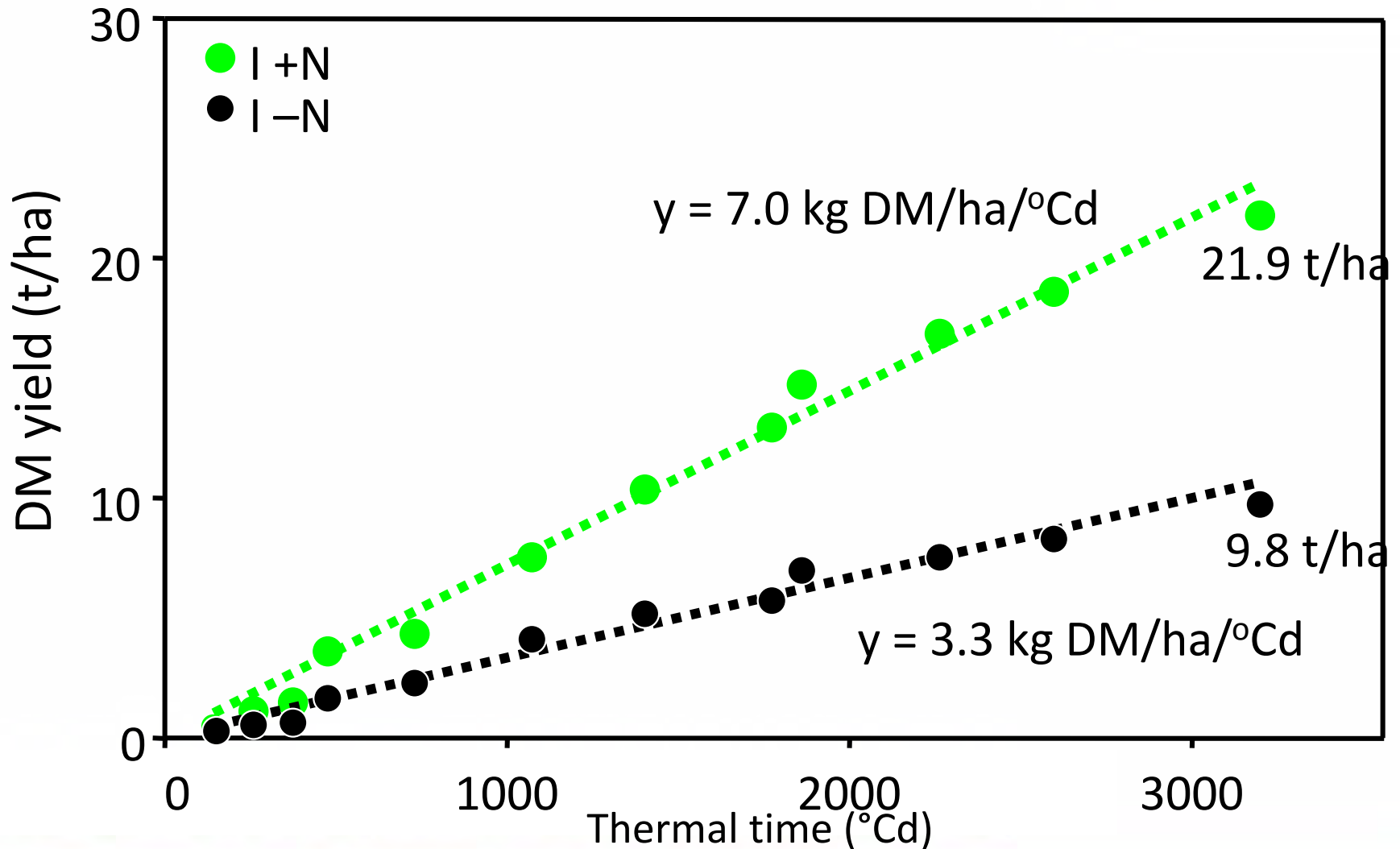


Winter

⇒ temperature response



The Nitrogen gap

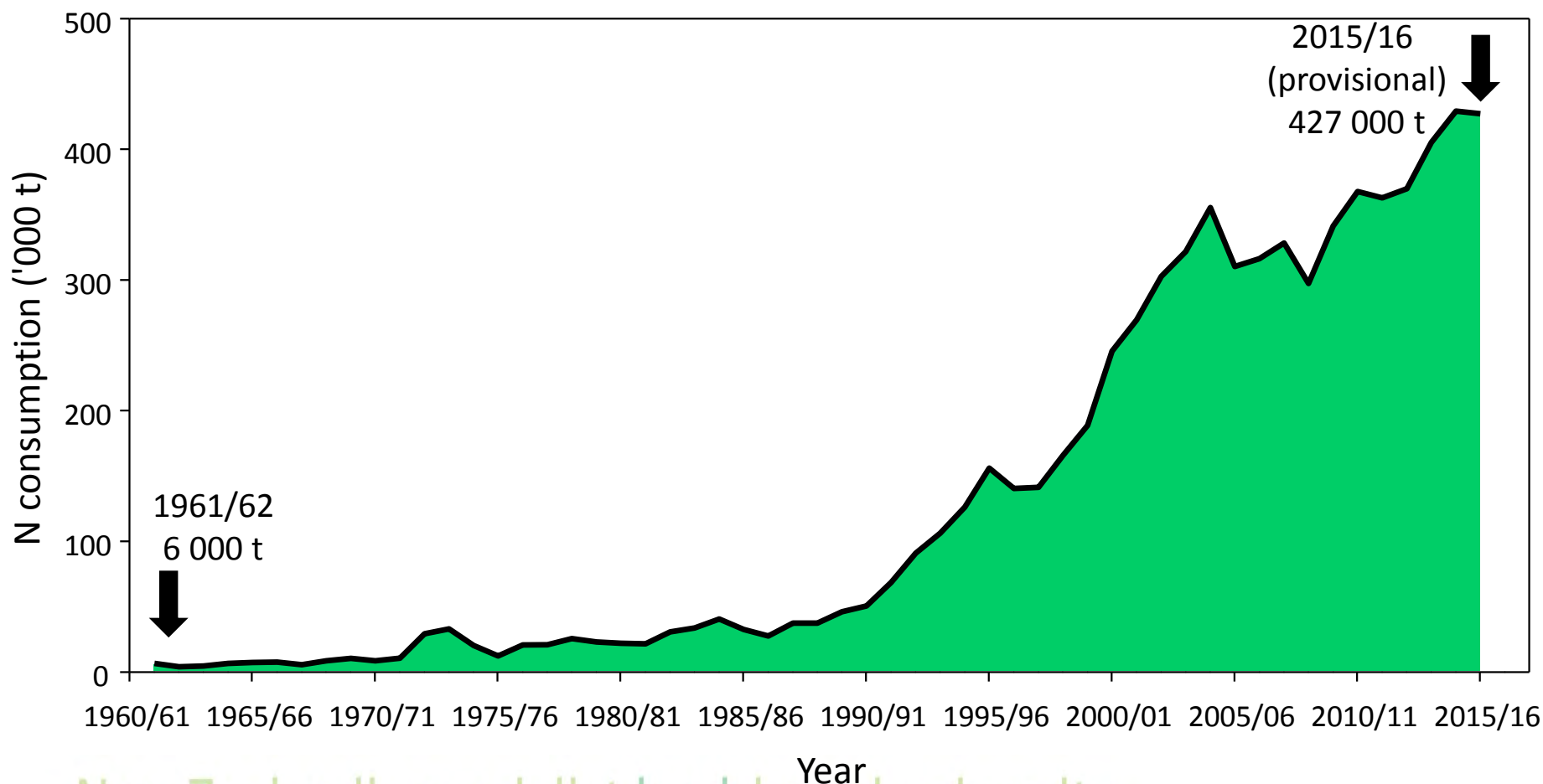


Nitrogen deficient pasture



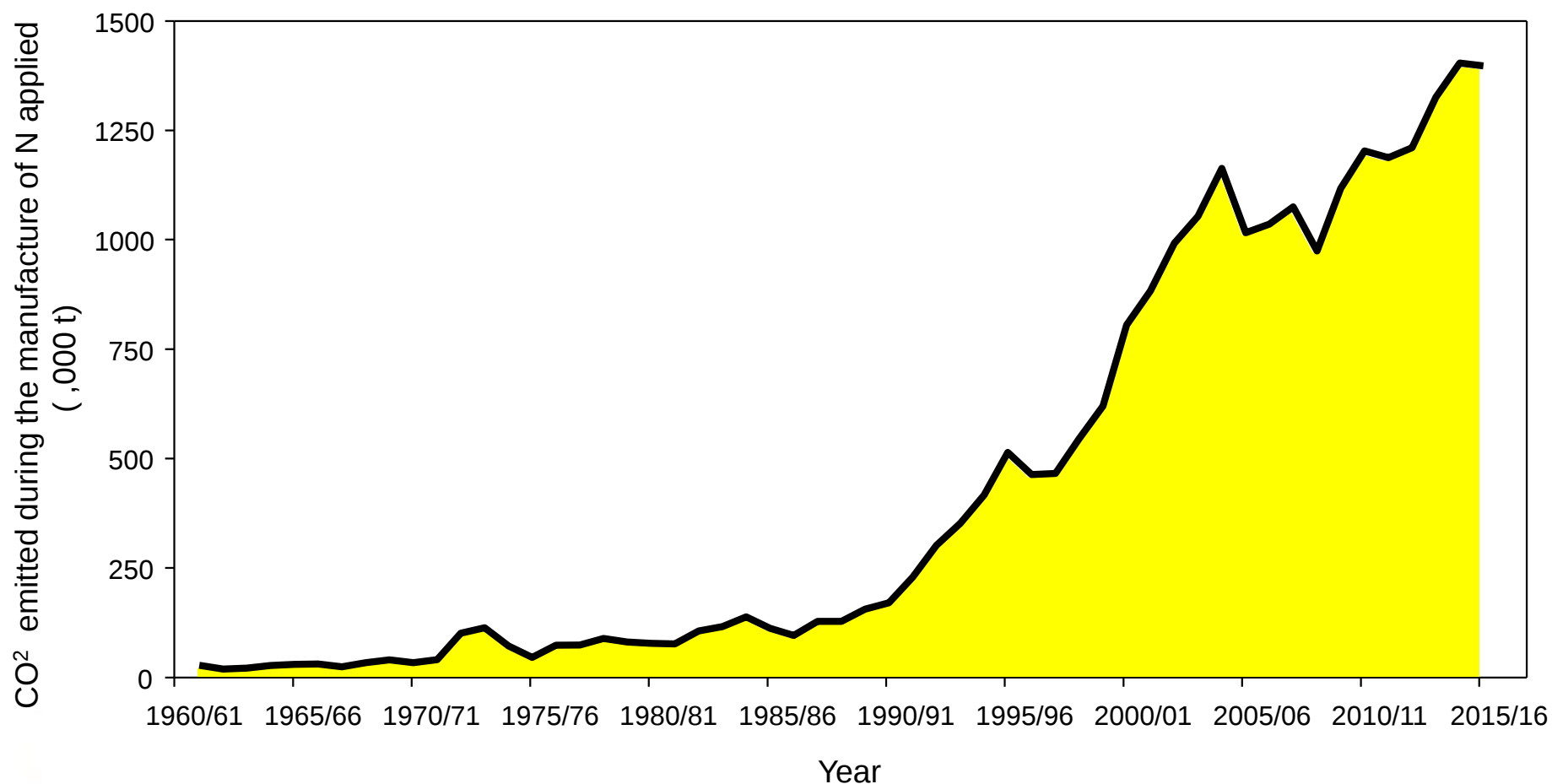
1000 kg N/ha

Nitrogen applied in NZ



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CO₂ emissions generated in the production of N fertiliser



Future dryland pastures

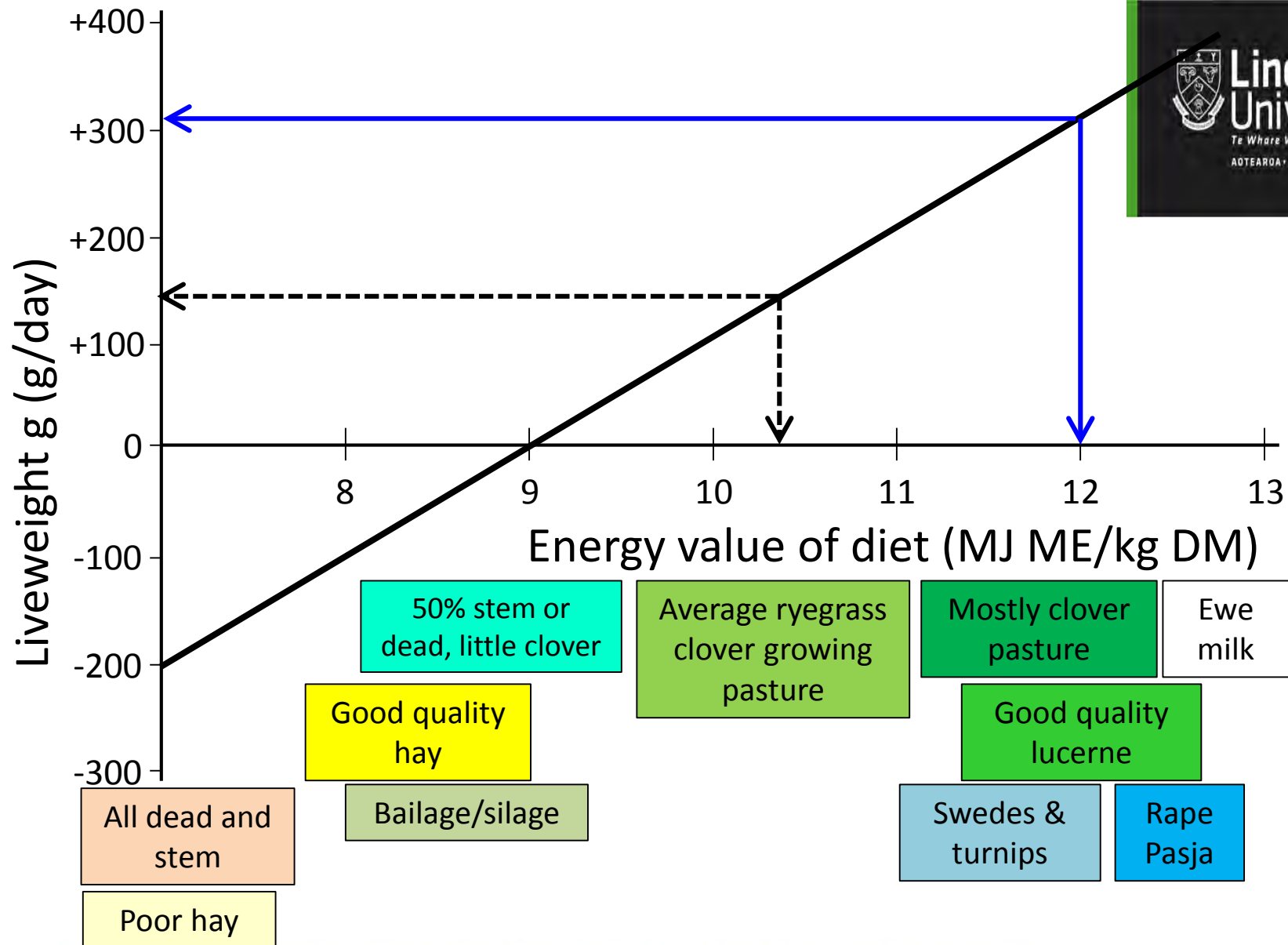
- Limited water supply
- N to make plants grow!
- Meet animal demand (lactation)
- Minimize impact on air, soil, water
- Productive and profitable
- Socially acceptable

Legume dominant

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Sheep prefer 70% legume, 30% grass





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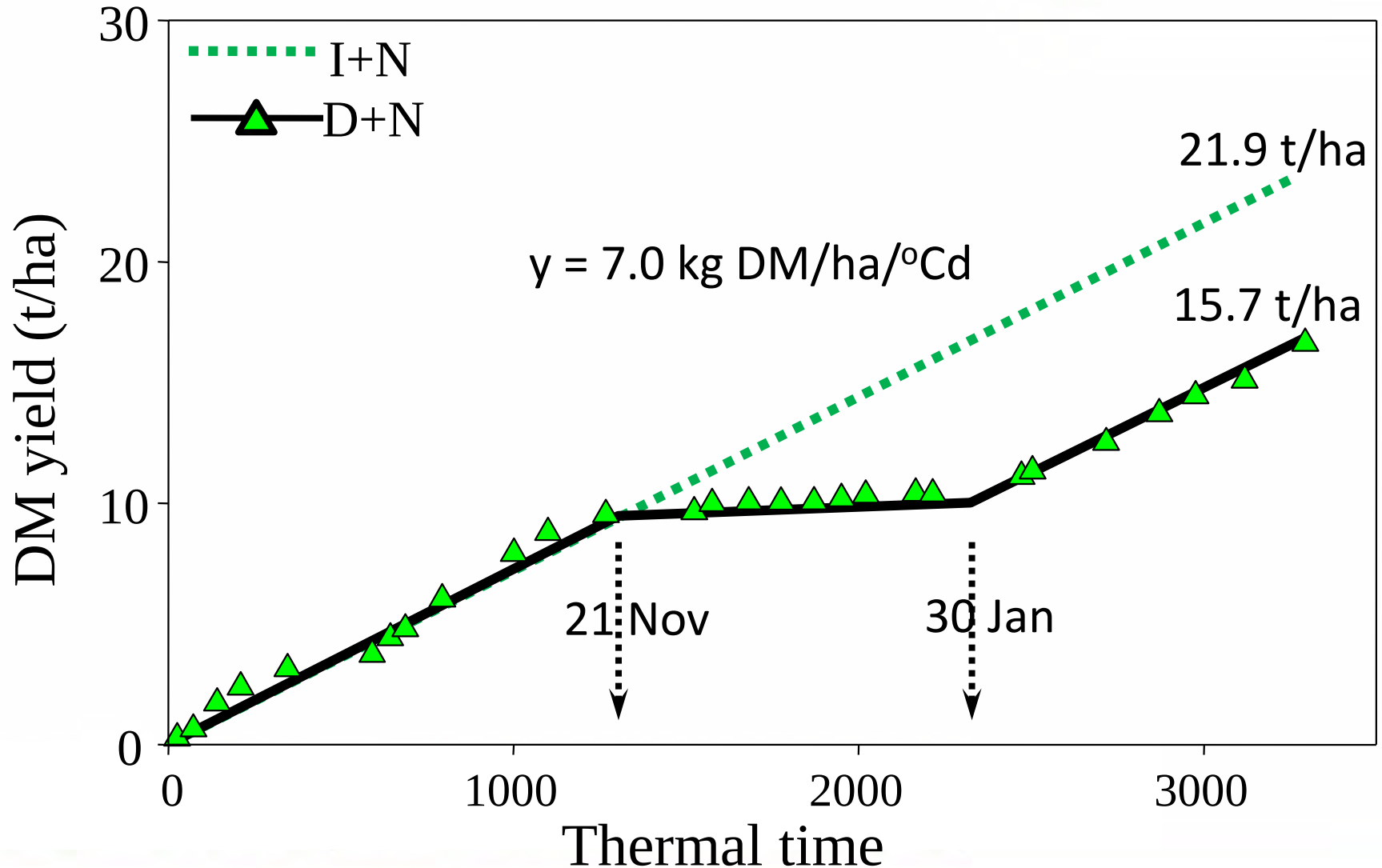


Nitrogen fixation
25-30 kg N/t DM



Summer $\Rightarrow$ moisture response

Water stress effect on yield



Soil moisture deficit 2003/04

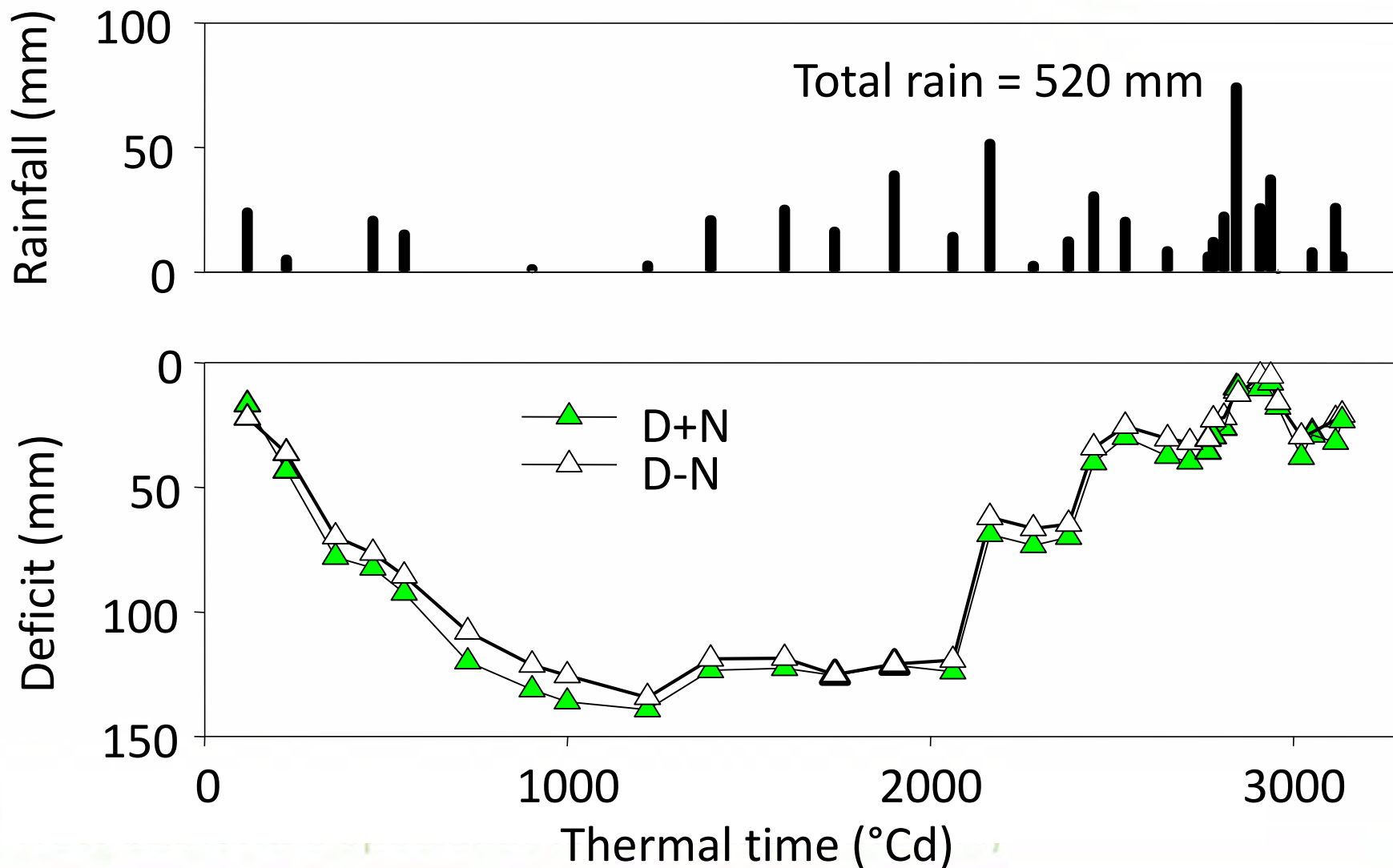




Photo: DJ Moot
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Photo: V Fasi
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Lucerne Objectives

- Describe key establishment issues.
- Describe management to maximise production, quality and persistence.
- Answer any dryland questions on any species.

Establishment

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

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



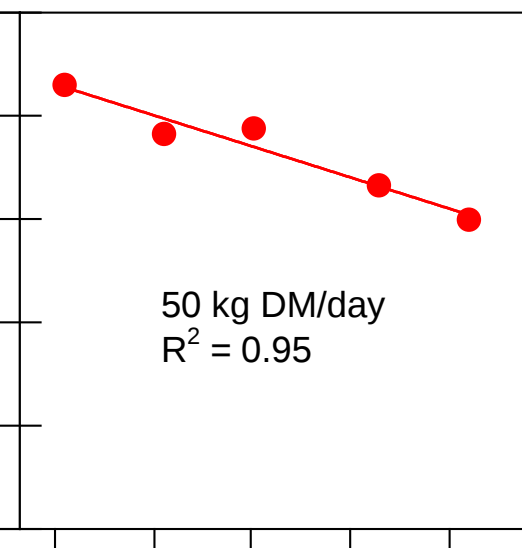
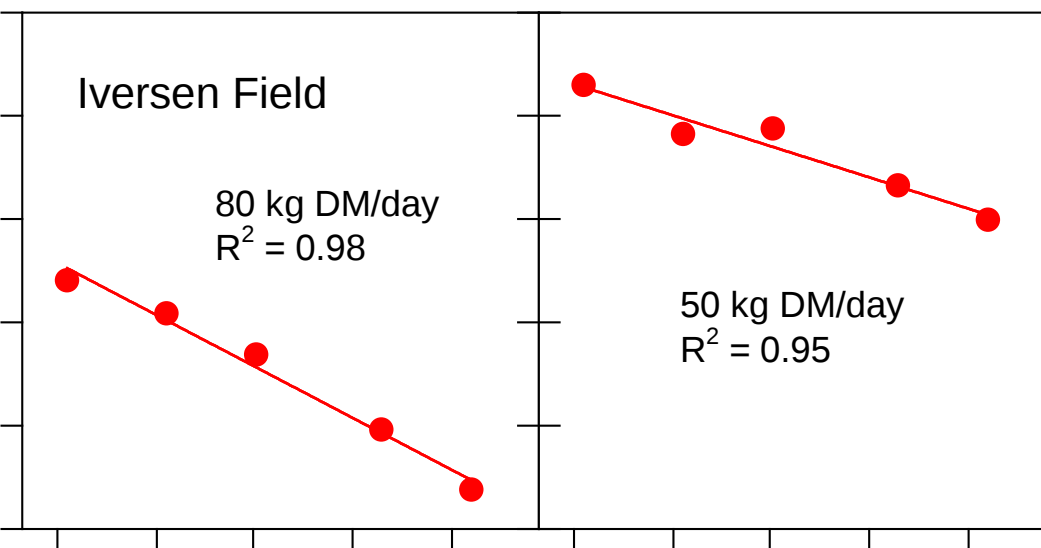
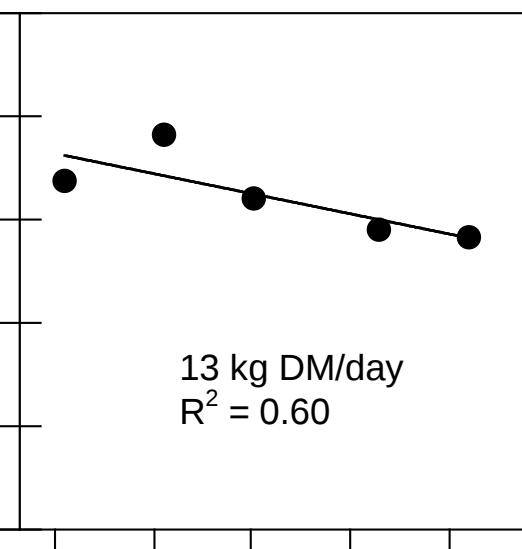
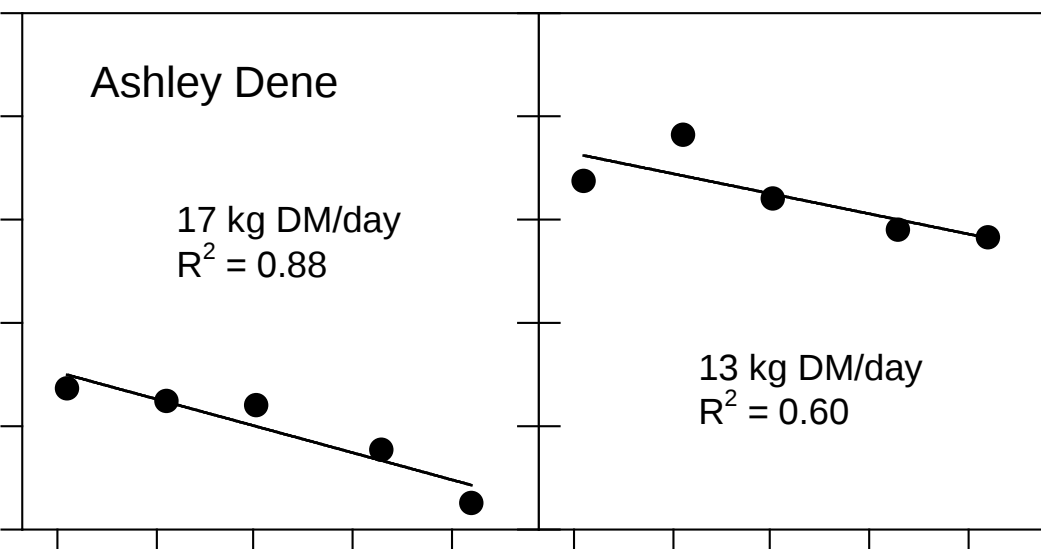
**Lucerne root
~8 months after sowing
> 1.5 m length**

Establishment

Year Two



Total annual yield (t DM/ha)



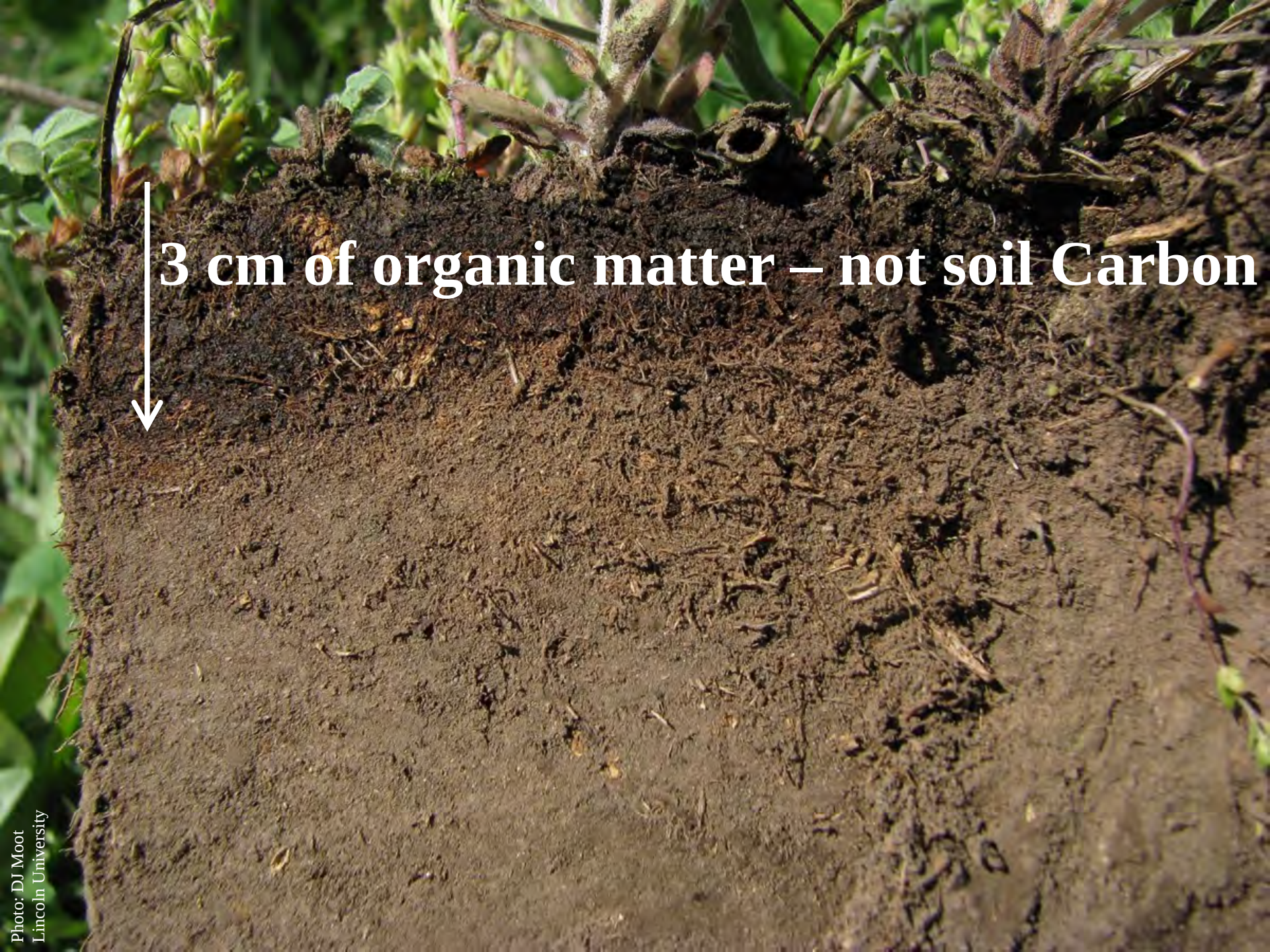
Oct Nov Dec Jan Feb Oct Nov Dec Jan Feb

Sowing date

**Delayed sowing
cost yield**

Pre-development

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

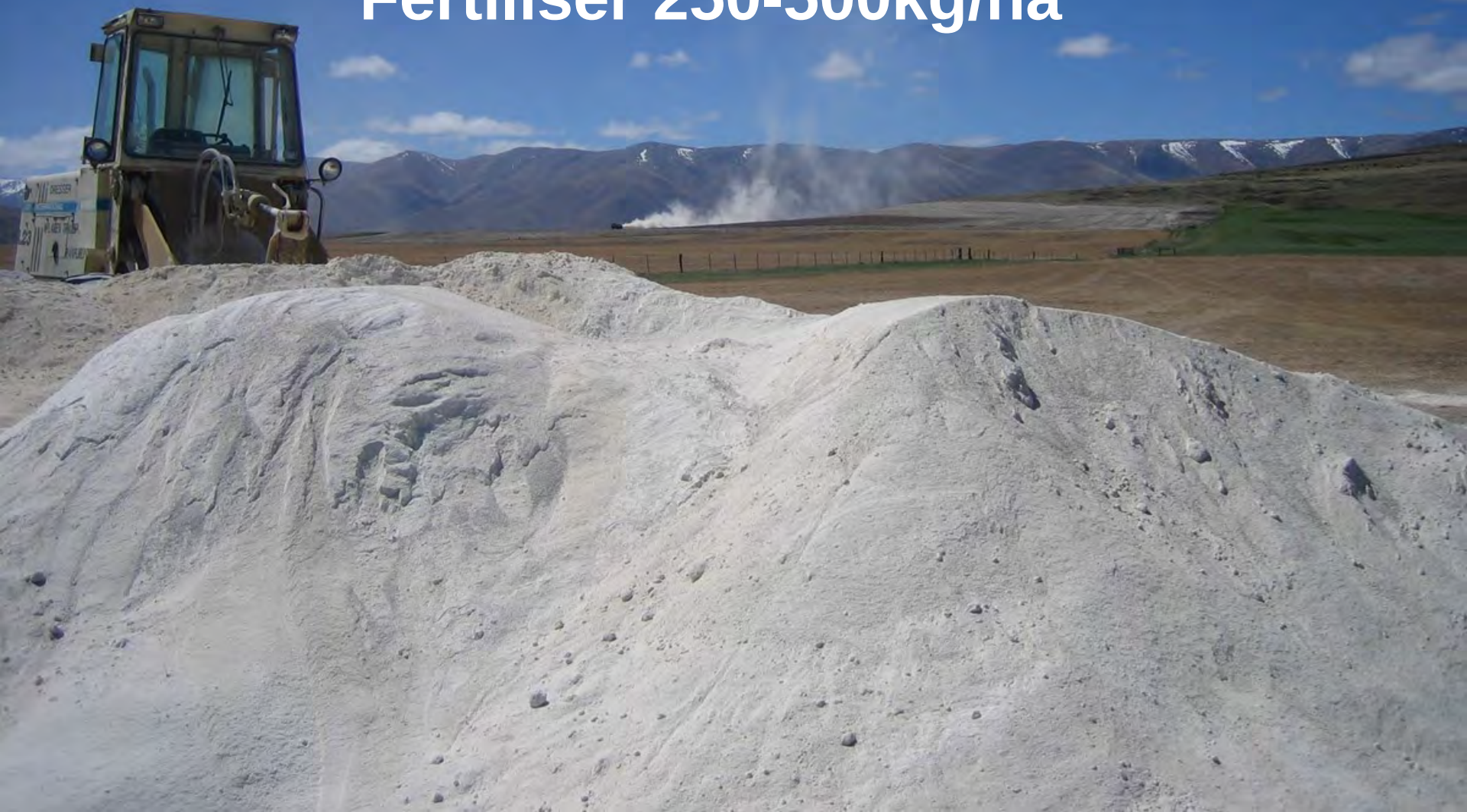


3 cm of organic matter – not soil Carbon

Lime and Fertiliser Application

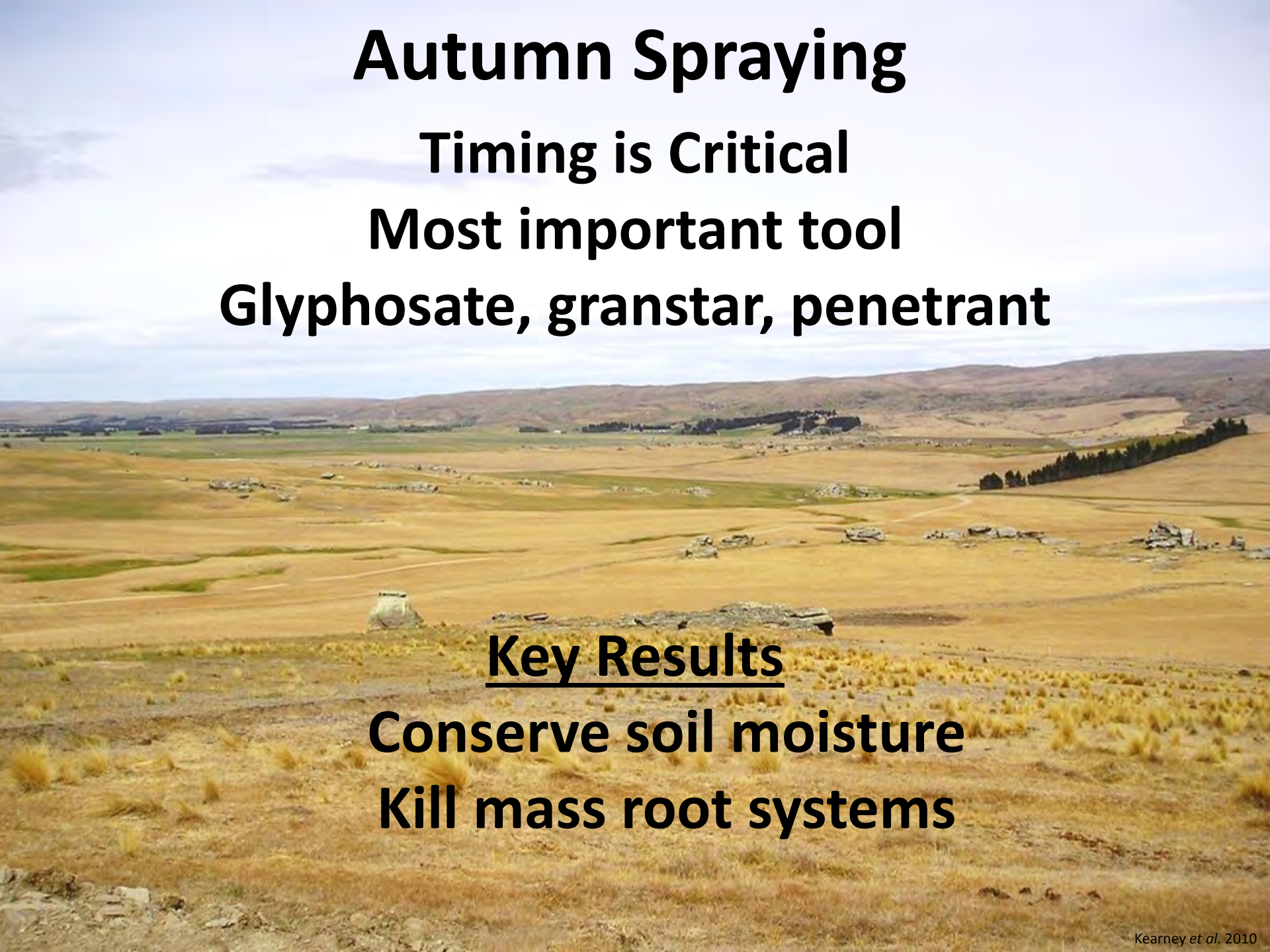
Lime 3-5 ton/ha

Fertiliser 250-500kg/ha



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

	pH	Olsen P (ug/ml)	Potassium (QTU)	Sulphur (ug/g)	Aluminium (mg/kg)
<u>Pre- (2008)</u>					
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
<u>Post- (2010)</u>					
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



Autumn Spraying

Timing is Critical
Most important tool
Glyphosate, granstar, penetrant

Key Results

Conserve soil moisture
Kill mass root systems

2nd Spray – Spring

Glyphosate, insecticide, penetrant



Result from Autumn spray, photo taken 1 November 2010

Drilling seed with fertiliser

Direct drilling = seed + fertiliser



Styx Station

Sown 21/11/2007

Photo taken 1/11/2010



Supplement Production

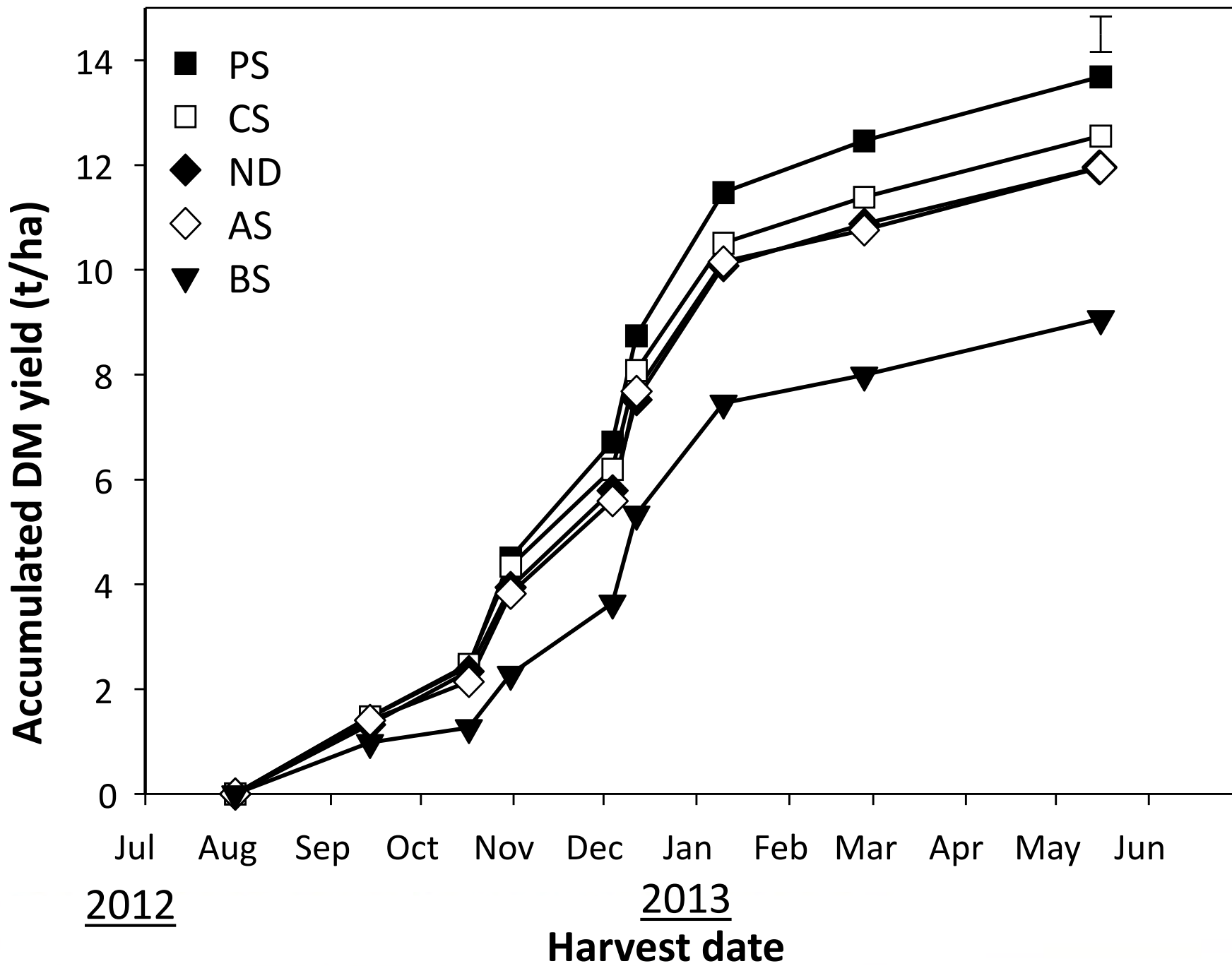
Balage/Hay/Silage/Chaff.....



Inoculation Experiment

- At Lincoln University
- Dryland, variable silt loam soil
- No history of lucerne
- Split plot design with 3 replicates
- 4 sowing dates
- 4 seed inoculant technologies used
- Bare seed control also used (no rhizobia)

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No inoculant (bare seed)



Inoculated with peat



Sowing rate and date

Established 2007 LU – Templeton silt loam

Coated 'Grasslands Kaituna' lucerne.

Four sowing dates

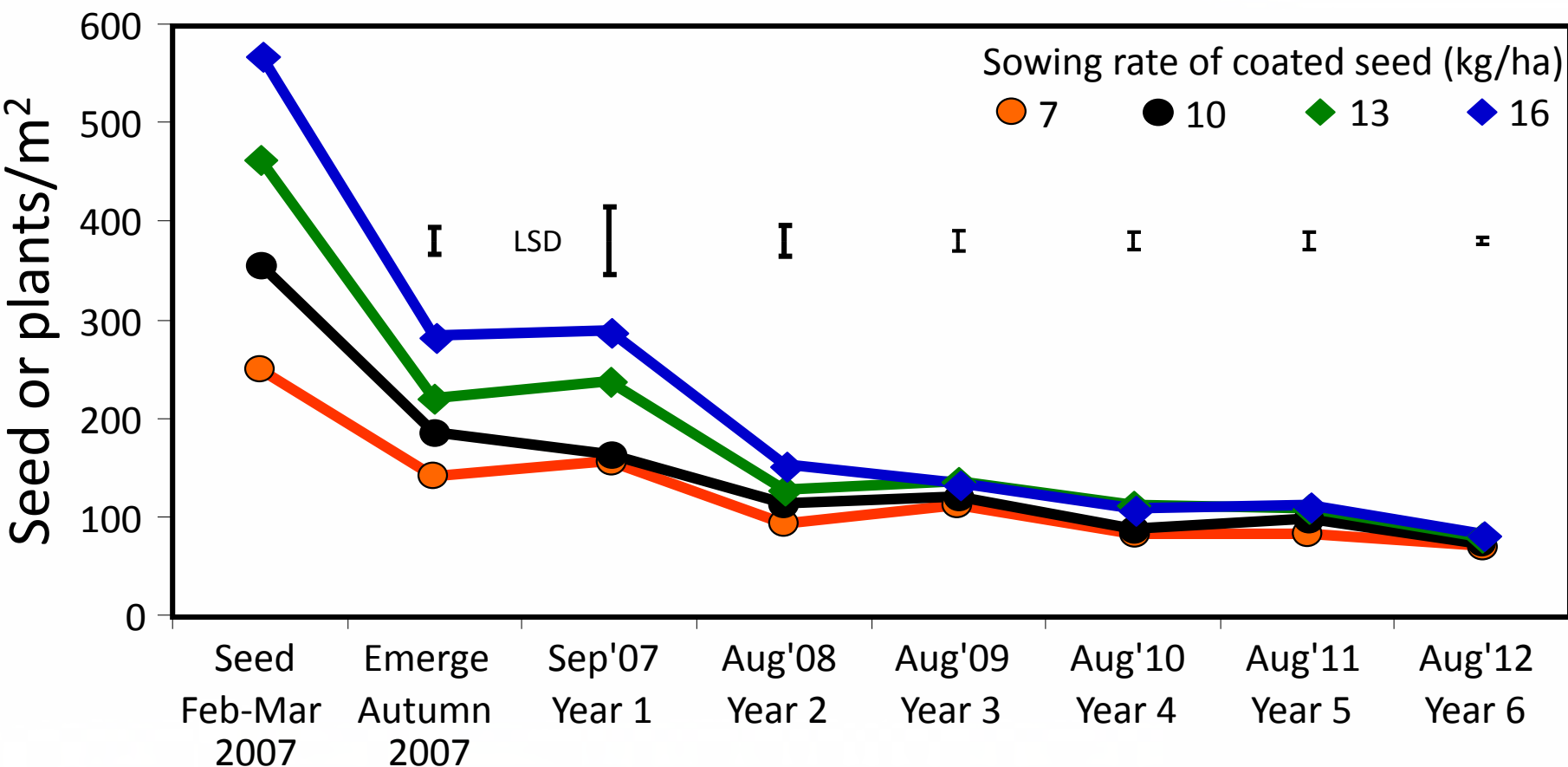
- **21 February,**
- **2 March,**
- **16 March and**
- **30 March**

Four sowing rates

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

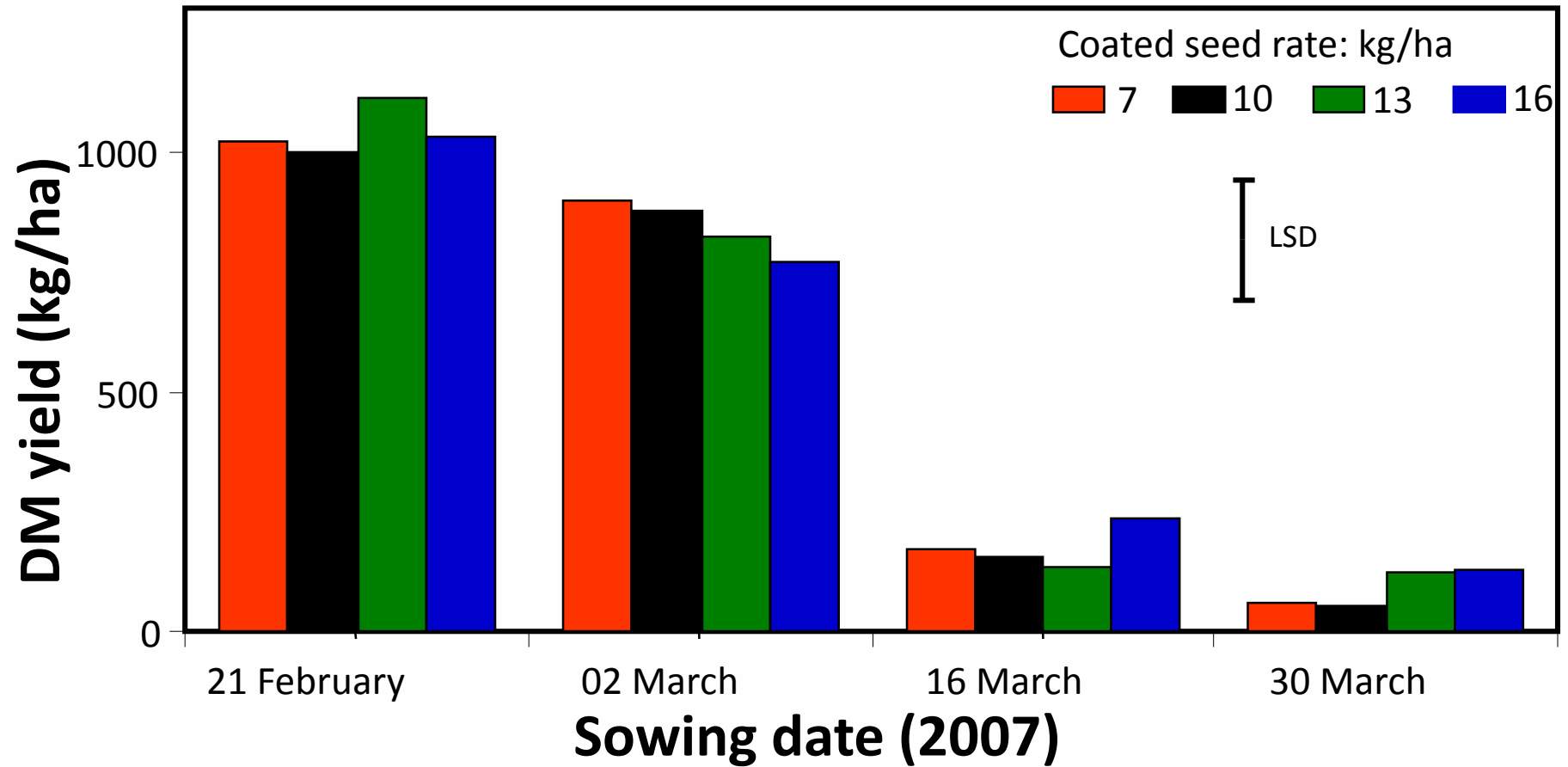
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Sown seed & plant population over time



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Seedling lucerne yield to early June



Weeds present @ 09 October 2007 (Year 1)

Sown 21 Feb 2007

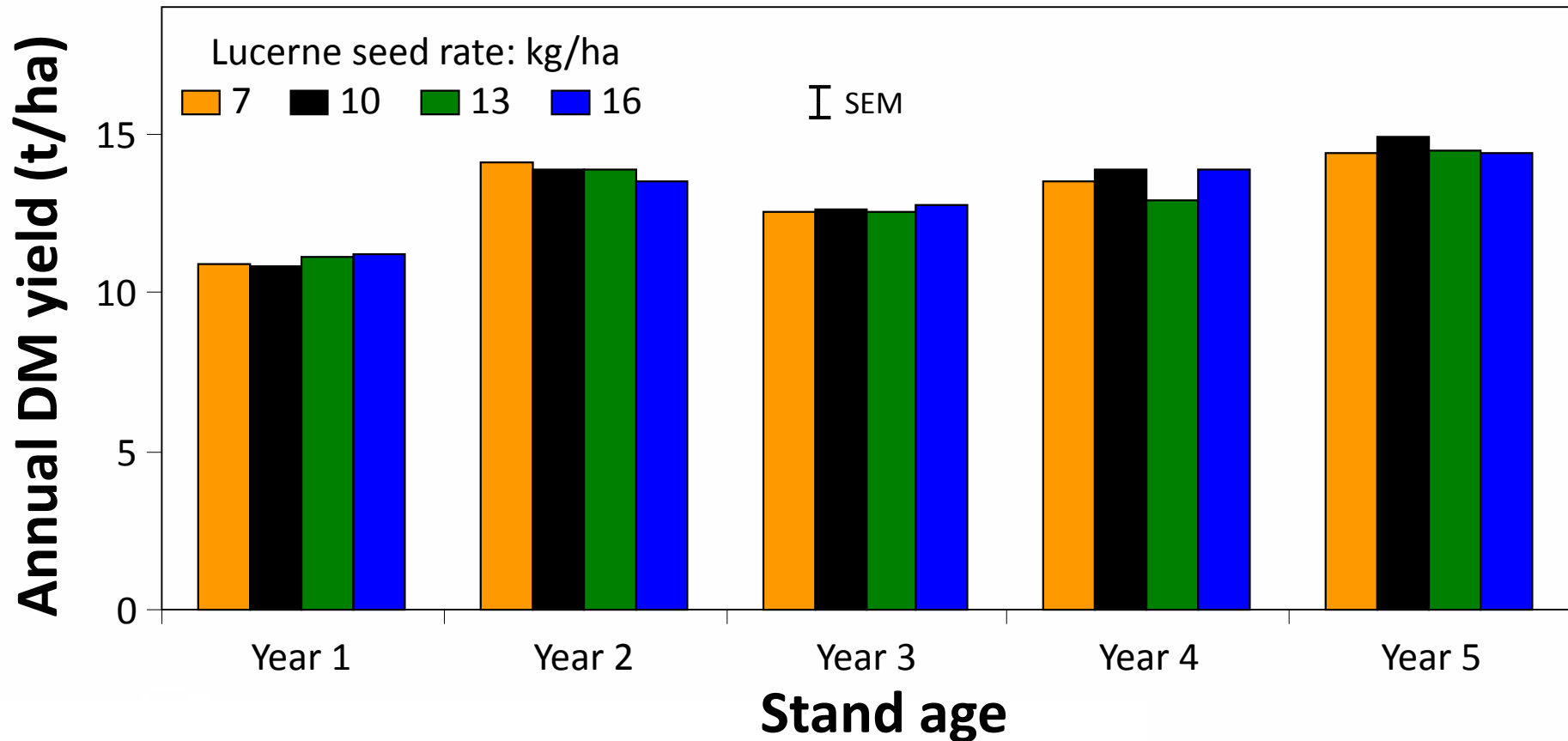
Sown 30 Mar 2007



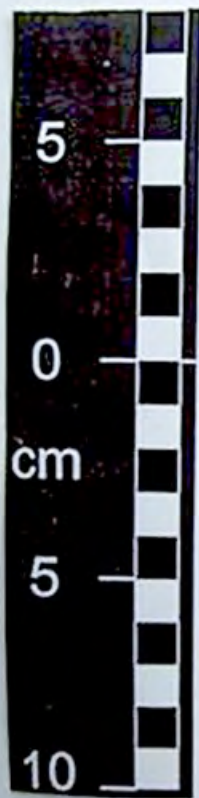
Weed control – Year 1

- Ensure adequate control of perennial weeds before sowing lucerne
- Trifluralin pre sowing – note dry conditions
- Spinnaker and 2,4 DB post emergence - or graze at 15 cm if weeds are an issues.
- Fathen only lasts one year.
- Minimal winter weed control in Year 0.

Annual yield in relation to sowing rate



Sown: February October



Sampled: June

Taproot mass

Establishment

- Pre sowing – fertility and weed control pre-sowing
- Firm seed bed for accurate seed depth (1 cm)
- Spring sow – October
- Insects pests ?
- First crop cut – December
- Graze earlier if weedy - then flowering
- Start rotational grazing in January 15-30 cm
- Don't need 10% flowering

Growth:

is dry matter accumulation as a result of light interception and photosynthesis

Development:

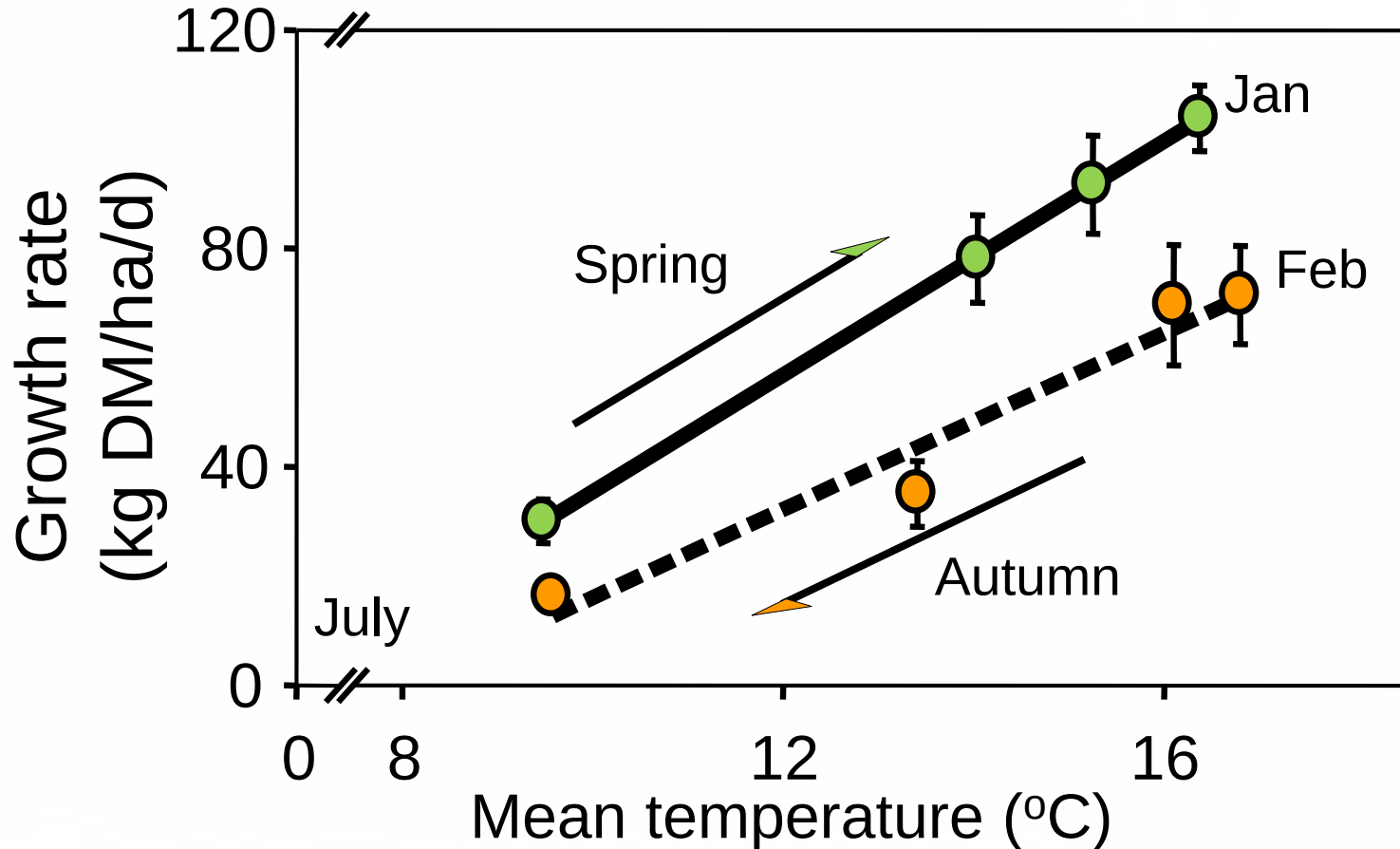
is the 'age' or maturity of the regrowth crop
e.g. leaf appearance, flowering

Growth and development are both influenced by environmental signals

The canopy: the energy capture device



Vegetative growth



Experiment 2

flexible grazing

38 days resting

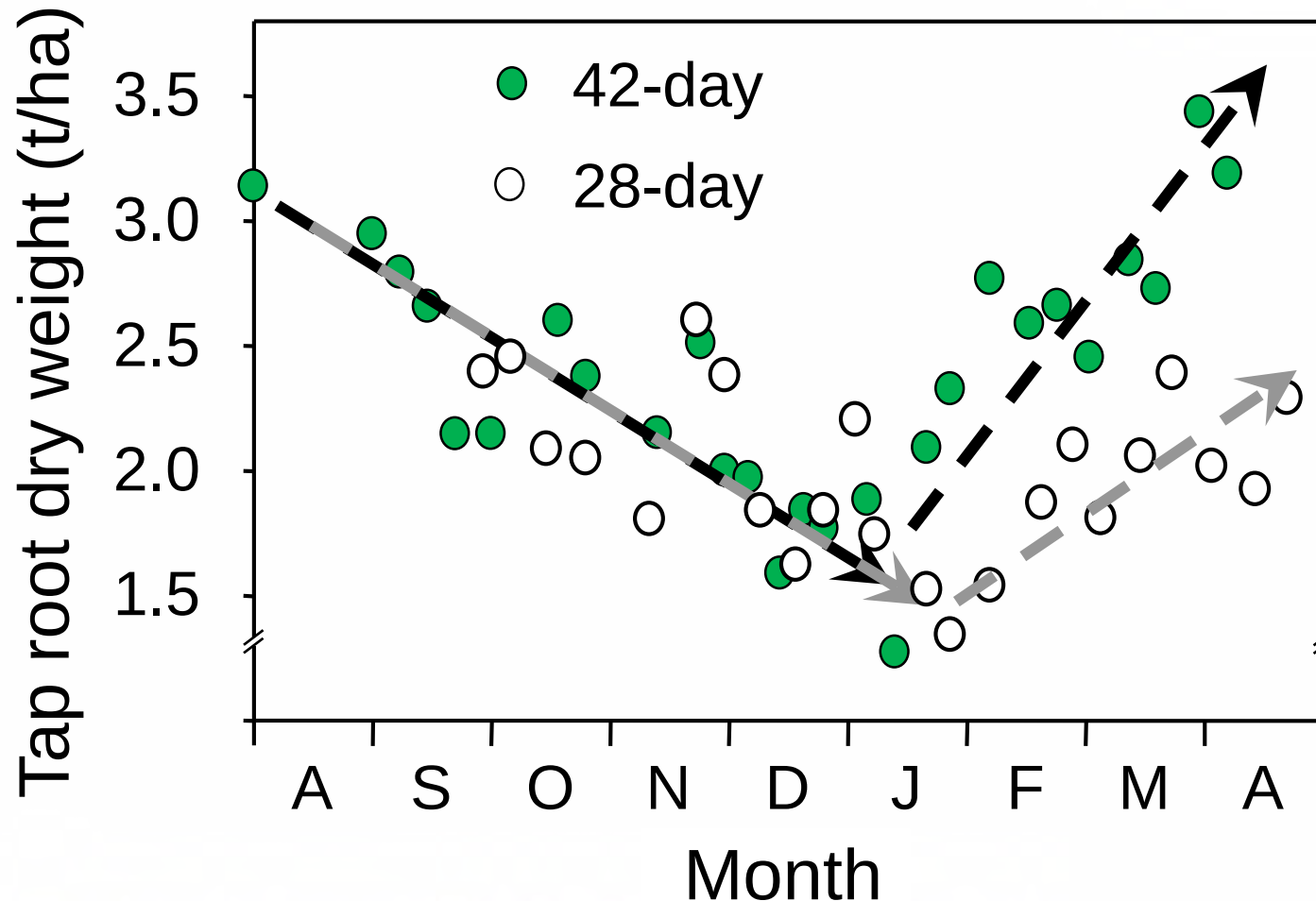
4 days grazing



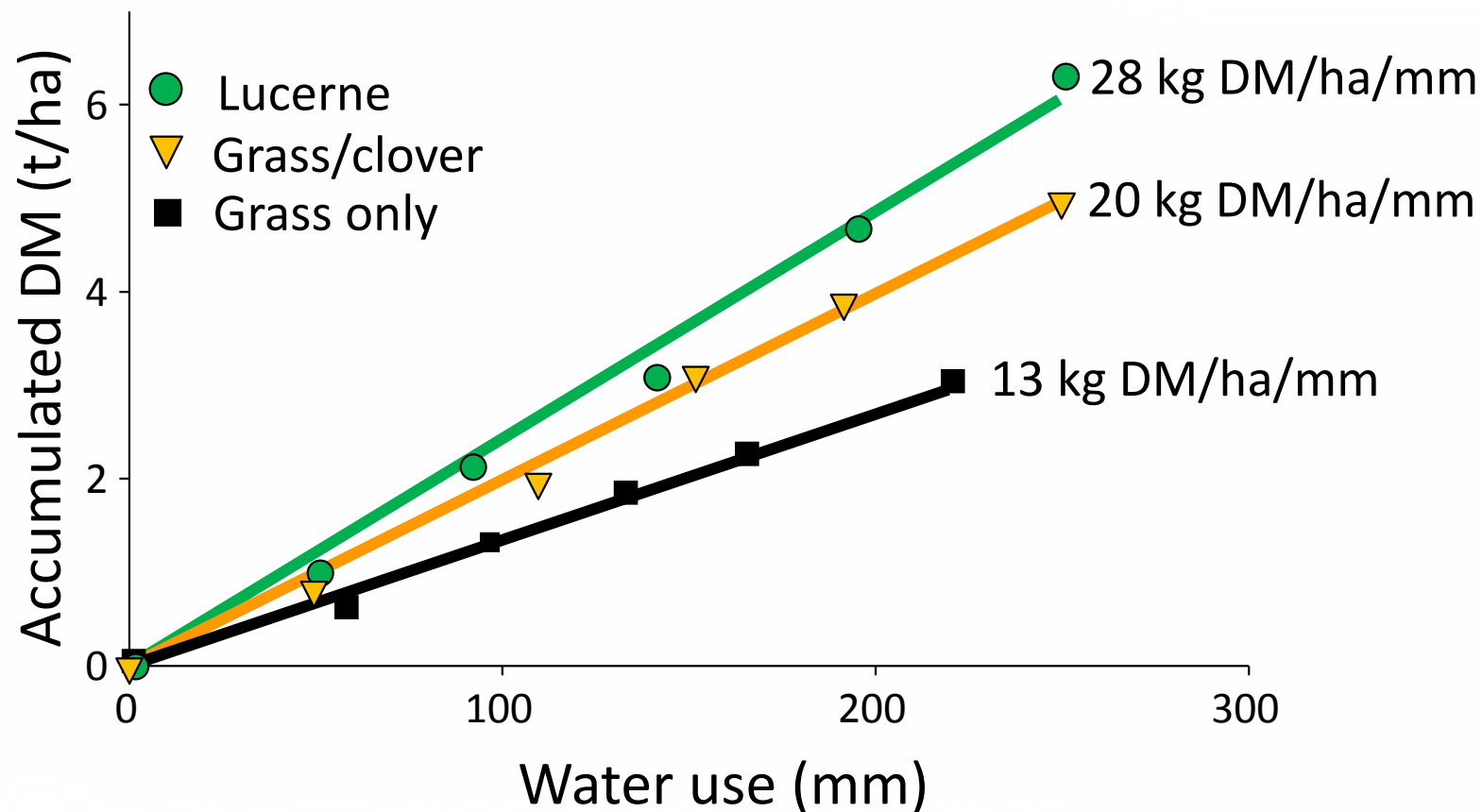
25 days resting

3 days grazing

Partitioning to roots



Spring WUE



Seasonal grazing management

Spring

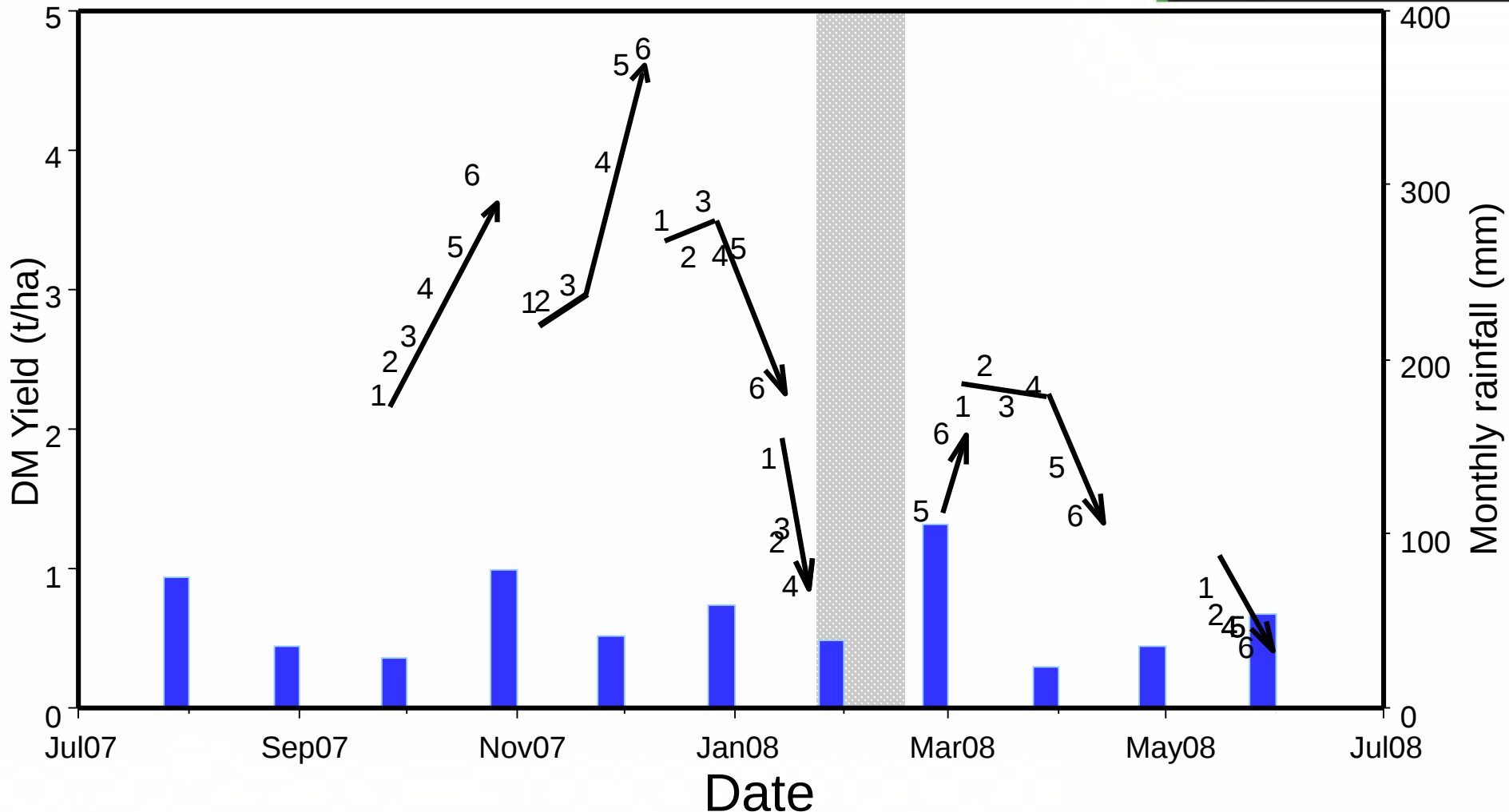
- 1st rotation aided by root reserves to produce high quality vegetative forage.
- can graze before flowers appear (~1500 kg DM/ha) ideally ewes and lambs but

Growing point at the top of the plant



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

MaxClover – 38-42 day rotation



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

Plot 31
Date: 2/11/07
Pre-graze

5th September 2011 – Cave, South Canterbury



Photo: DJ Moot
Lincoln University

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8 Aug 2001

7

6

5

4

3

2

1

0

cm



22 Aug 2001

13
12
11
10
9
8
7
6
5
4
3
2
1

cm

Photo: HE Brown
Lincoln University



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12 Sep 2001





Photo: HE Brown
Lincoln University



Spring grazing

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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



14 ewes + twins/ha

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High numbers for 7-10 days



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Fibre and salt

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Pre graze mow



06/10/2015

Maximize reliable spring growth – high priority stock



Dryland dairy grazing lucerne



Photo: DJ Moor
Lincoln University

Oct 2016 “two hours on before afternoon milking”
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Seasonal grazing management

Early autumn (Feb-April)

- terminal drought $\Rightarrow$ graze standing herbage
- allow 50% flowering
- long rotation (42 days) somewhere between Jan and end of May.

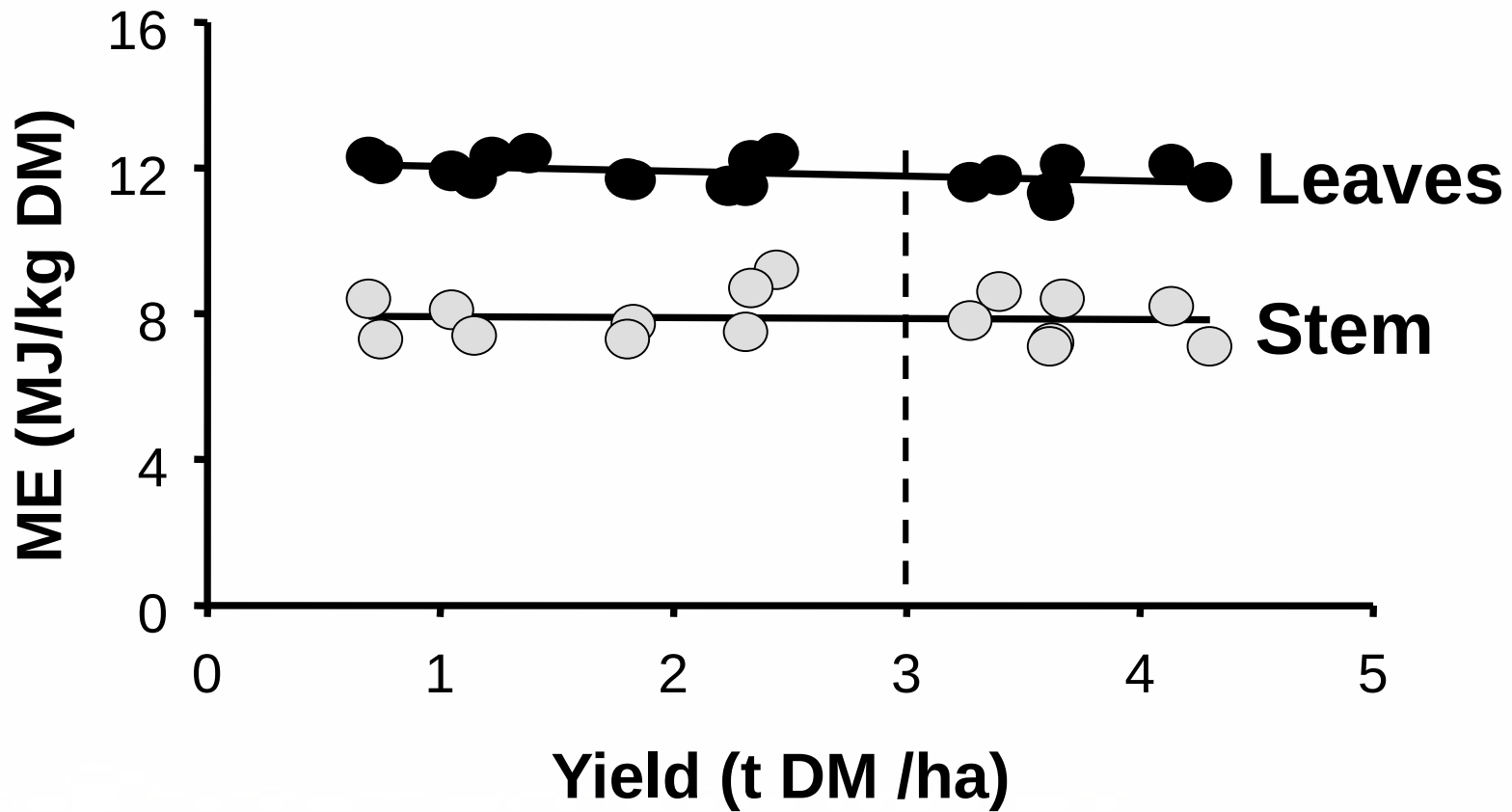
**$\Rightarrow$ build-up root reserves for spring growth
and increase stand persistence**

Autumn = flowering plants



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

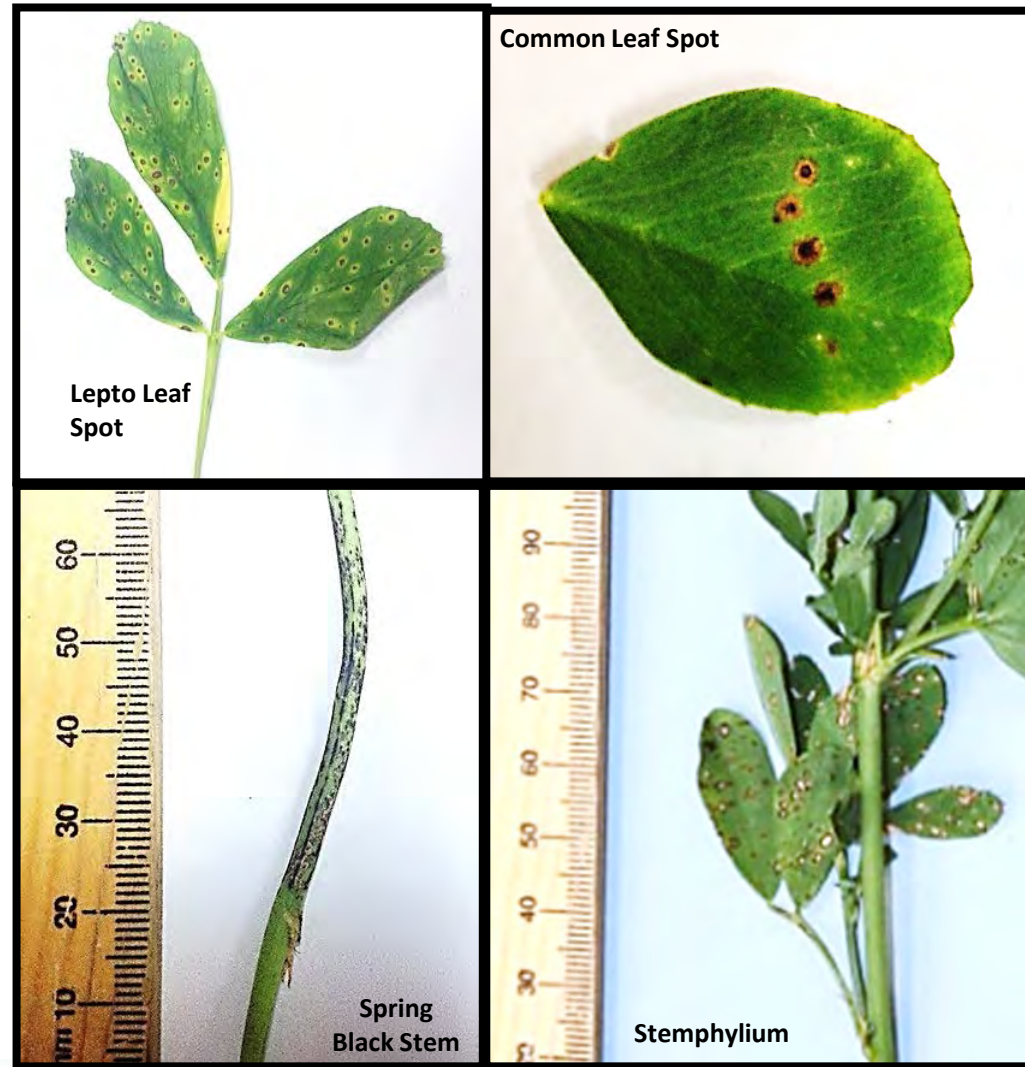
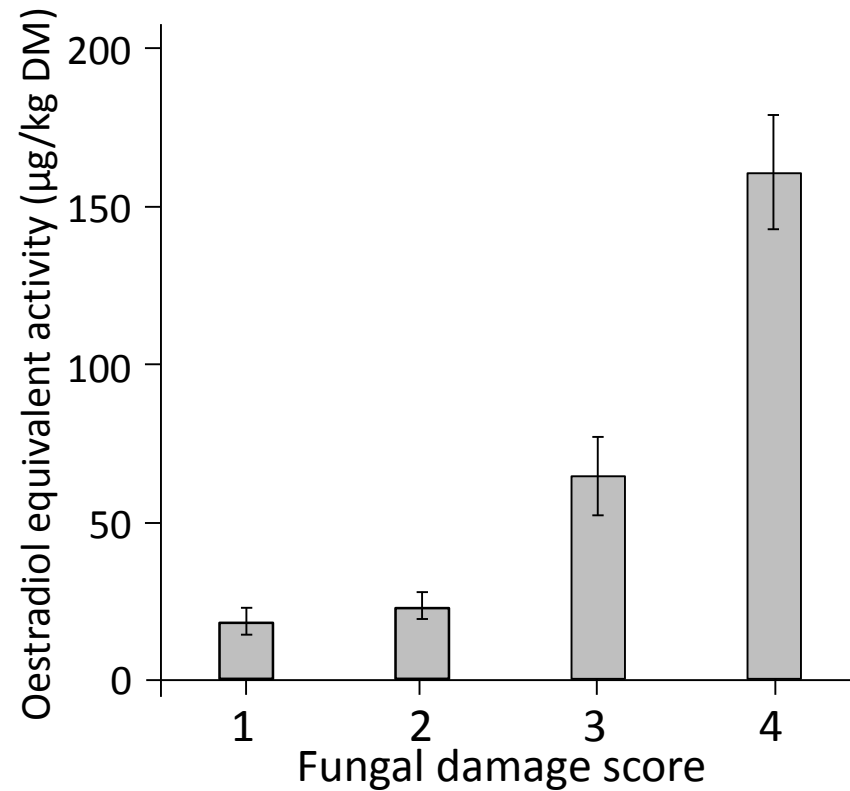
Metabolisable energy of lucerne



Animal health

- **Clostridial bacteria:** vaccinate
- **Cobalt:** vitamin B12 injection
- **Worm haven:** Camping on small area – river edge?
- **Avoid flushing if:** leaf spots or dull weather

Common fungal pathogens of lucerne



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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

Conclusions

- Start spring grazing at 15- 20 cm
- Two hours pre pm milking is working
- Quality maximized at 30 cm
- Leaf and soft stem are highest quality
- Ignore residual
- Drop out paddocks if recovery is rapid
- Allow a period of extended growth in autumn

Ashley Dene
9 Jan 2015

**Required lamb growth =
5 to 35 kg
in ~100 days**

Subterranean Clover



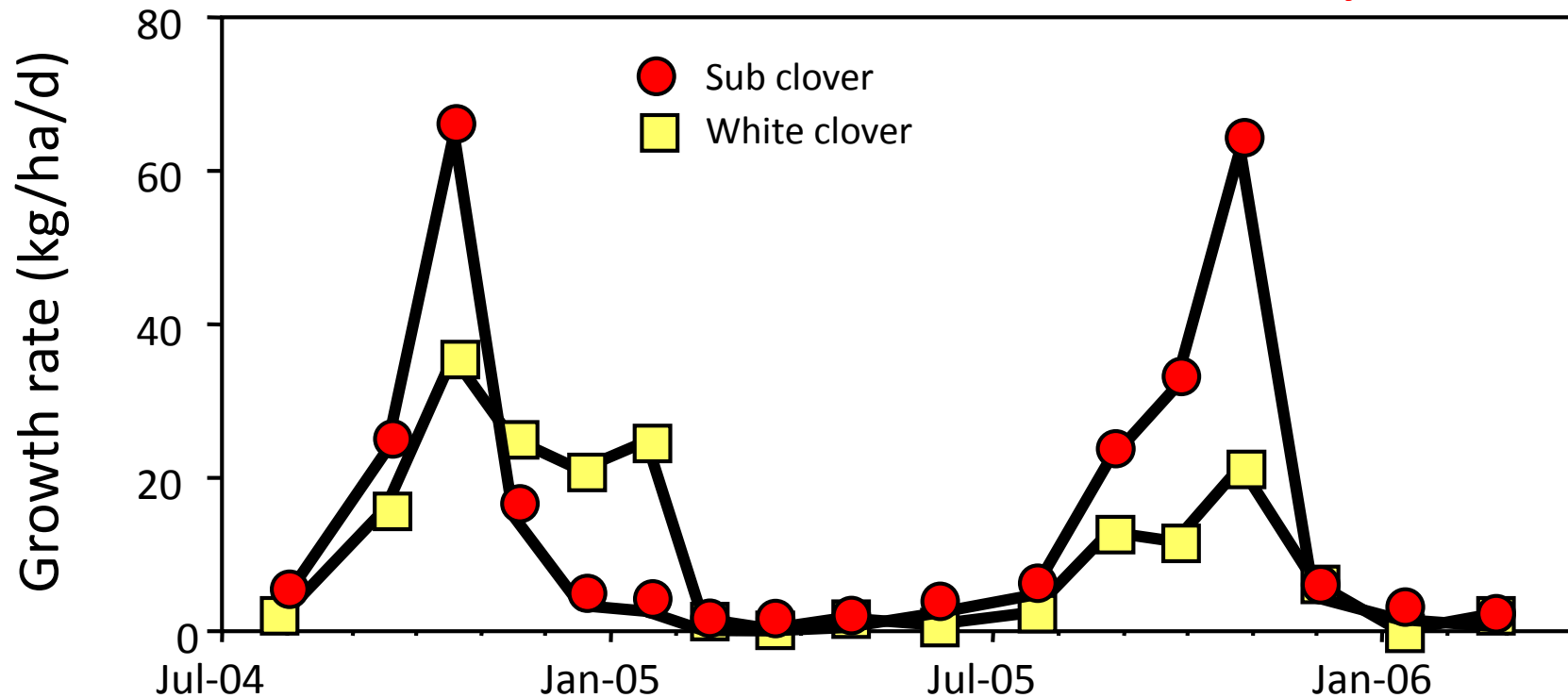


Sub clover dominant pasture 8 Oct 2015

Seasonal clover growth

Wet summer

Dry summer



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Subterranean Clover

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

Tempello

meat - wool - wine

Uncultivated – grazing only – no seed...



Reap the benefits in the following years. You probably only need to repeat this every 10-15 years or so.



Over 560 ha Tempello Corrie area



In poor price year with \$4.40/kg CW and \$1.80/kg store ... \$40,000 ahead if lambs 7 kg heavier at weaning.

Tonnes meat from 60 to 76 tonnes despite fewer ewes.

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Direct drilled during the drought autumn 2017



Sub mgmt. this spring

- Identify areas that have sub clover
- Target these for reseeding – use cattle
- Reduce stocking 1- 2 weeks after flowers
- Identify areas that could grow sub – annuals
- Soil test those areas for P
- Hard graze tag in summer
- Autumn overdrill/oversow sub

References

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DPR Websites/Social Media presence

Lincoln University Dryland Pastures Website:

<http://www.lincoln.ac.nz/dryland>

Lincoln University Dryland Pastures Blog:

<https://blogs.lincoln.ac.nz/dryland/>

YouTube:

<https://www.youtube.com/DrylandPastures>

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