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Dryland Pastures Update - Blenheim

28 August 2014

Dr. Derrick Moot

Professor of Plant Science

New Zealand's specialist land-based university

Funded by:



Topics

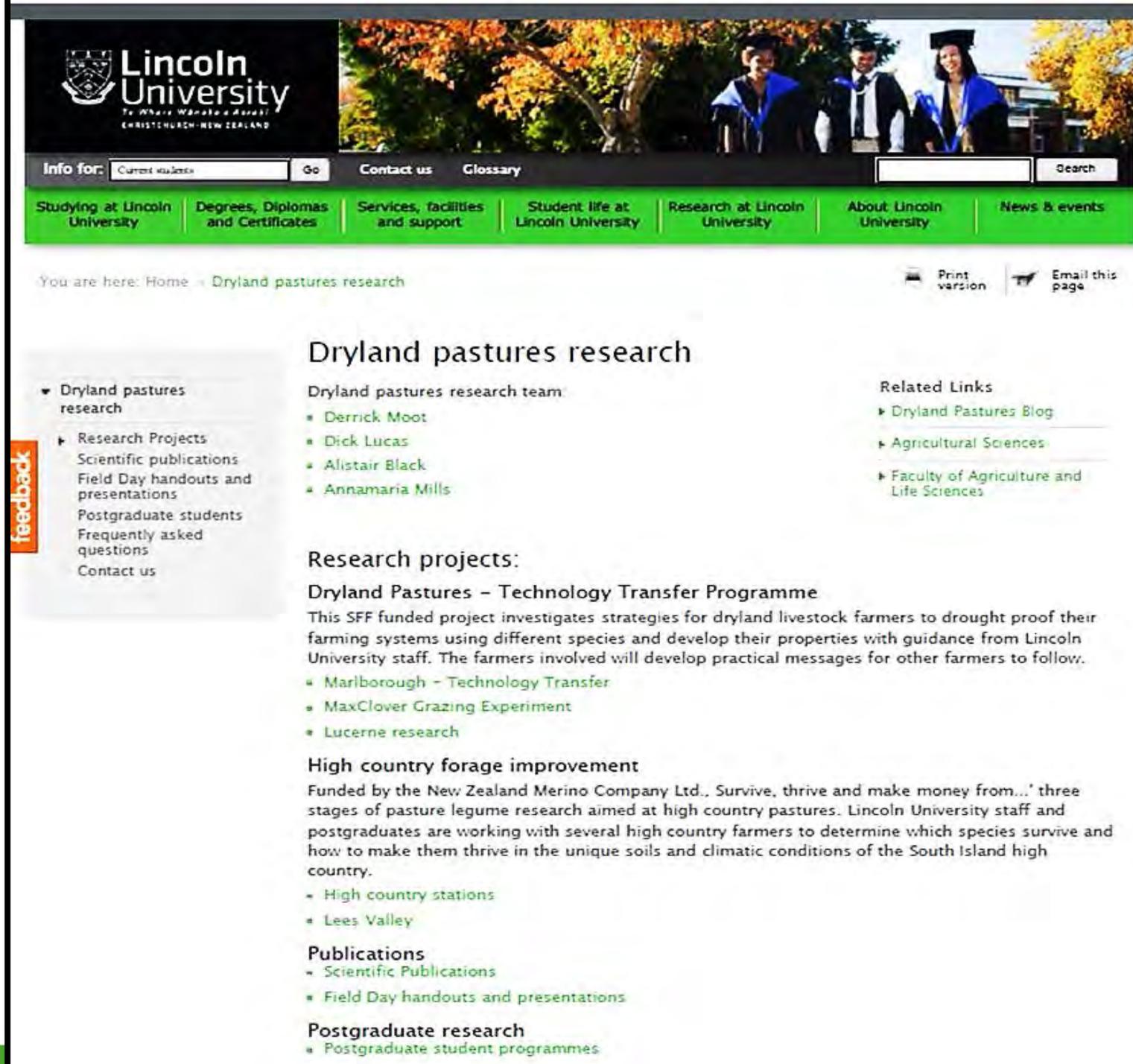
- MaxClover photo diary
- Lucerne establishment
- Lucerne water use
- Lucerne grazing management
- Lucerne grass mixes
- Current research projects

The website...

Info on:

- Current projects
- Field day presentations
- Scientific publications
- FAQs
- Postgraduate study
- Photo Diary

www.lincoln.ac.nz/dryland



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Dryland pastures research

Feedback

- ▼ Dryland pastures research
 - ▶ Research Projects
 - Scientific publications
 - Field Day handouts and presentations
 - Postgraduate students
 - Frequently asked questions
 - Contact us

Dryland pastures research team:

- [Derrick Moot](#)
- [Dick Lucas](#)
- [Alistair Black](#)
- [Annamaria Mills](#)

Related Links

- ▶ [Dryland Pastures Blog](#)
- ▶ [Agricultural Sciences](#)
- ▶ [Faculty of Agriculture and Life Sciences](#)

Research projects:

Dryland Pastures – Technology Transfer Programme

This SFF funded project investigates strategies for dryland livestock farmers to drought proof their farming systems using different species and develop their properties with guidance from Lincoln University staff. The farmers involved will develop practical messages for other farmers to follow.

- [Marlborough – Technology Transfer](#)
- [MaxClover Grazing Experiment](#)
- [Lucerne research](#)

High country forage improvement

Funded by the New Zealand Merino Company Ltd., 'Survive, thrive and make money from...' three stages of pasture legume research aimed at high country pastures. Lincoln University staff and postgraduates are working with several high country farmers to determine which species survive and how to make them thrive in the unique soils and climatic conditions of the South Island high country.

- [High country stations](#)
- [Lees Valley](#)

Publications

- [Scientific Publications](#)
- [Field Day handouts and presentations](#)

Postgraduate research

- [Postgraduate student programmes](#)



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Dry matter yield and botanical composition of the 'MaxClover' grazing experiment at Lincoln University, Canterbury, New Zealand

PHOTO DIARY - 2002/03 to 2010/11

Funded by:



Prepared by: DJ Moot; A Mills; RJ Lucas; KM Pollock; M Smith
Lincoln University DryLAND Pastures Research Team

NOTE:

The slides outlining the changes in pasture yield and composition of the MaxClover grazing experiment at Lincoln University have been removed from this presentation.

The full photo diary can be viewed by following this link:

<http://www.lincoln.ac.nz/Documents/Dryland-Pasture-Research/MaxClover/Maxclover-Photo-Diary-Reduced-Size.pdf>

Blenheim, Marlborough
28th August 2014



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Lucerne establishment and grazing

Dr Derrick Moot
Professor of Plant Science

New Zealand's specialist land-based university

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



Autumn Spraying

Timing is Critical

Most important tool

Glyphosate, granstar, penetrant

Key Results

Conserve soil moisture

Kill mass root systems



Drilling seed with fertiliser
Direct drilling = seed + fertiliser



Sowing rate and date

Established 2007 LU – Templeton silt loam

Coated 'Grasslands Kaituna' lucerne.

Four sowing dates

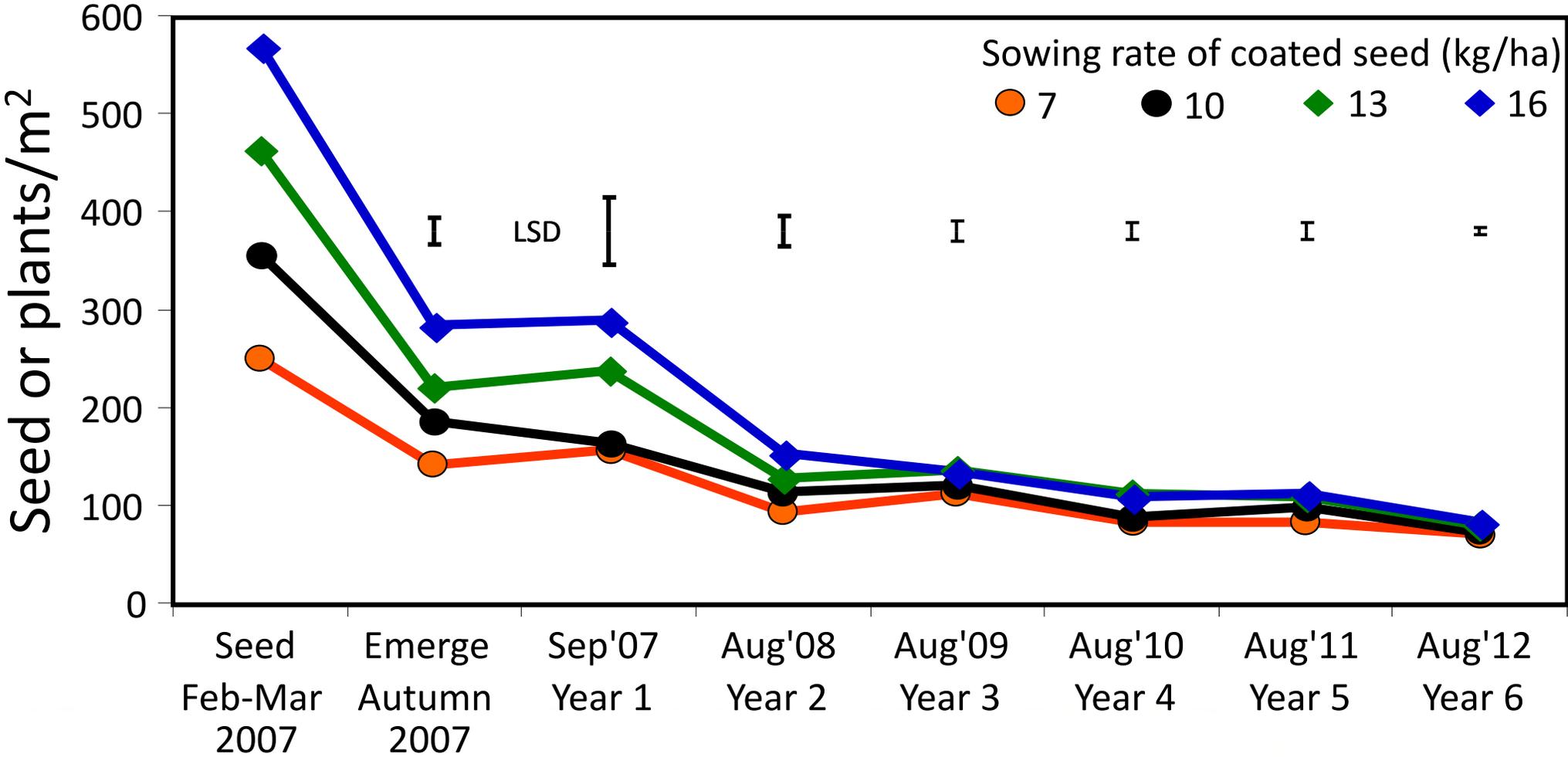
- 21 February,
- 2 March,
- 16 March and
- 30 March

Four sowing rates

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

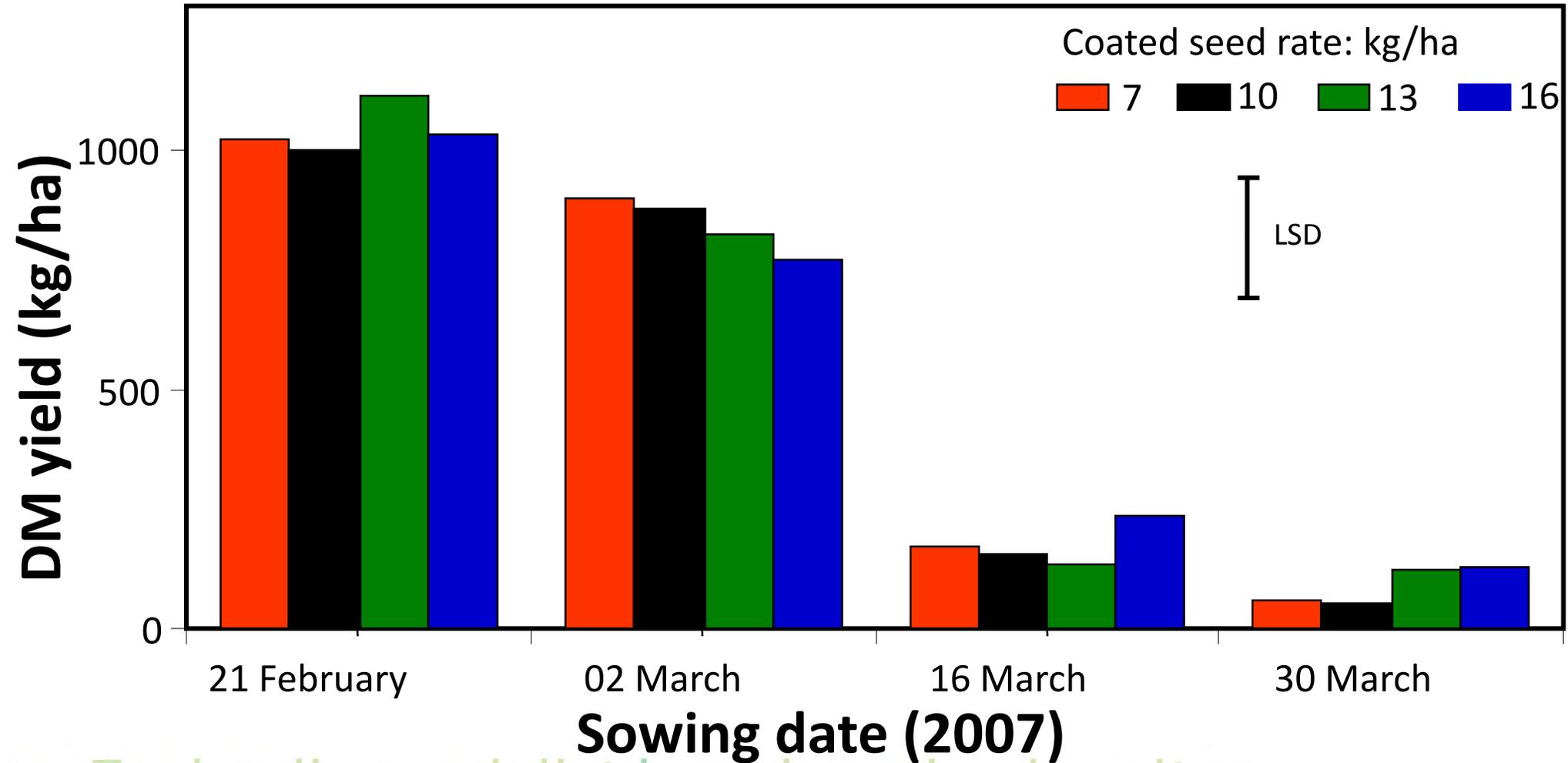
New Zealand's specialist land-based university

Sown seed & plant population over time



Source: Moot et al. 2012

Seedling lucerne yield to early June



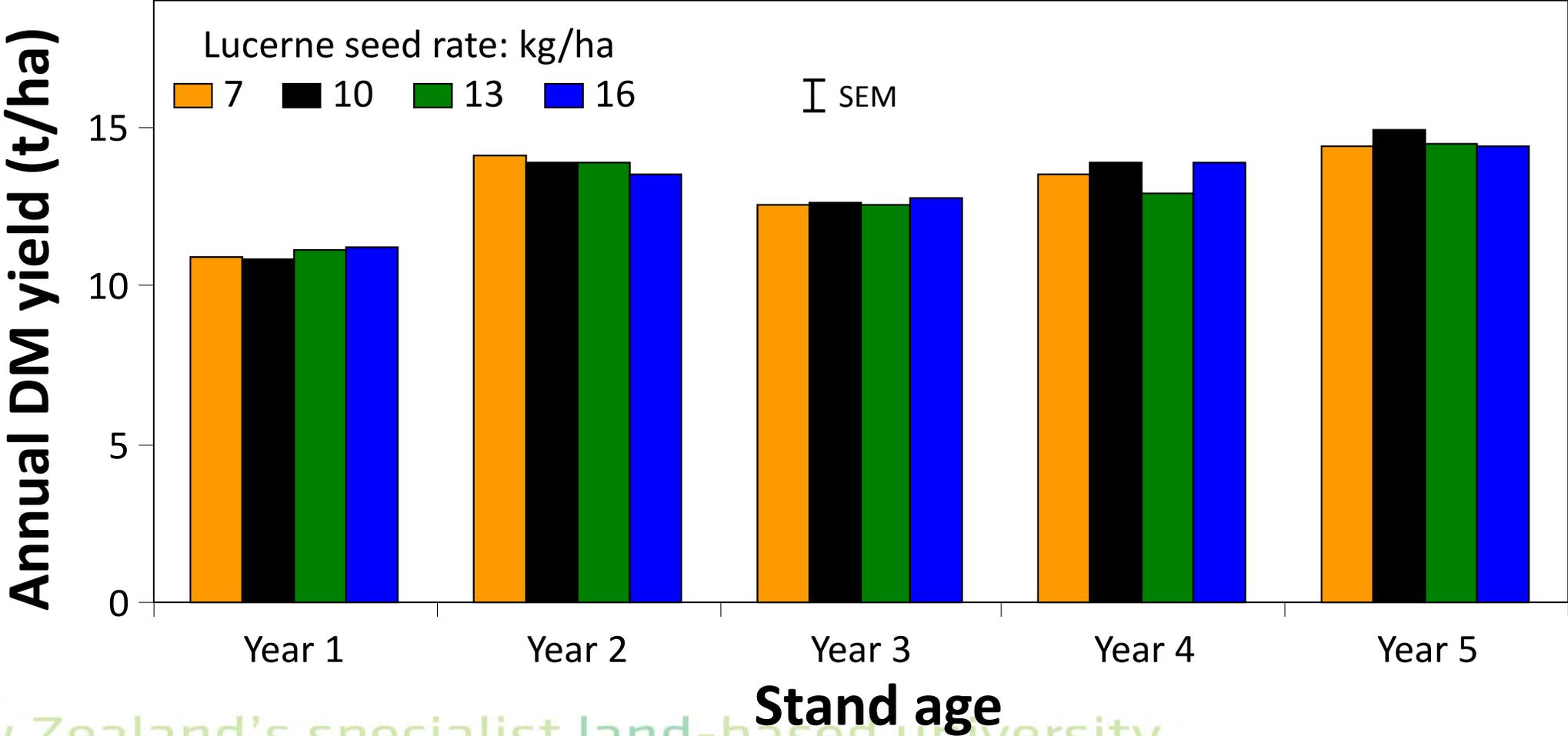
Weeds present @ 09 October 2007 (Year 1)

Sown 21 Feb 2007

Sown 30 Mar 2007

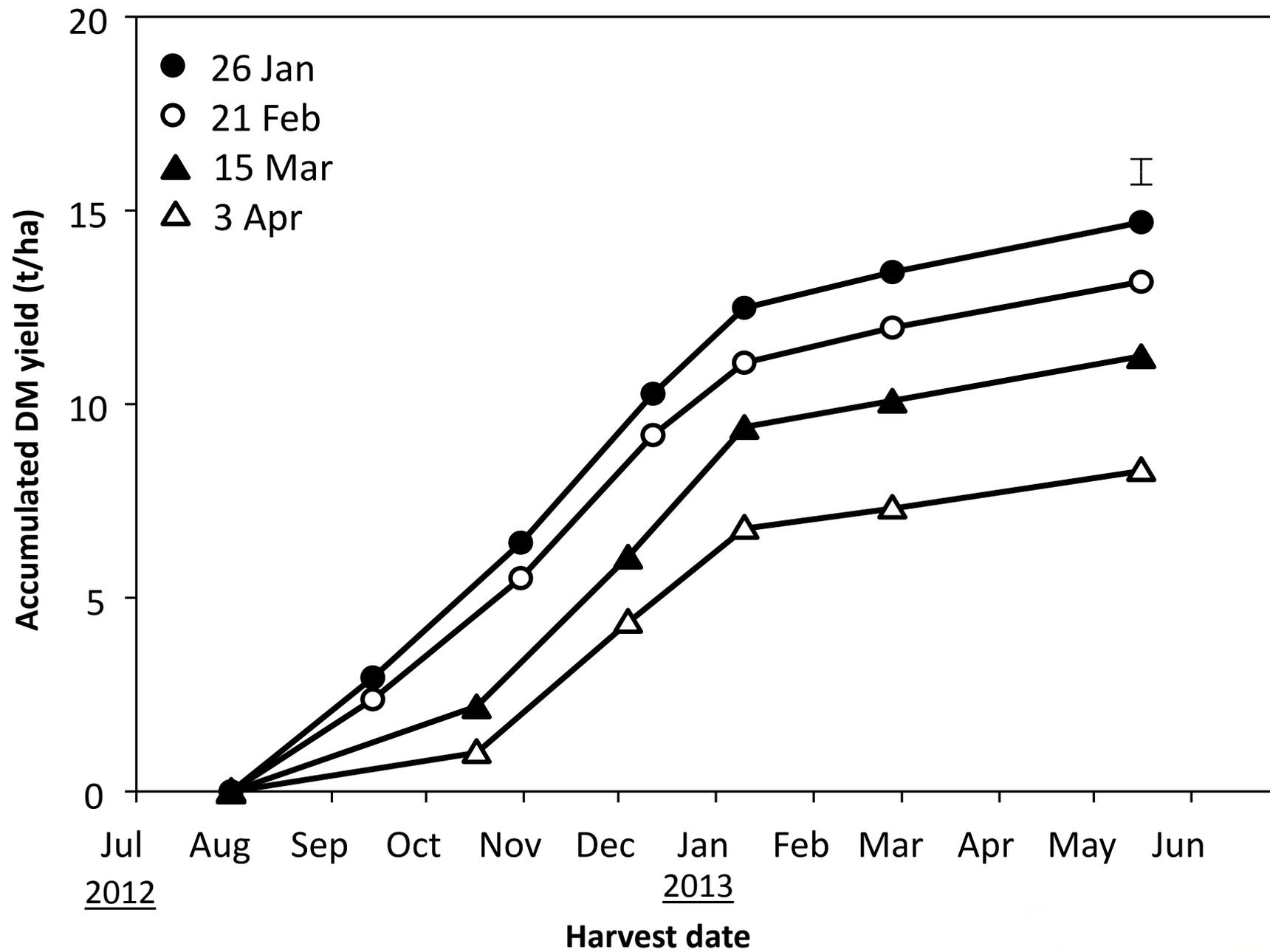


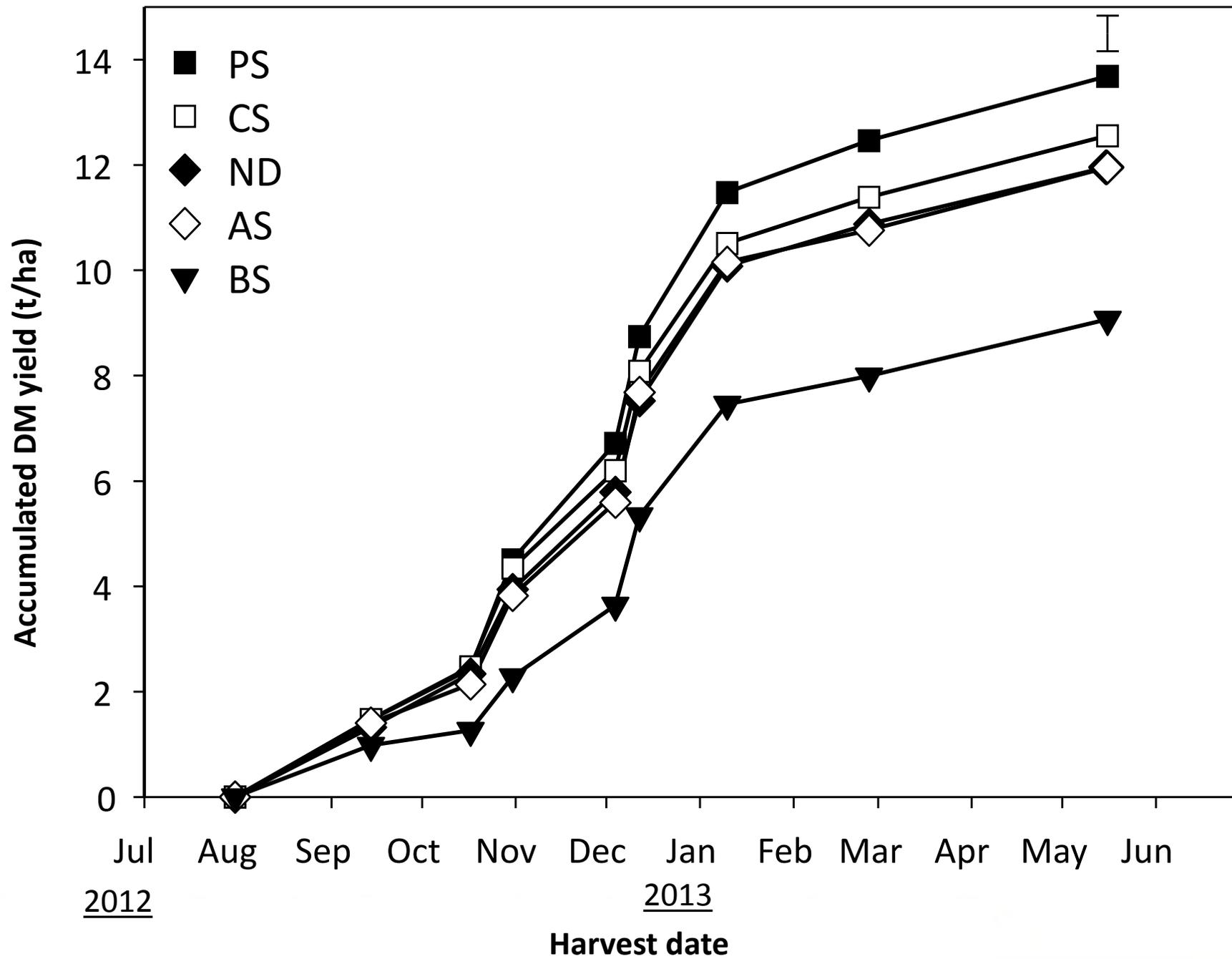
Annual yield in relation to sowing rate



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)

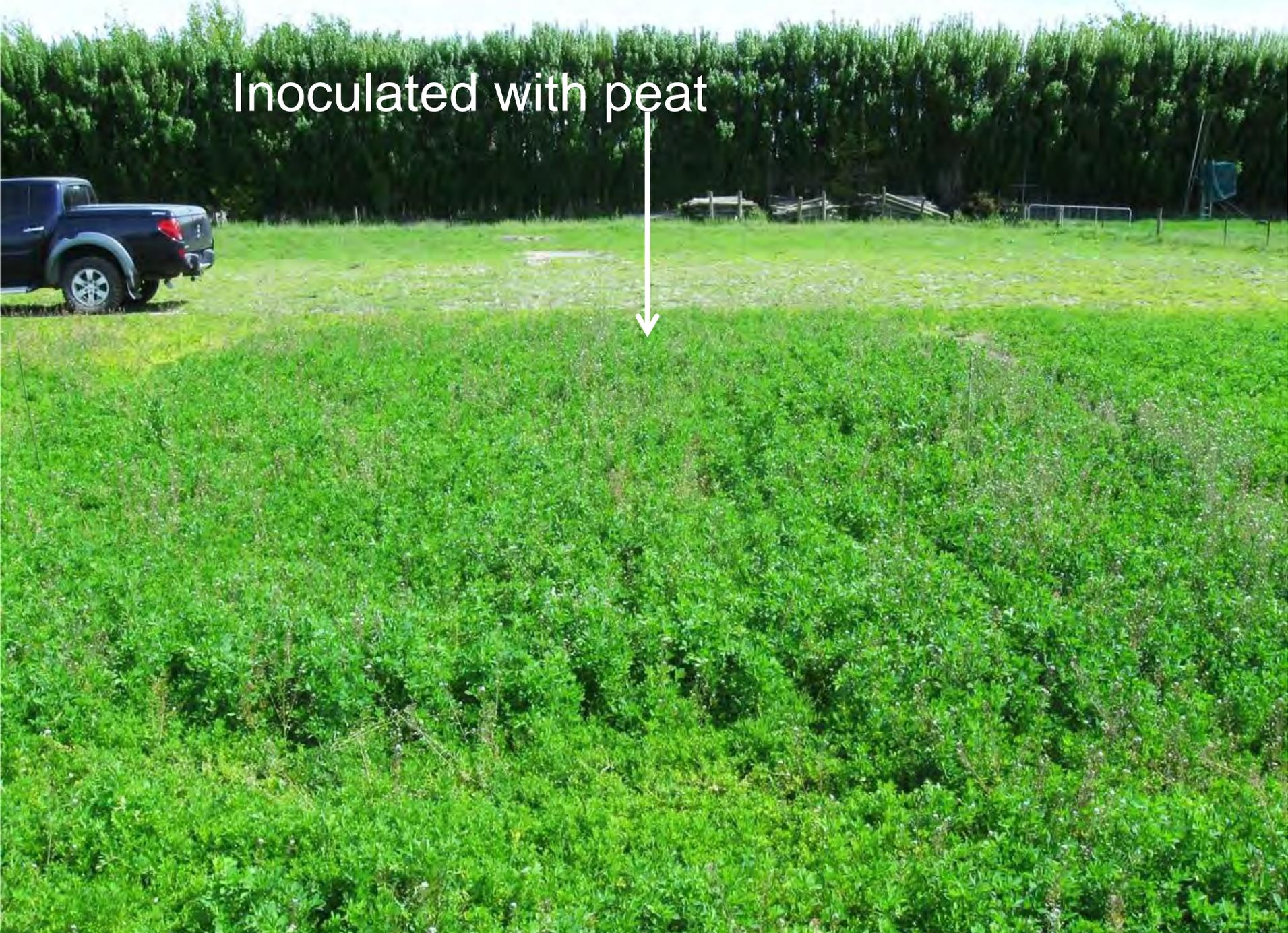




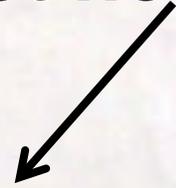
No inoculant (bare seed)



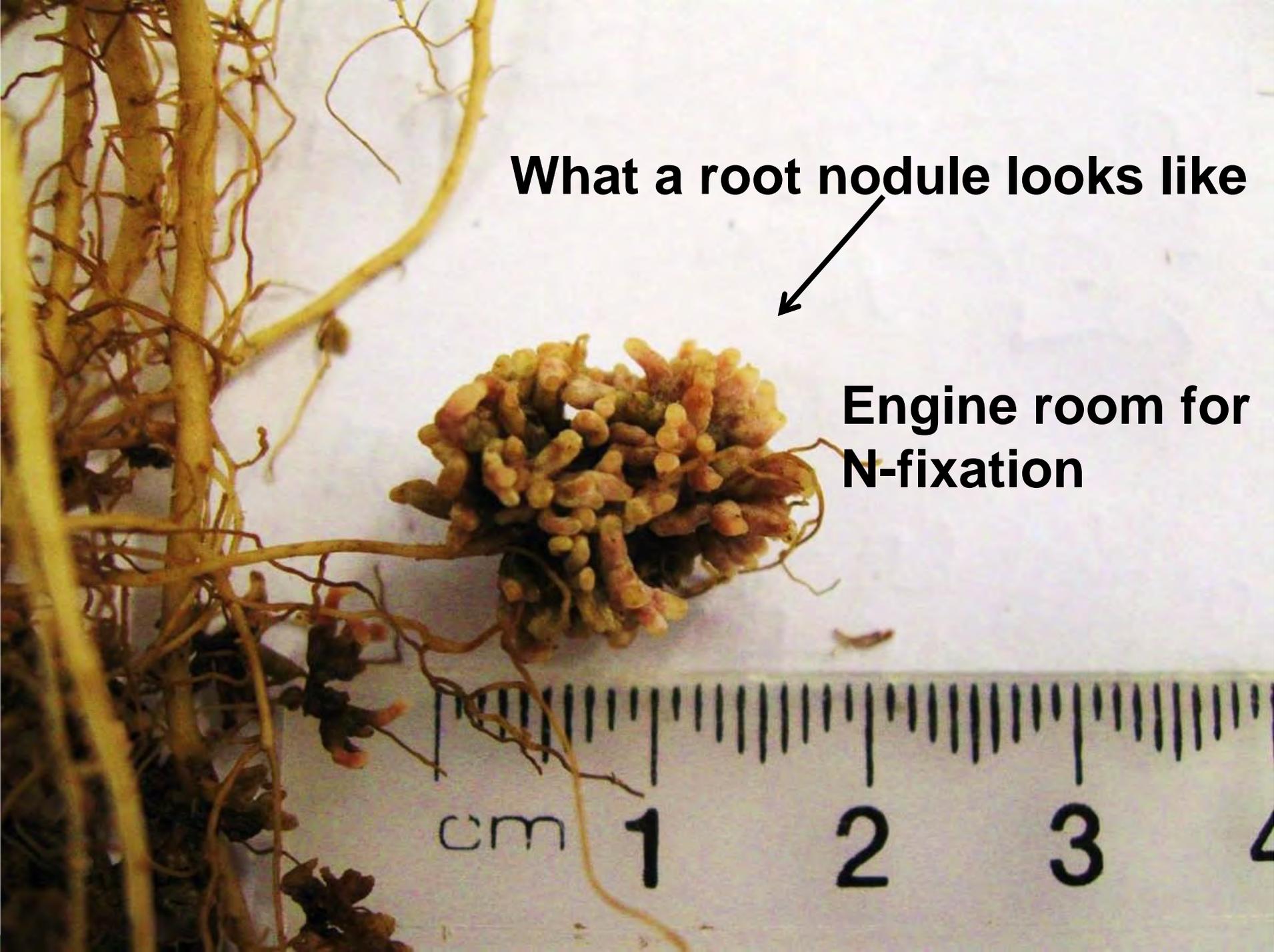
Inoculated with peat



What a root nodule looks like

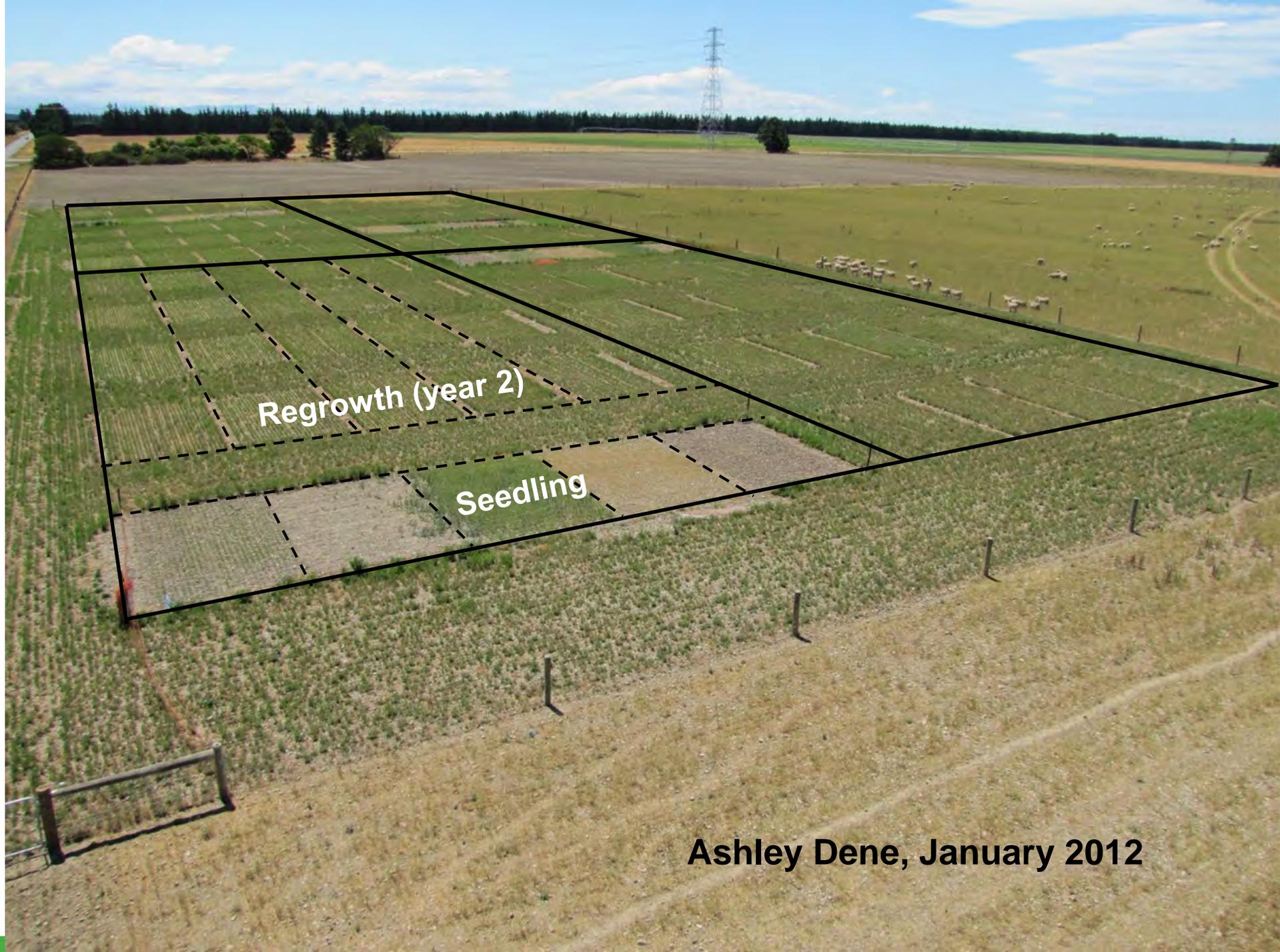


**Engine room for
N-fixation**



Richard Sim PhD results

1. Soil type & sowing date
 2. Seedling vs regrowth crops (yr 2)
- Low soil water at Ashley Dene on stones
 - High soil water at LU on silt!

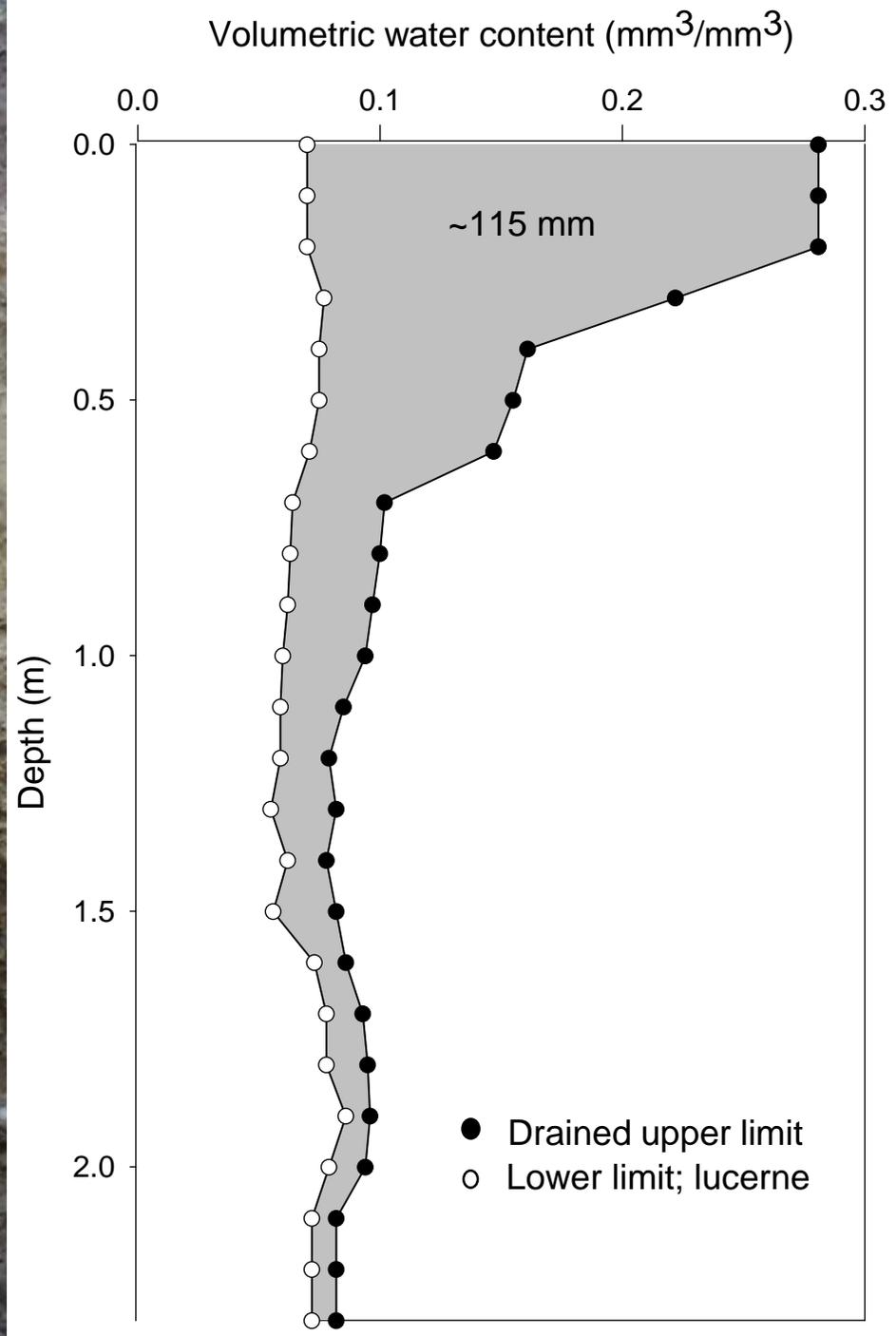


Regrowth (year 2)

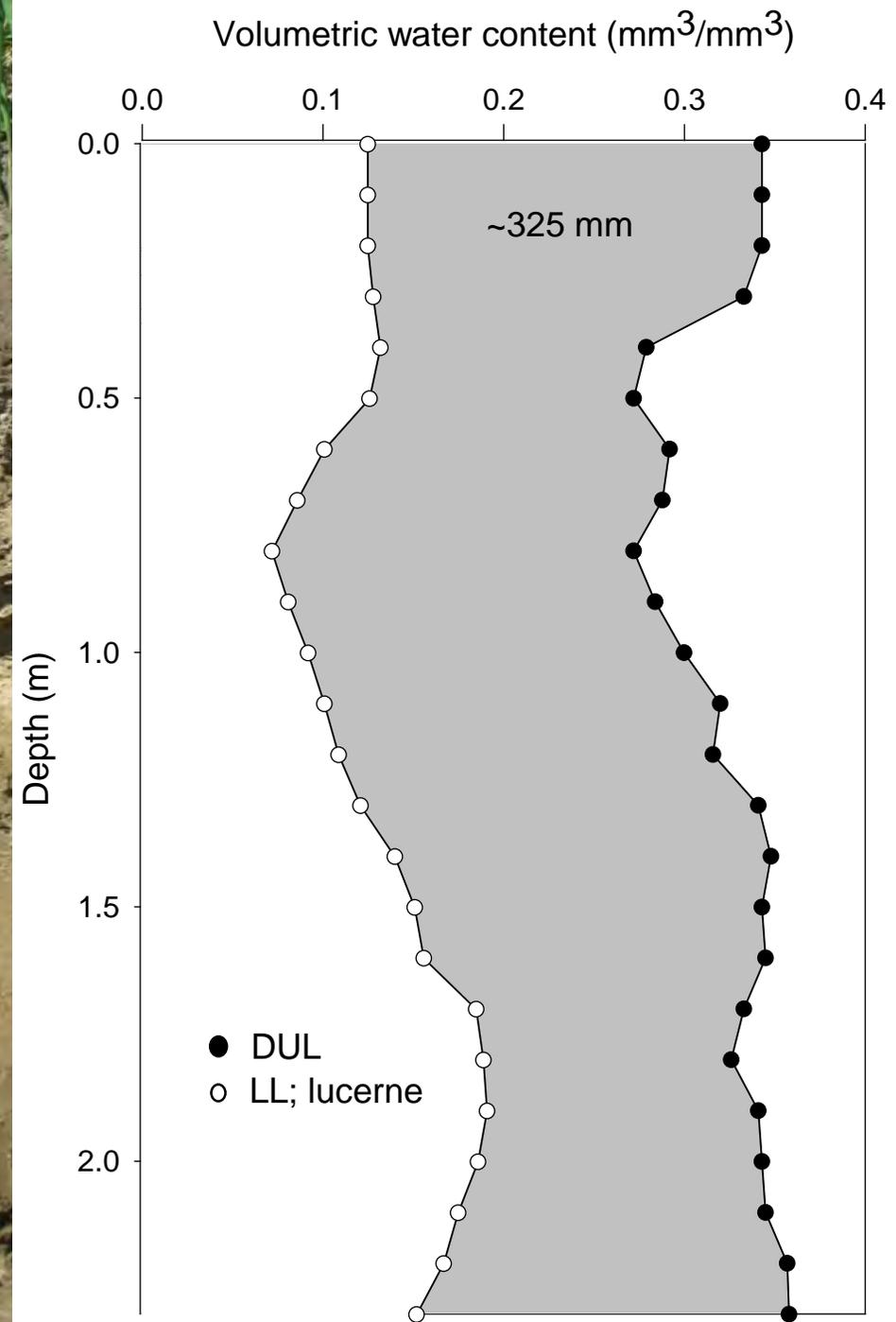
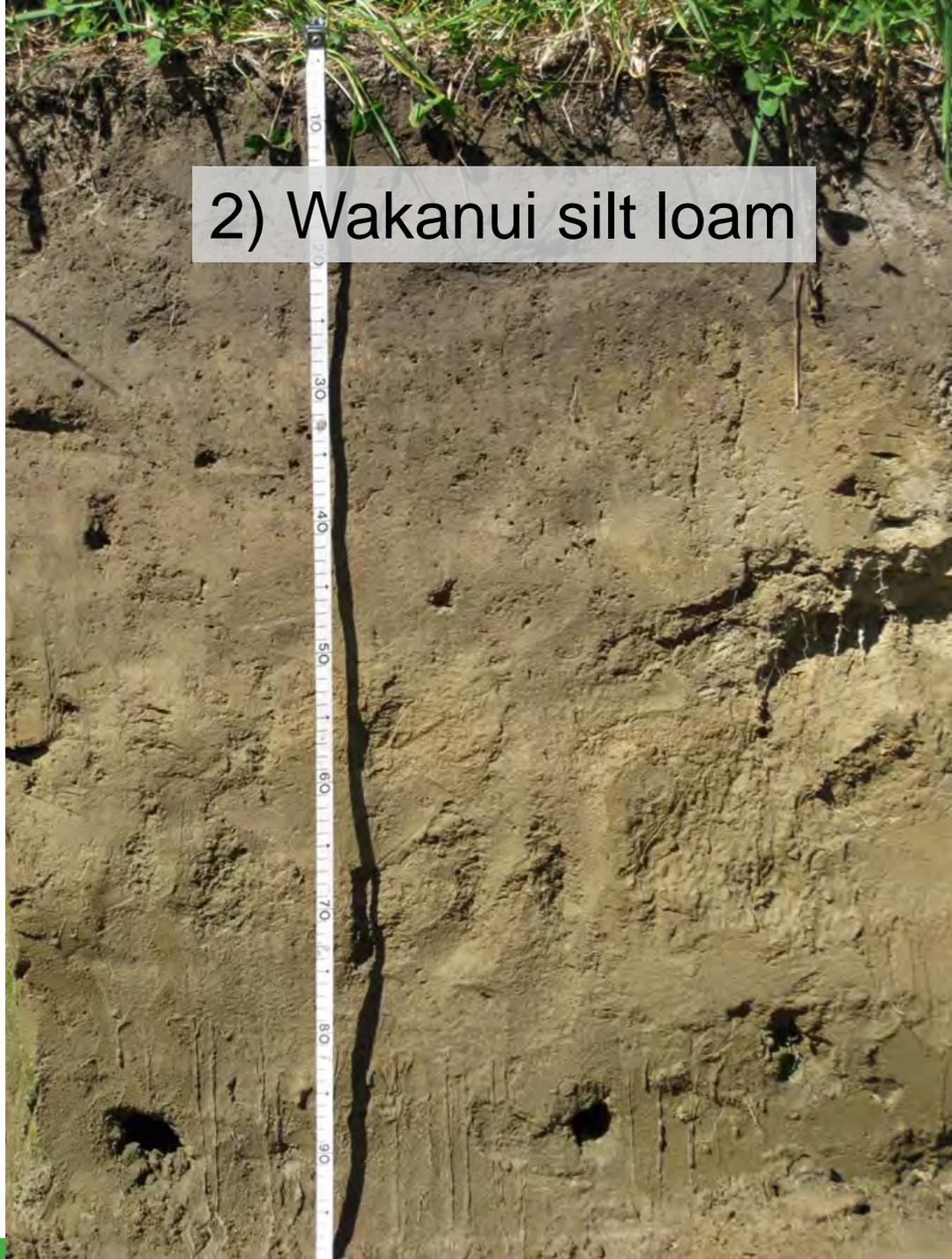
Seedling

Ashley Dene, January 2012

1) Lismore stony silt loam



2) Wakanui silt loam

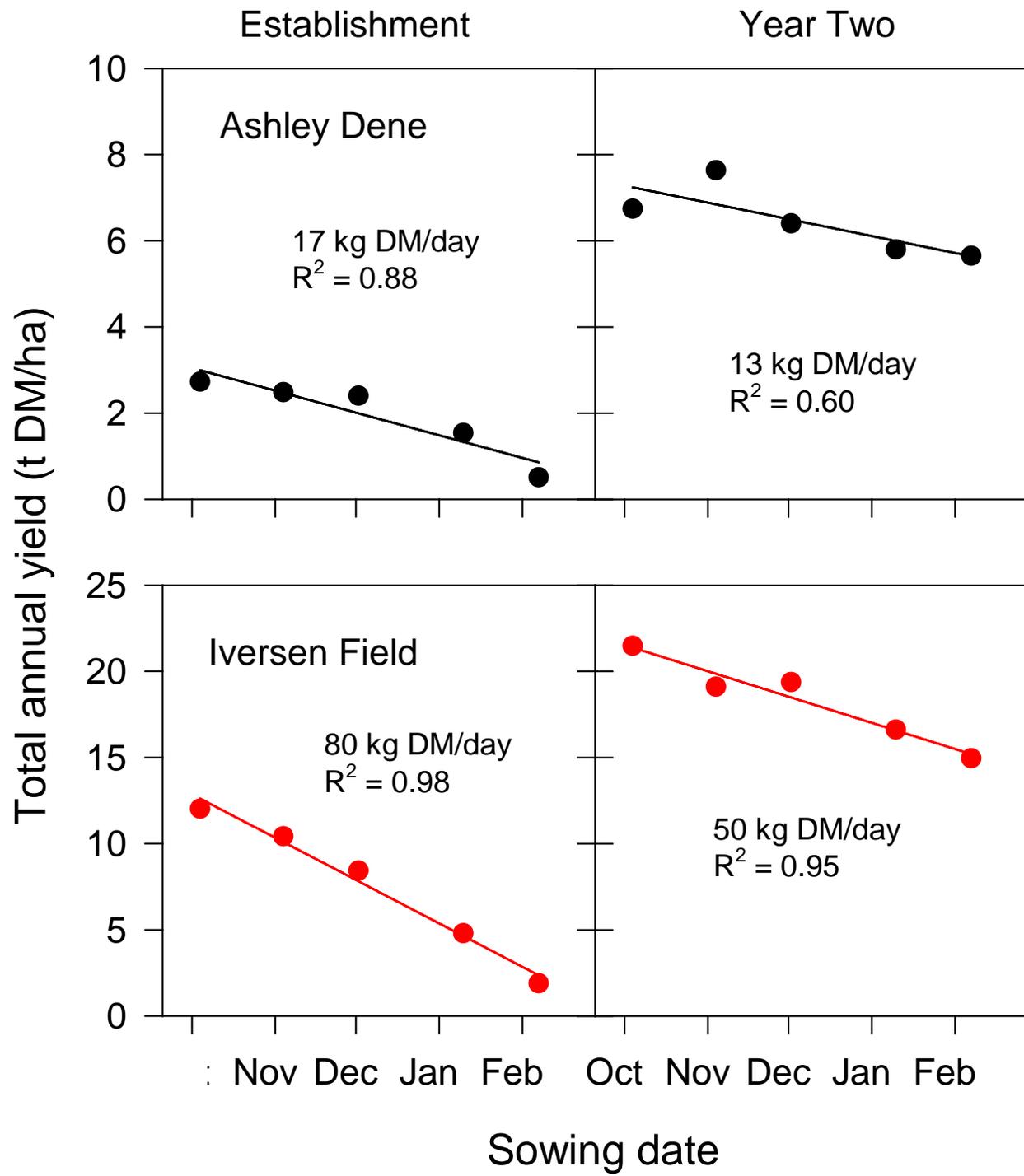


An aerial photograph of a field. In the center, there is a rectangular plot of bare, brownish soil, outlined with dark lines. A wooden stake with a white tag is positioned at the top-left corner of this plot. The surrounding area is covered in dense, vibrant green vegetation. In the background, a line of trees and a white building with a dark roof are visible under a clear sky.

Iversen 12, January 2012

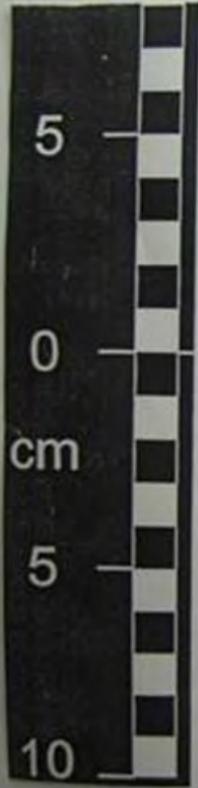
Seedling

Regrowth (year 2)



Delayed sowing cost yield

Sown: February ~ October



Sampled: June

Taproot mass

Taproot mass – Iversen 12

Sowing date	Root mass (t DM/ha)		
	Establishment	Year Two	Shoot+root (year 2)
October	5.3 _b	6.7 _a	21.9
November	5.7 _a	6.6 _a	20.0
December	4.9 _{ab}	6.6 _a	21.2.
January	3.2 _c	6.9 _a	20.3
February	1.1 _d	5.7 _b	19.5
P	<0.001	<0.05	
SEM	0.30	0.23	

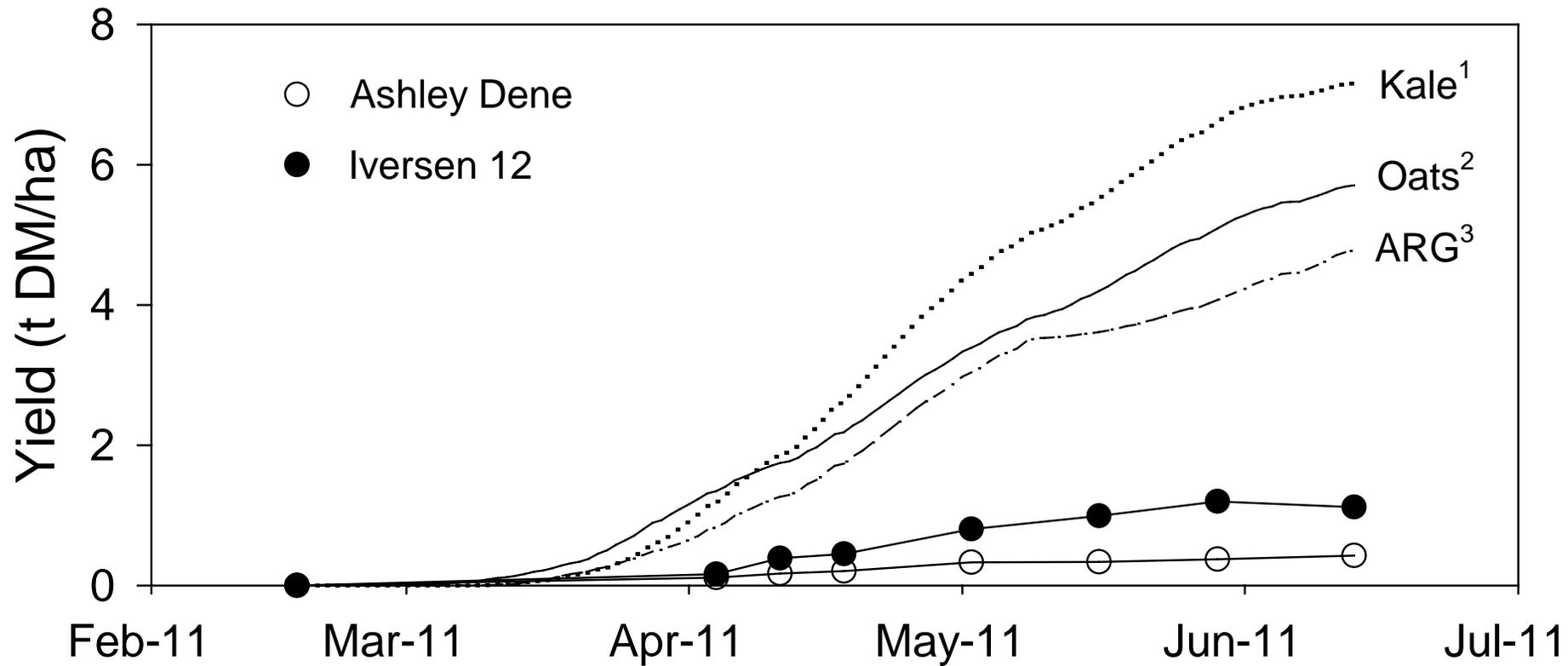
Establishment – sowing to June 2011; Year Two – June 2011 to July 2012

Taproot mass – Ashley Dene

Sowing date	Root mass (t DM/ha)		
	Establishment	Year Two	Shoot+root (year 2)
October	2.2 _a	4.8 _a	9.3
November	2.0 _a	4.6 _{ab}	9.2
December	1.6 _{ab}	4.0 _b	8.2
January	1.2 _b	3.5 _b	8.1
February	0.6 _c	3.4 _b	8.5
P	<0.001	<0.05	
SEM	0.19	0.24	

Establishment – sowing to June 2011; Year Two – June 2011 to July 2012

Potential yield of alternative crops



Sim 2014

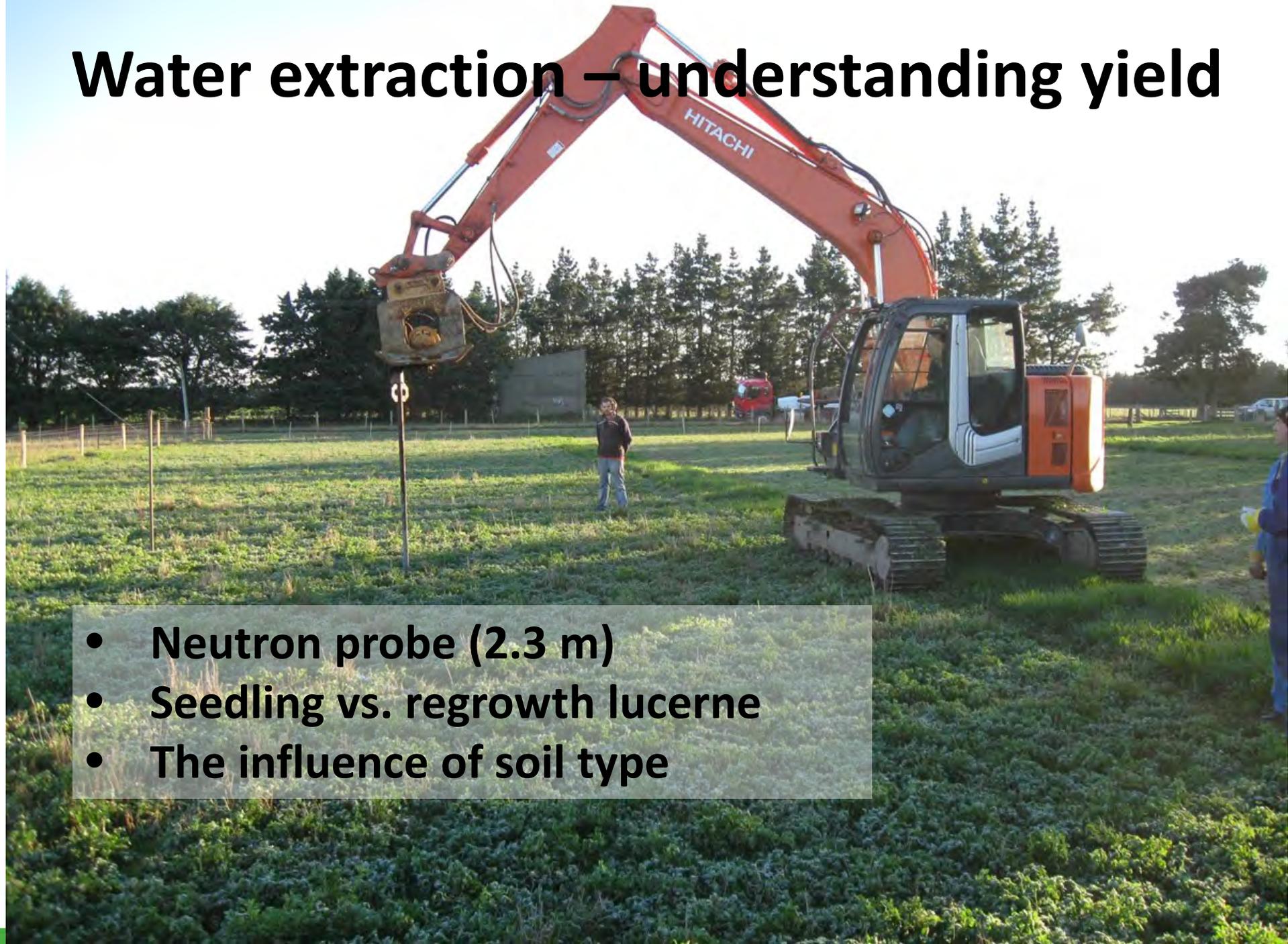
Source data:

¹ Chakwizira (2008), Chakwizira *et al.*, (2011)

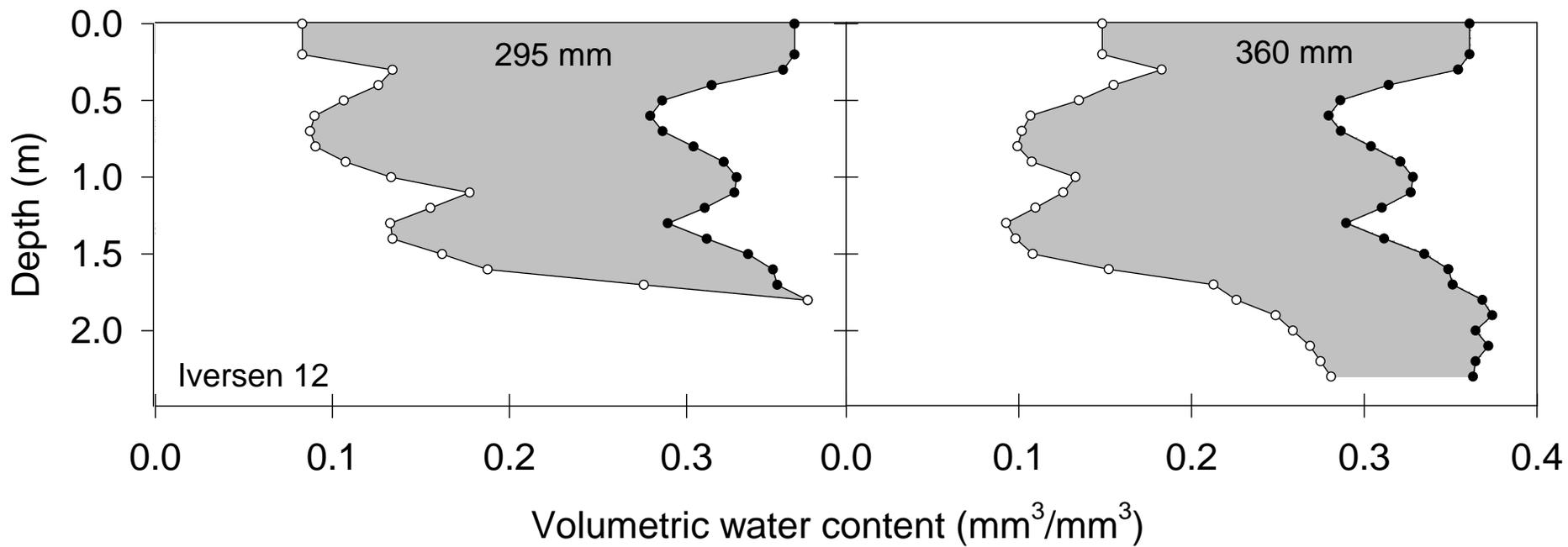
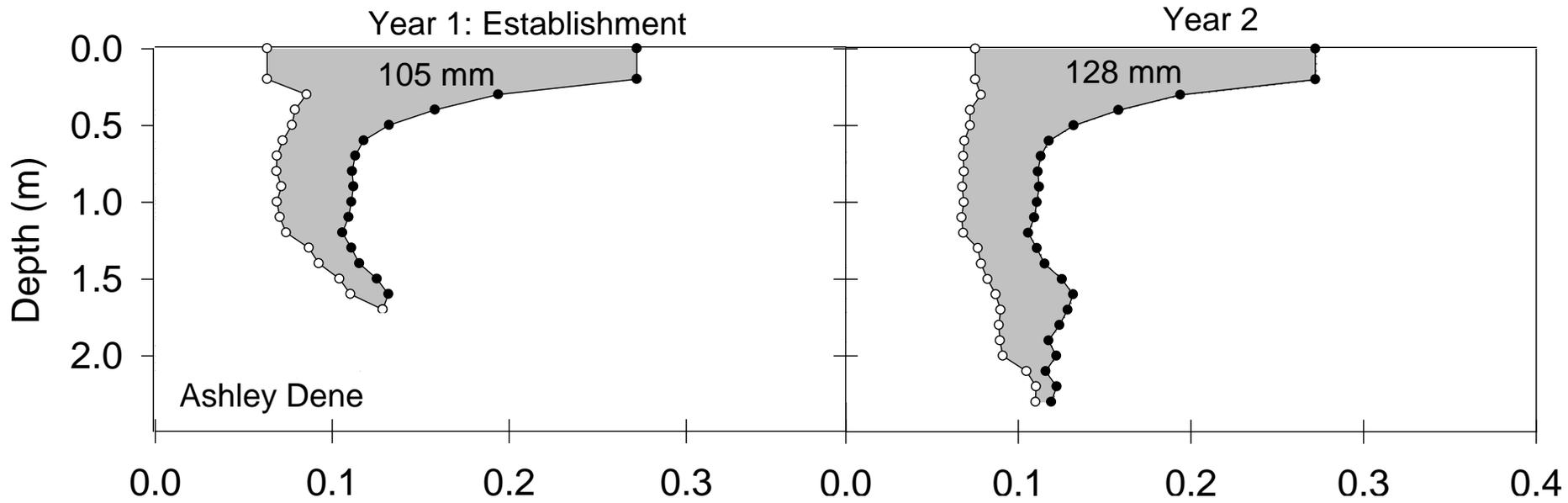
² Martini *et al.*, (2009)

³ Martini, (2012)

Water extraction – understanding yield



- Neutron probe (2.3 m)
- Seedling vs. regrowth lucerne
- The influence of soil type

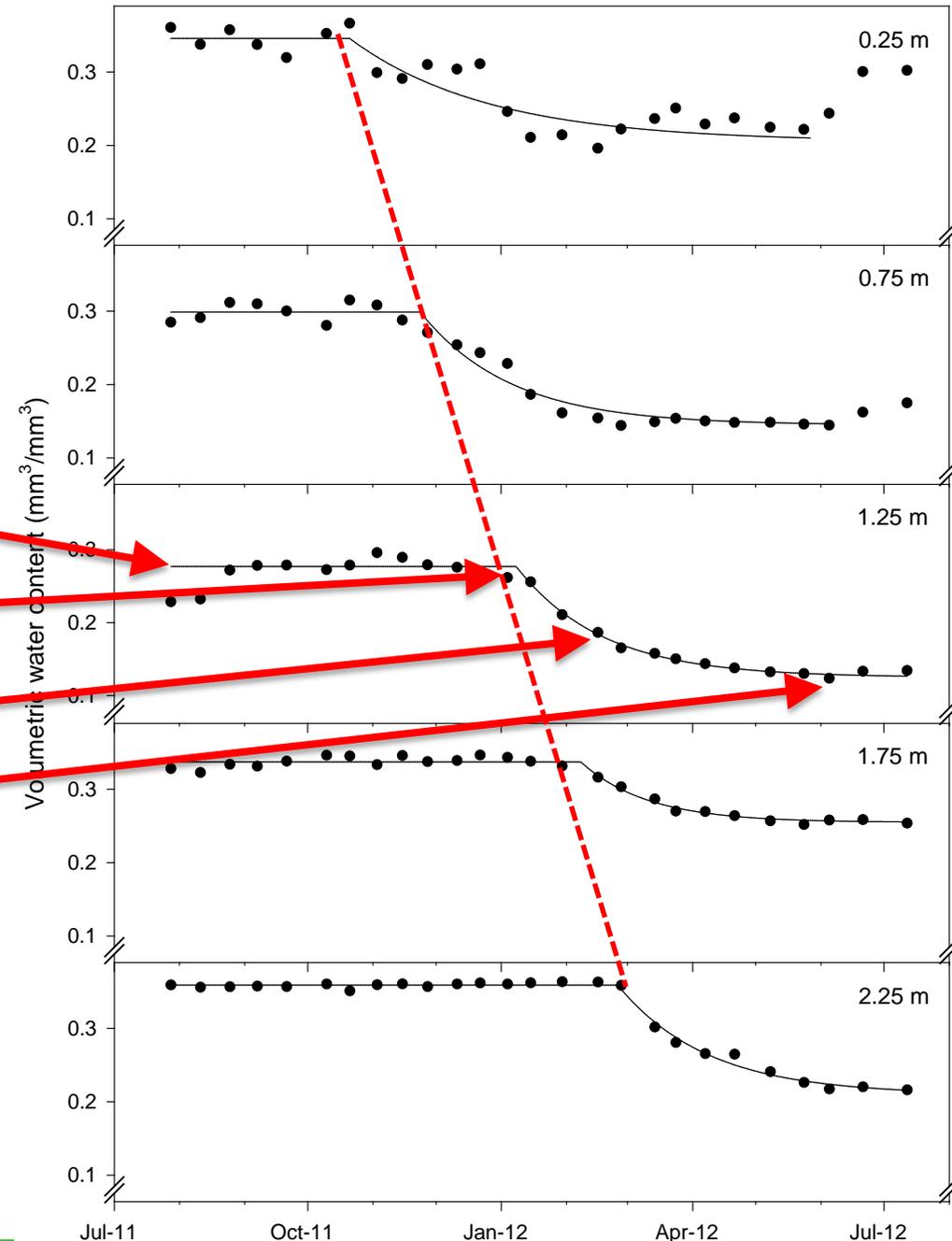


Water extraction

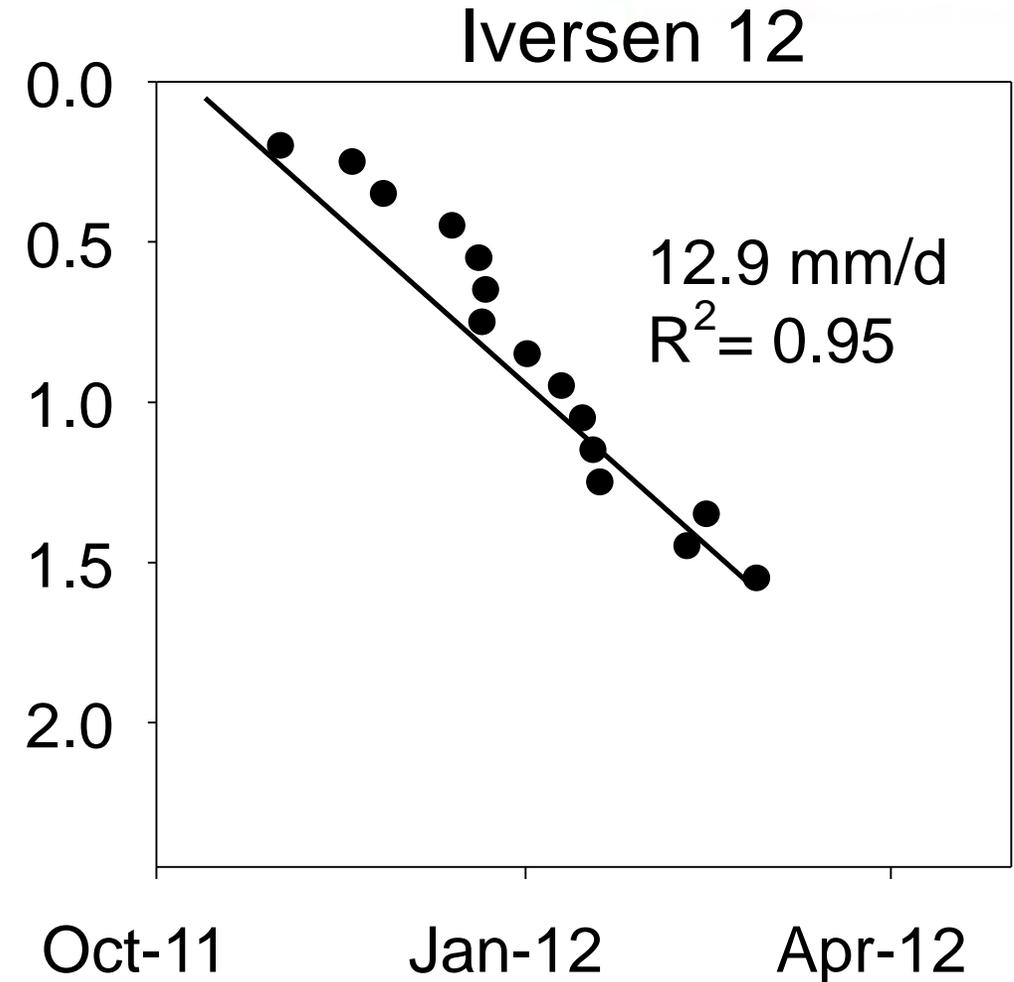
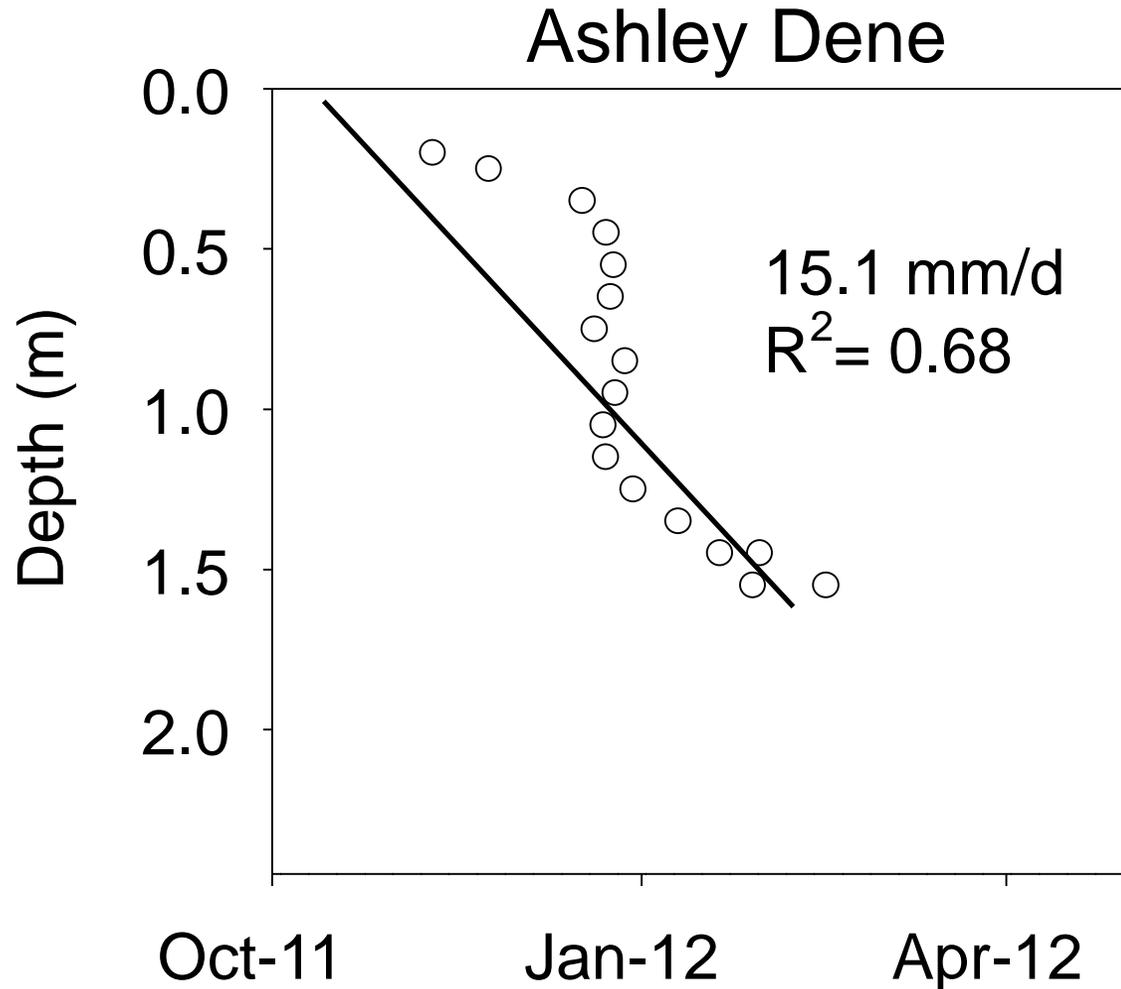
Water extraction

Field capacity
Start of extraction
Rate of extraction
Lower limit

Extraction front velocity



Extraction front velocity - establishment



Ashley Dene



Iversen 12



Sown 10 October
Emerged 18 October
200 plants/m²

2nd Trifoliolate leaf

6th Trifoliolate leaf

Shoot DW (mg)

Root DW (mg)

Shoot DW (mg)

Root DW (mg)

Ashley Dene

15.0_b

3.7_b

53.4_b

15.6_b

Iversen 12

25.3_a

4.6_a

117.4_a

23.6_a

P

<0.001

<0.001

<0.001

<0.05

SEM

0.82

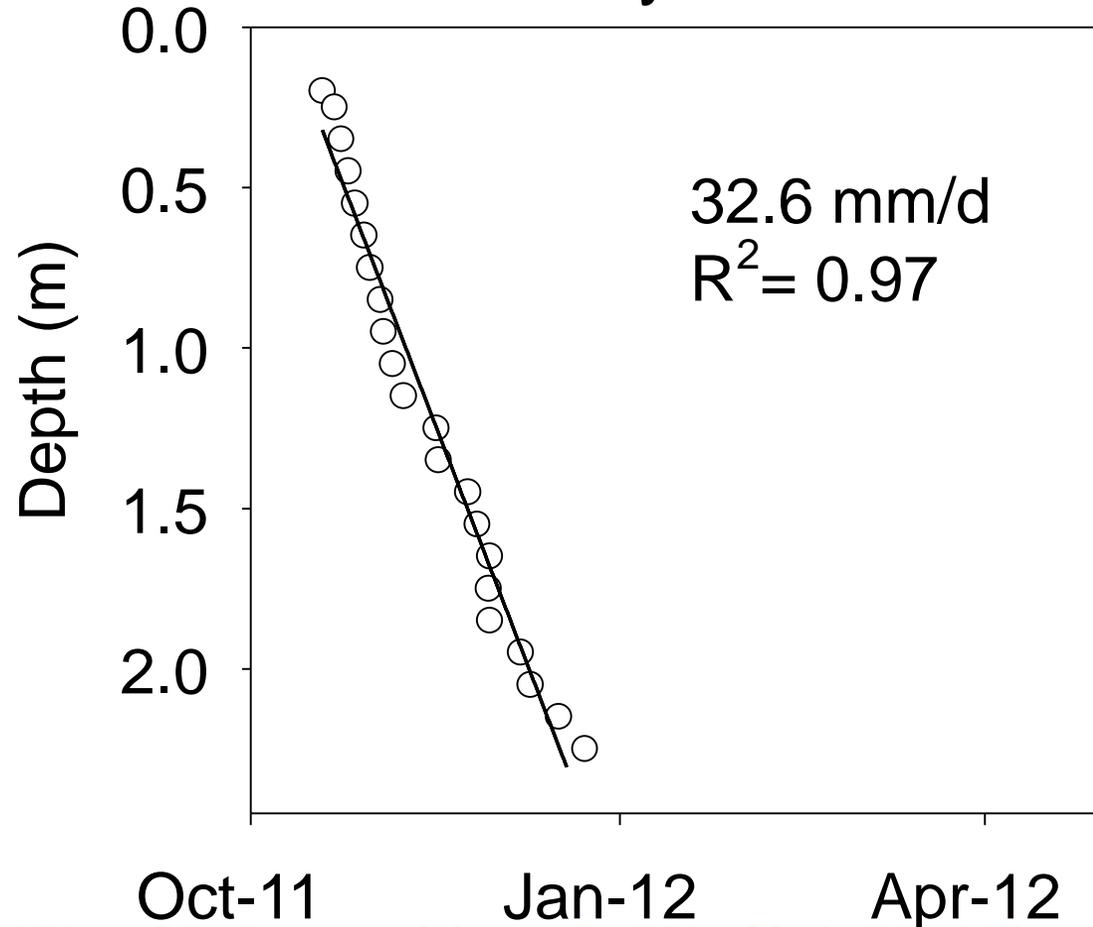
0.24

8.37

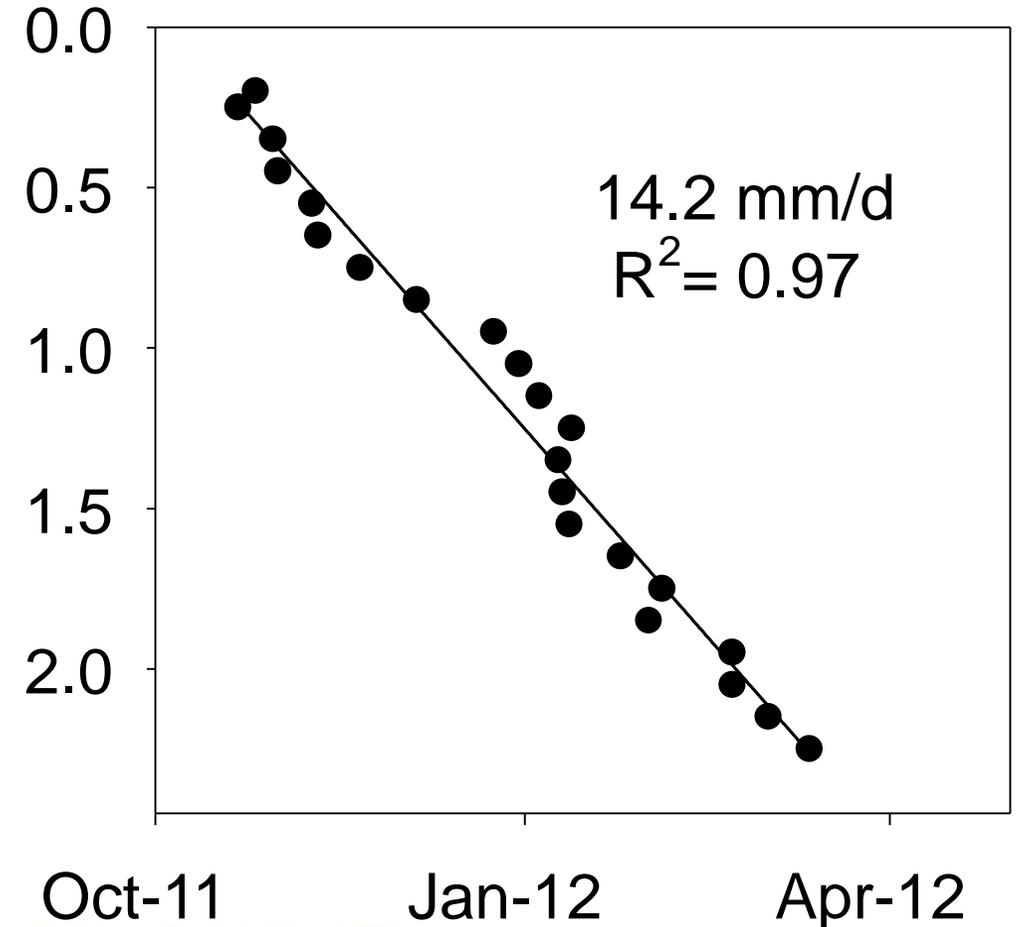
2.23

Extraction front velocity – year 2

Ashley Dene



Iversen 12



Ashley Dene, January 2012

Feed supply

- Regrowth vs seedling crops
- Sowing window: Oct-Dec
- First grazing in 3 months (50% flowering)

Conclusions from establishment

- Spring sow or grow a forage crop
- Yield in year one is lower due to partitioning
- Plant population self thins over time
- Inoculation is important in new sites
- Sow on deep soils
- Regrowth crops on shallow soils use soil water quickly
- Spread feed supply by new sowings each year.

Lucerne grazing options

- Rotational grazing
- Set stocking
- Grass mixes

Pastoral 21 B+LNZ funded programme

New Zealand's specialist land-based university

Growth:

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

Development:

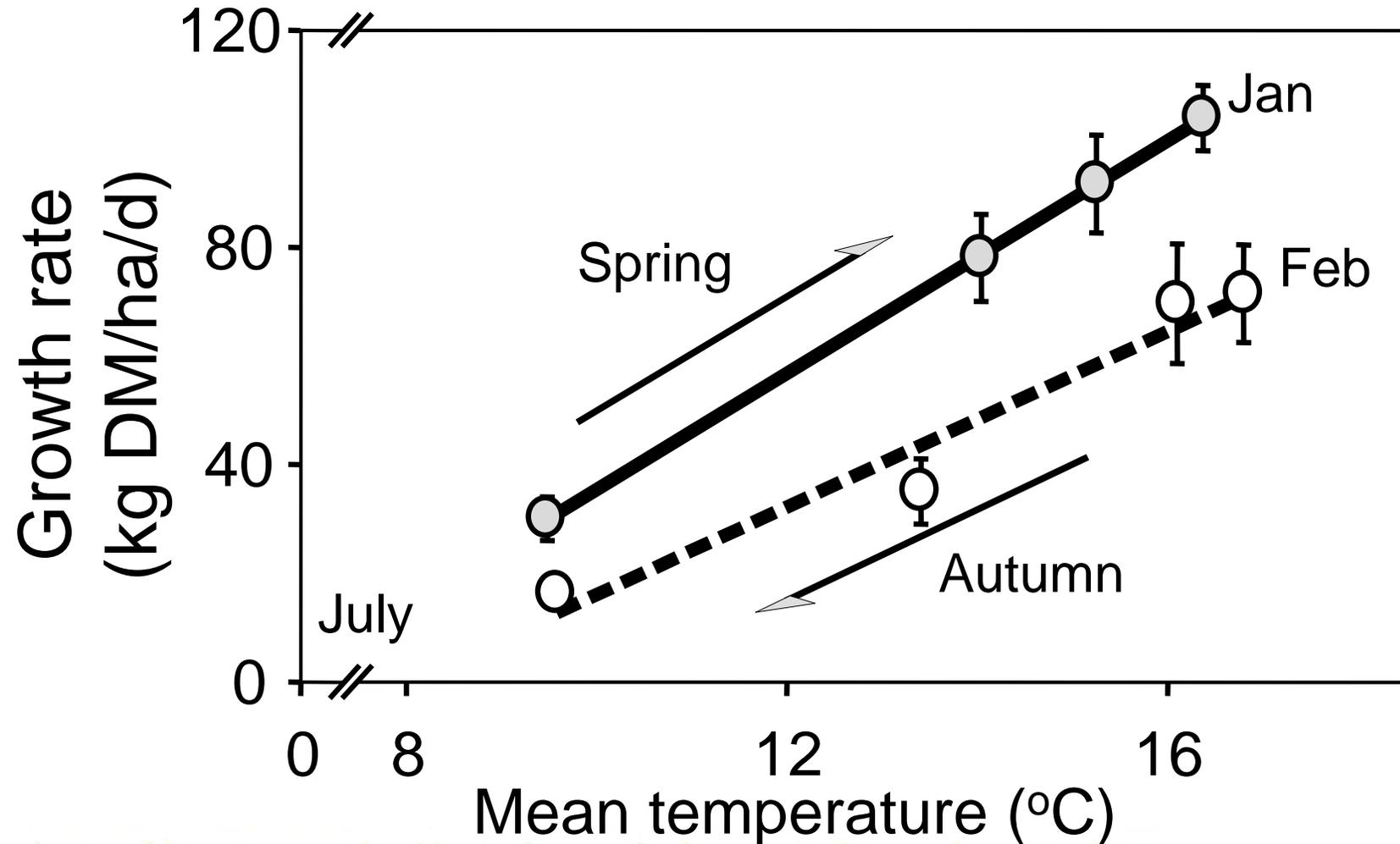
is the 'age' or maturity of the regrowth crop e.g. leaf appearance, flowering

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

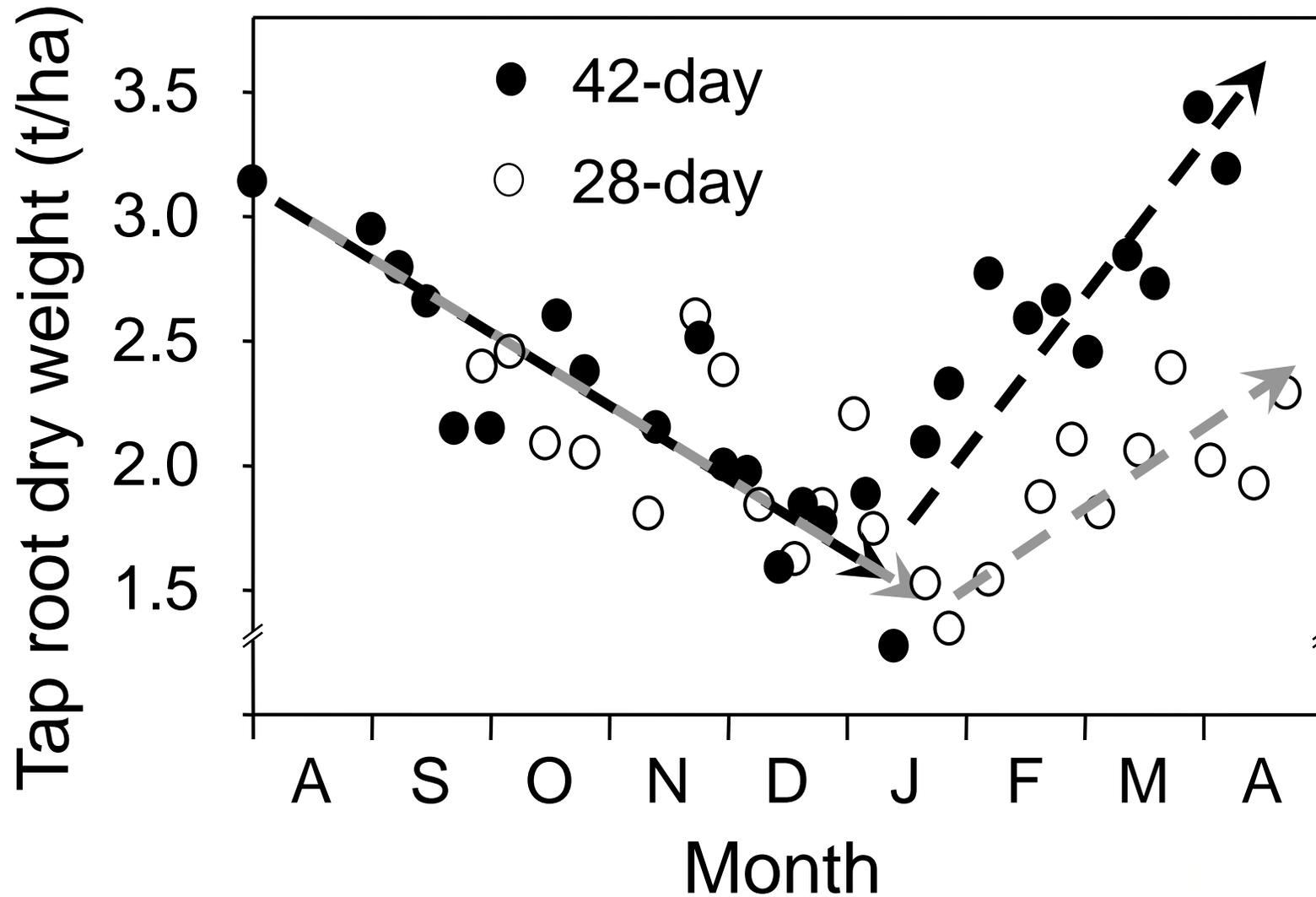


25 days resting

3 days grazing



Partitioning to roots



Seasonal grazing management

Spring

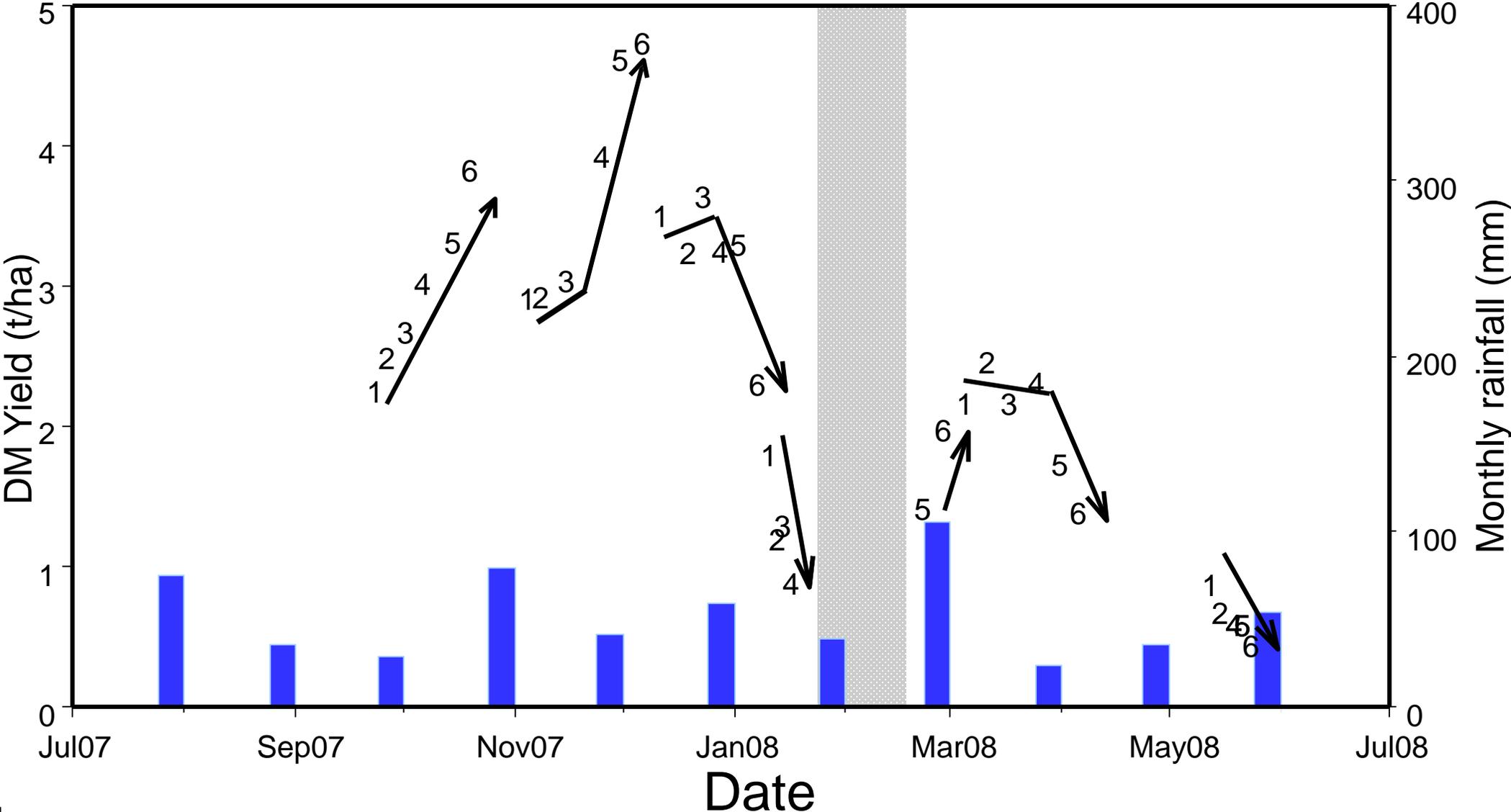
- 1st rotation aided by root reserves to produce high quality vegetative forage.
- can graze before flowers appear (~1500 kg DM/ha) ideally ewes and lambs but

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





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 Sth Canterbury



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Stocking rates in New Zealand

- Spring 14 ewes plus twins/ha
- Summer 70 lambs/ha
- Ideally 7-14 days maximum on any one paddock
- Less intensive systems – don't open the canopy

Spring grazing



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



Photo: 'Bonavaree' Marlborough

14 ewes + twins/ha

High numbers for 7-10 days





Photo: 'Bonavaree' Marlborough

11.09.2009
Fibre and salt

Maximize reliable spring growth – high priority stock



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 But don't flush on this!



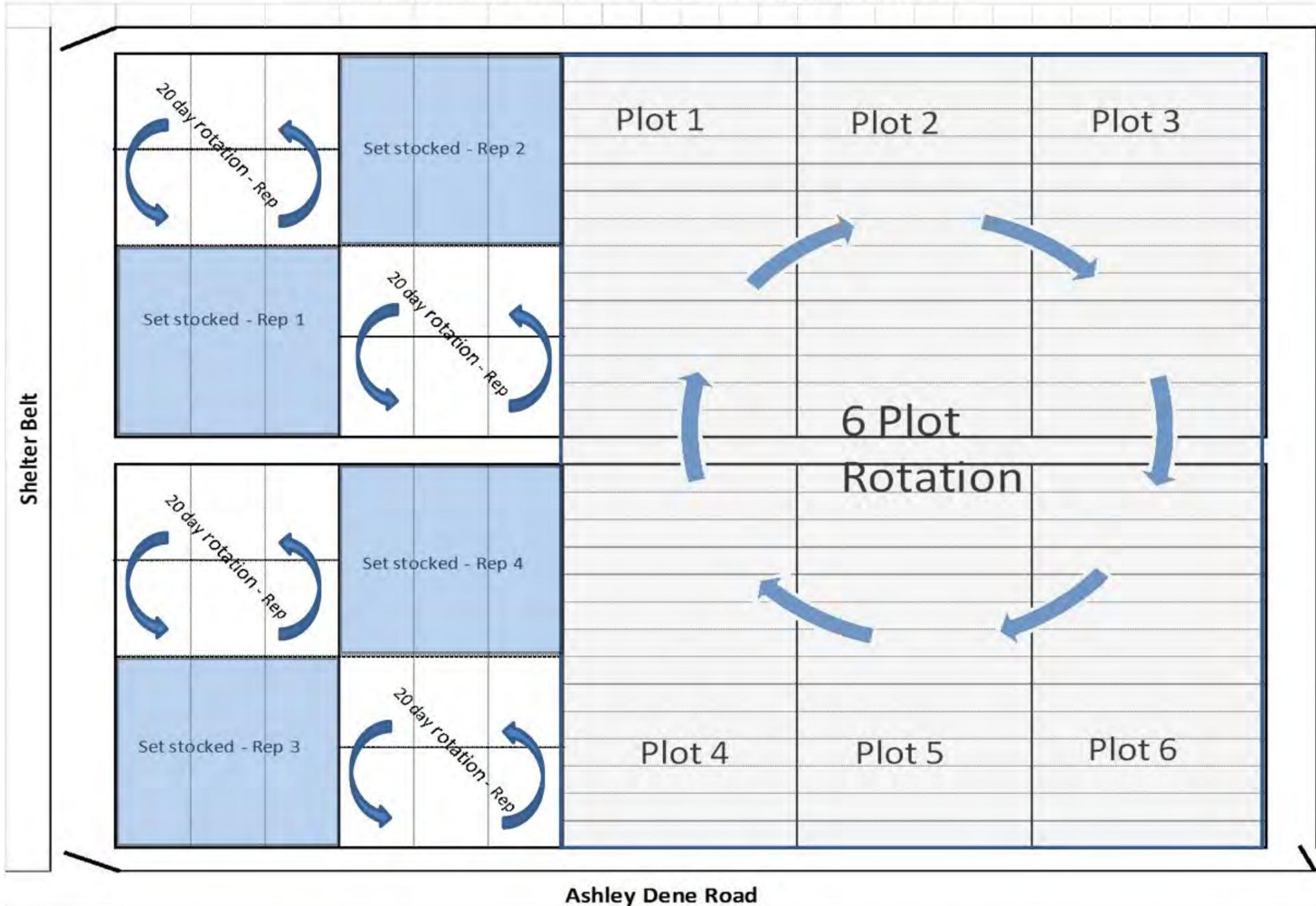
Rotation 4 Pre-graze
Plot 6 (28/2/08)
2.0 t DM/ha produced in 51 d

Objective

- Evaluate three spring grazing management strategies for lucerne monocultures
 - Rotational grazing (6 paddock system)
 - Set stocked (SS) until weaning
 - Semi set stocked (SSS) until weaning (10 day shifts)
- After weaning SS and SSS lambs mobbed up and moved to an 8 paddock rotational grazing system (RECOVERY PHASE)

Contributes to: Critical measures A & B

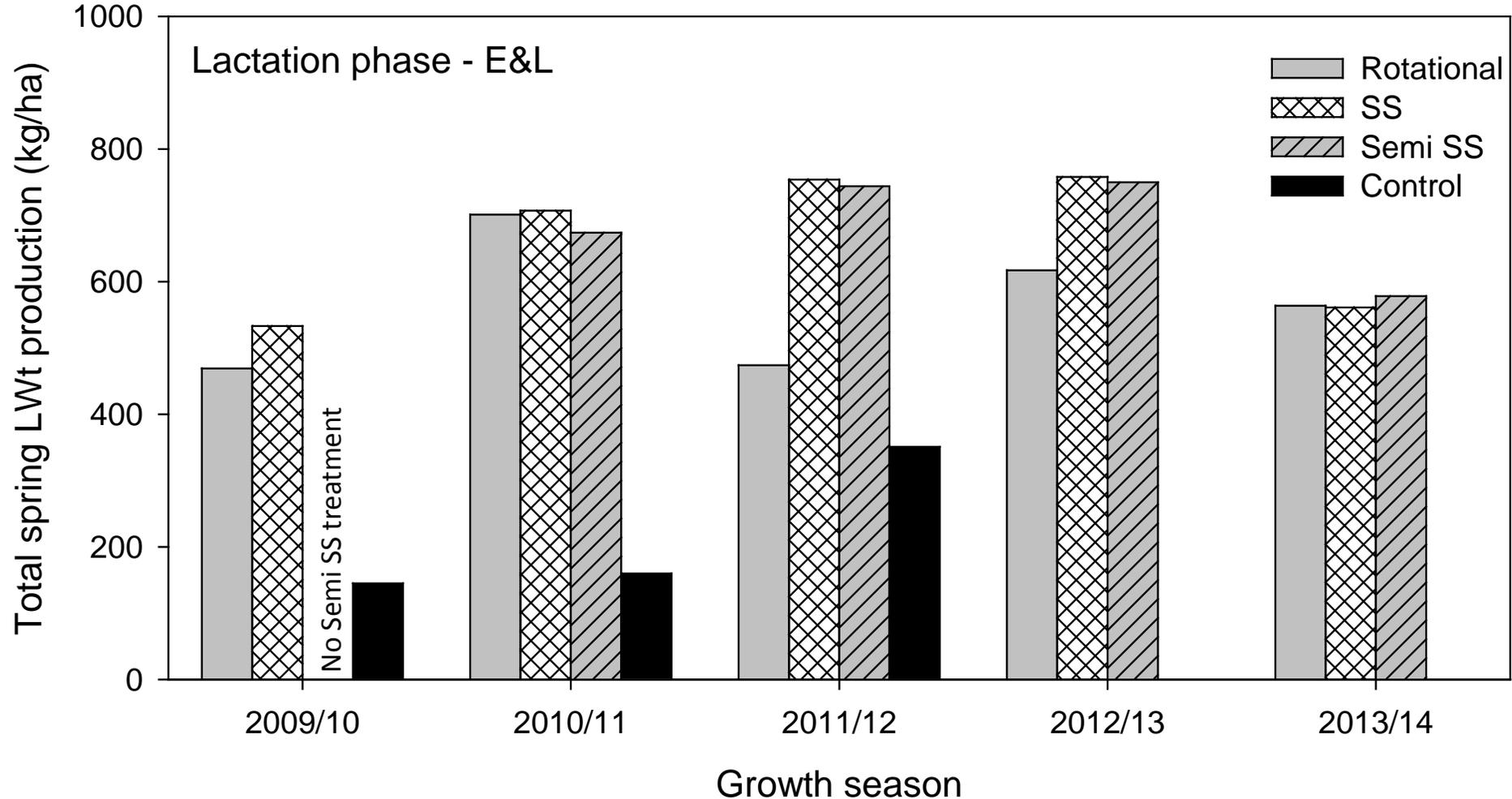
Ashley Dene Lucerne - H7 - Grazing Treatments



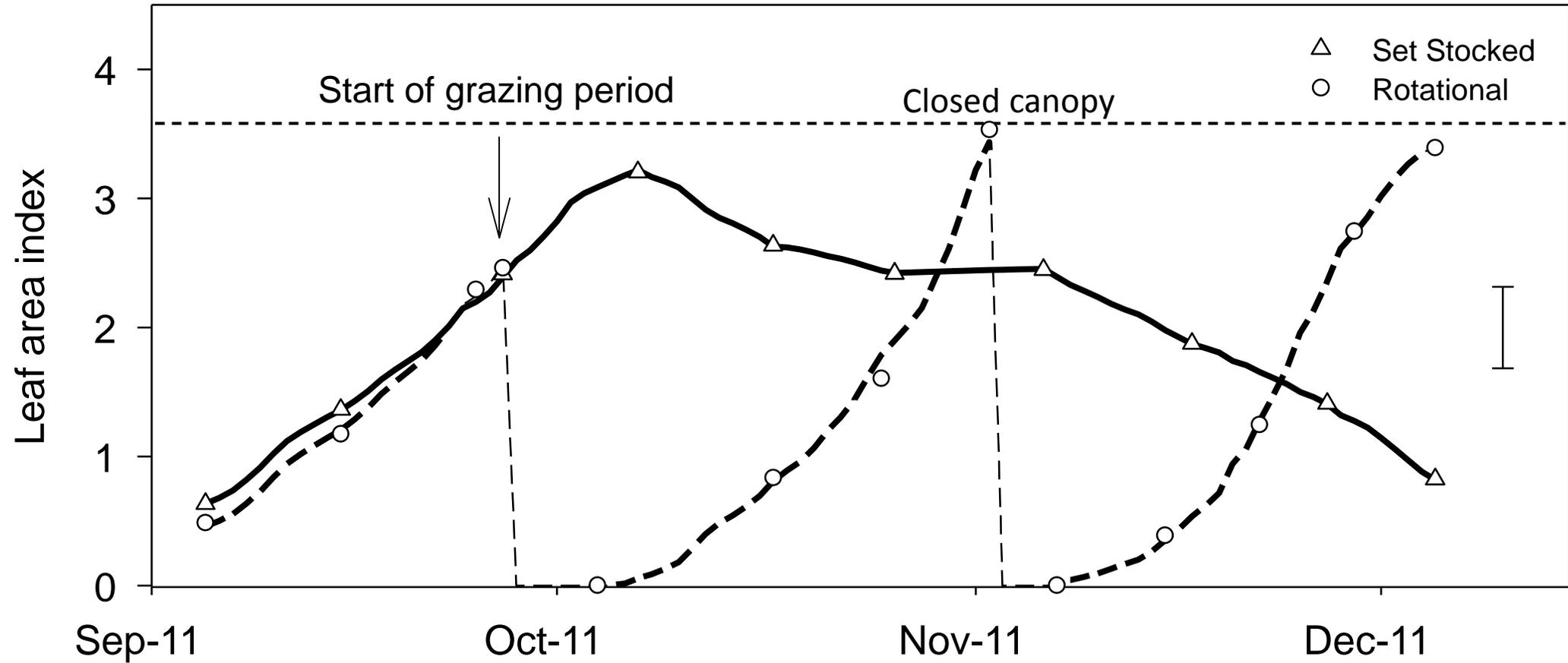
Project 3 – Spring grazing management of lucerne



Total LWt produced



Crop canopy

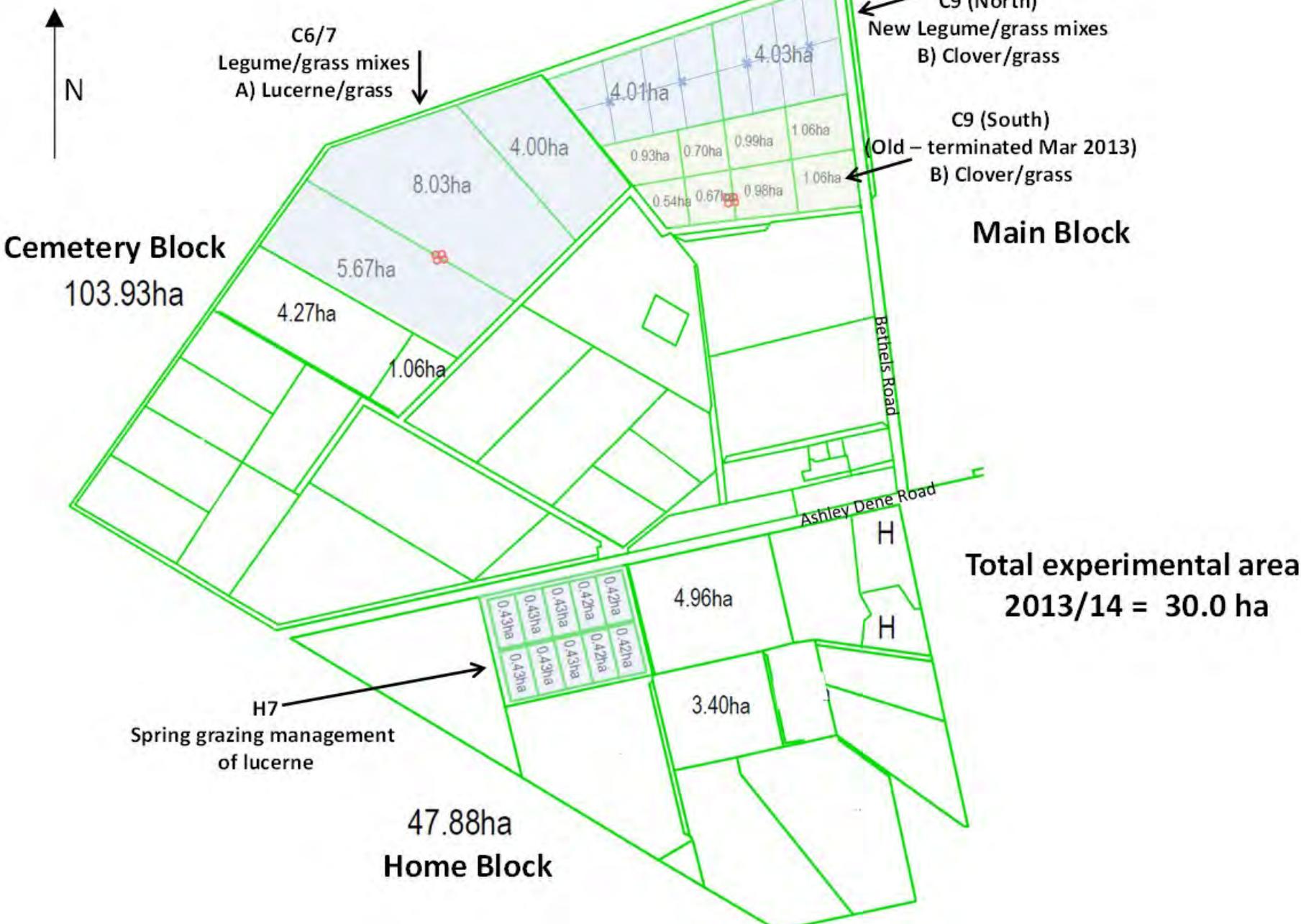


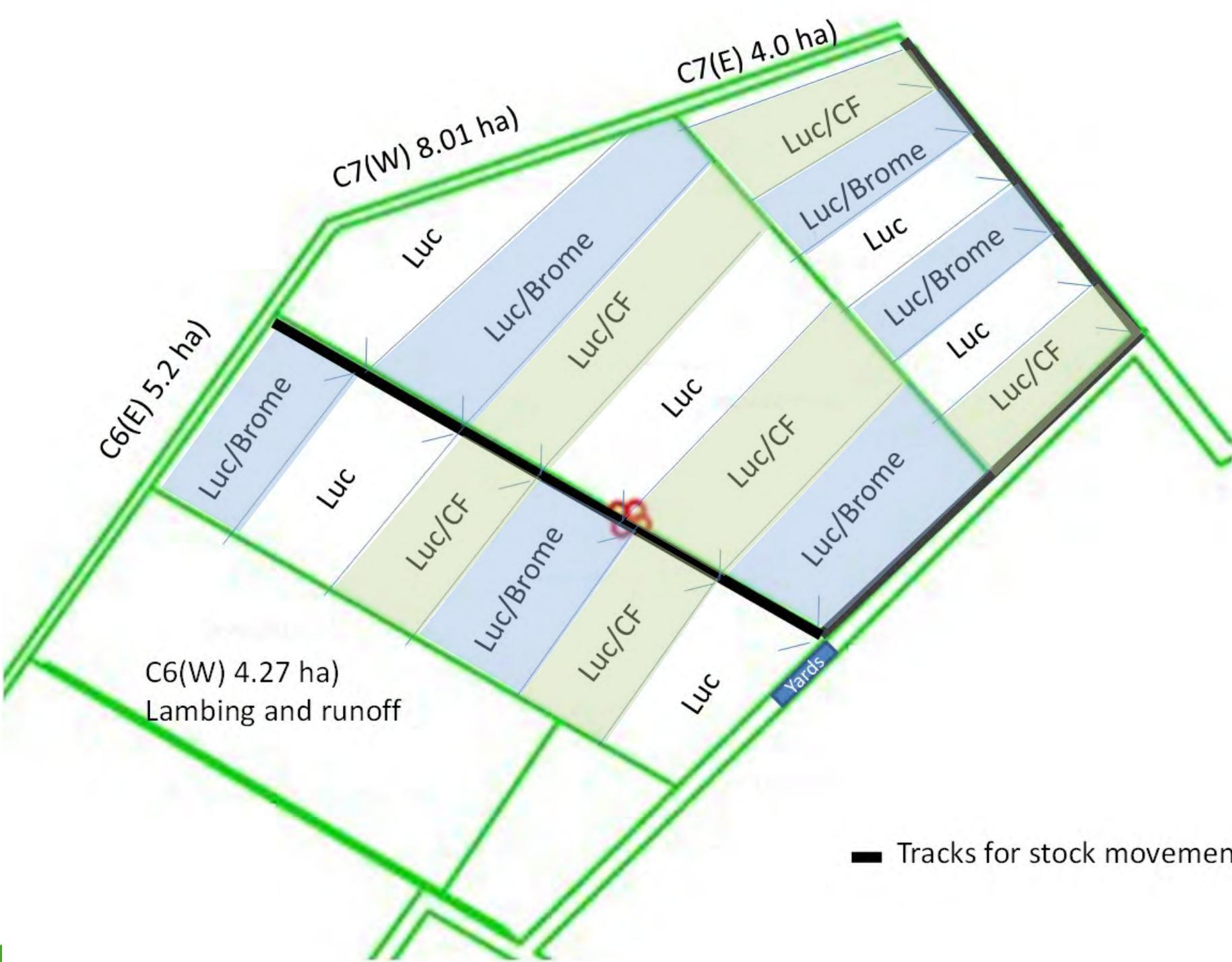
RULES FOR SET STOCKING

1. Manage lucerne pure swards first.
2. Choose paddocks to lamb on early in autumn – shelter, older, early clean-up graze and winter herbicide application.
3. Lucerne grass mixes – grass transition.
4. Early and late for condensed lambing (1 cycle).
5. Drift onto lucerne ~14 d prior to lambing
6. Lucerne ~20 cm tall and keep it there.

RULES FOR SET STOCKING cont'd.

7. Stock at about half the rotational grazing rate
8. SS for 4-5 weeks – then rotate
9. SS lambs use the taller feed as shelter.
10. Stocking rate to keep closed canopy!
11. Canopy gets taller over 4-5 weeks not shorter
12. Once canopy reduces begin rotational grazing
13. Open canopy = twitch, yarrow, dandelions.
14. Paddocks need autumn (6 wks) recharge.





— Tracks for stock movement

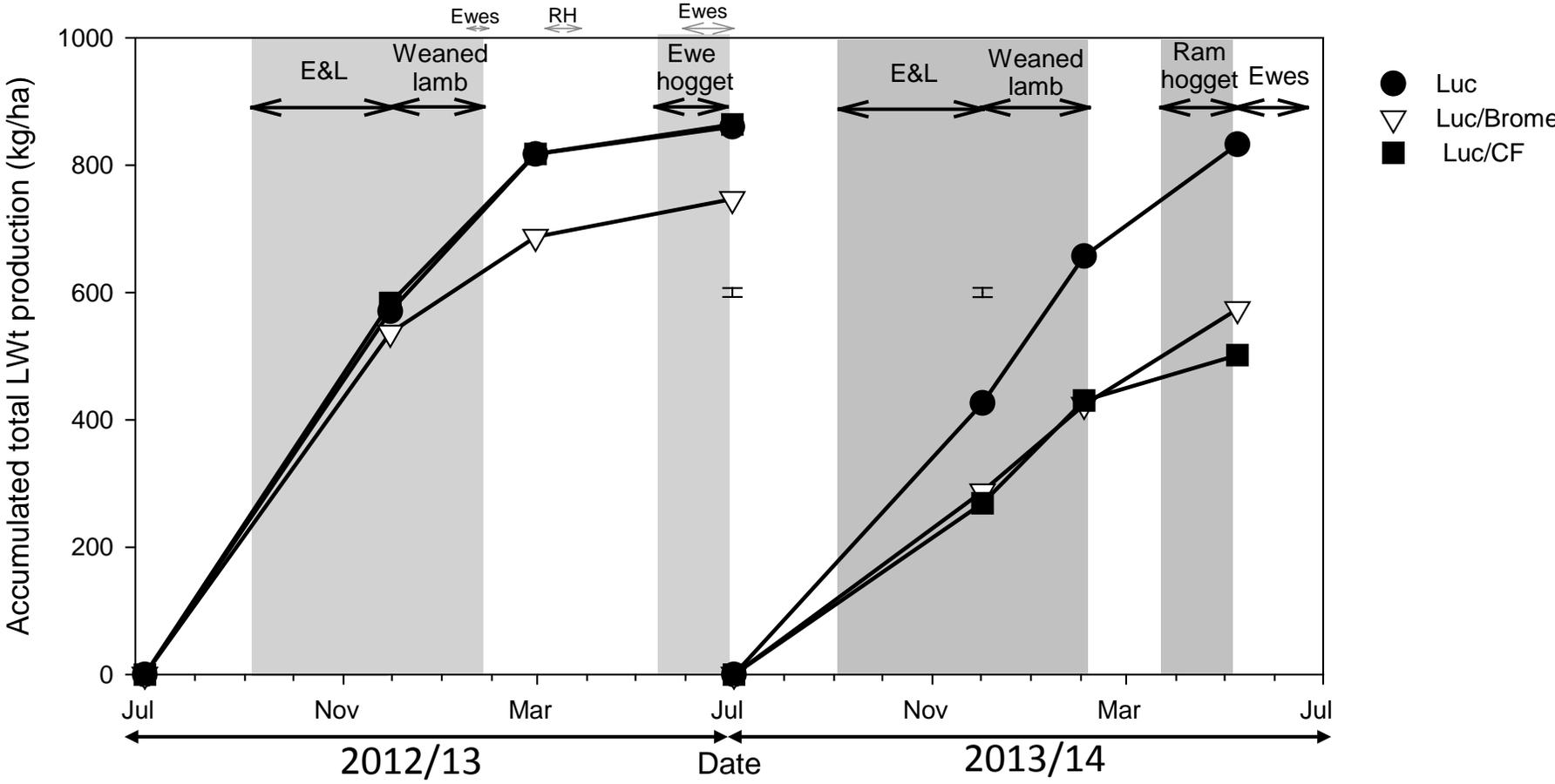


Plot 2 - Luc/CF

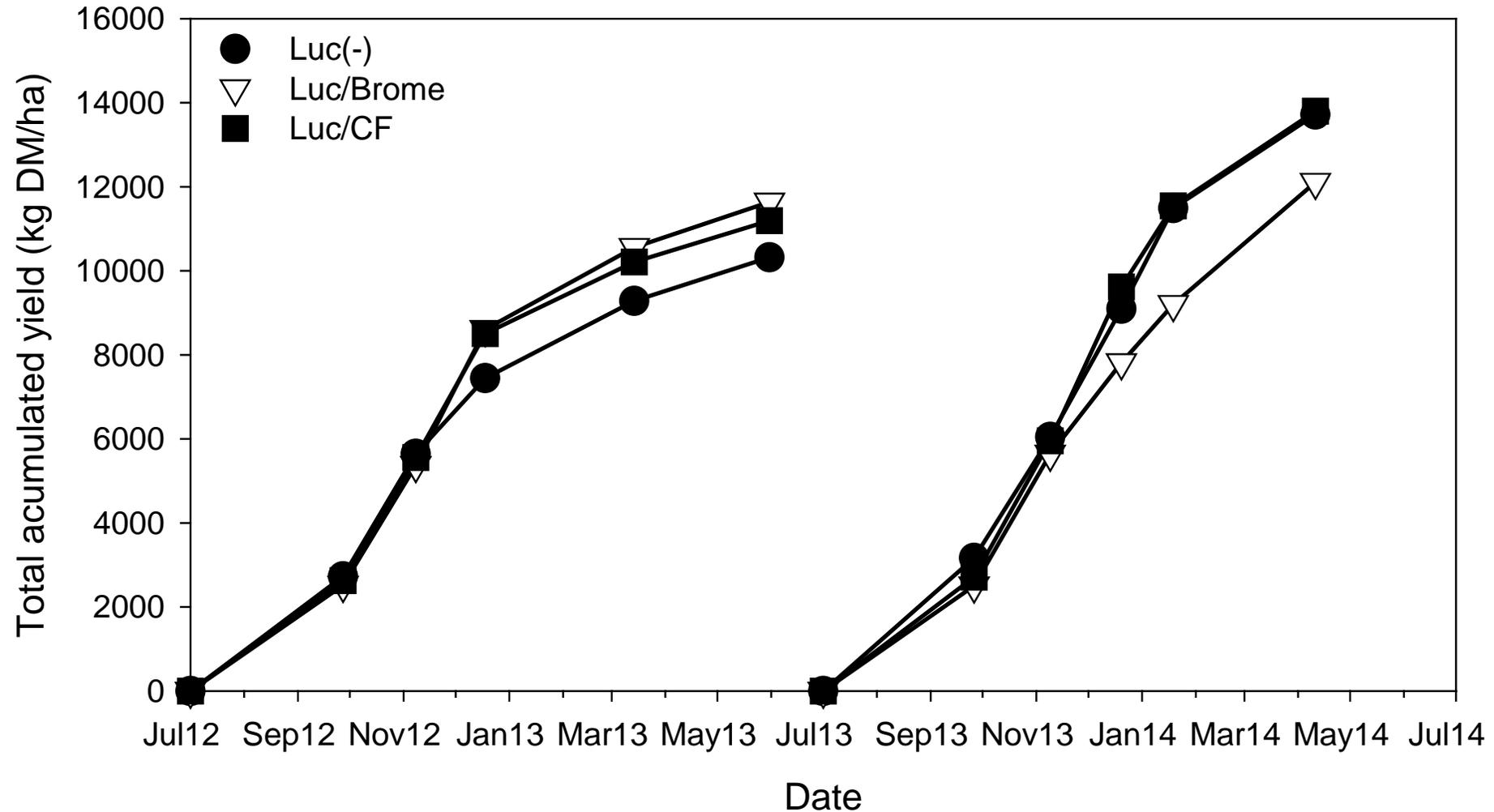
Plot 1 - Luc

Early spring

Total Accumulated LWt production



DM Yield





Plot 2
Luc/CF
24 Oct 2012



Plot 10
Luc/CF
17 Oct 2012

Lucerne/cocksfoot mix – Sept 2013





Plot 3
Luc/brome
24 Oct 2012



Plot 11
Luc/brome
17 Oct 2012



Plot 7
Luc/brome
11 Oct 2013



Plot 17
Luc/brome
14 Nov 2013

3 Feb 2014



3 Feb 2014

Luc/CF



3 Feb 2014
Luc/brome



3 Feb 2014

Luc



LU Research in progress

- **Luc/grass mixes**
- **Annual clovers for spring**
- **Lucerne oestrogens**
- **Lucerne Dormancy**

References & Links



Lincoln University Dryland Pastures Website: <http://www.Lincoln.ac.nz/dryland>

Lincoln University Dryland Pastures Blog: <http://www.lincoln.ac.nz/conversation/drylandpastures/MaxClover Photo Diary> (18 MB; PDF File)

Black, D. B. S. and Moot, D. J. 2013. Autumn establishment of lucerne (*Medicago sativa* L.) inoculated with four different carriers of *Ensifer meliloti* at four sowing dates. *Proceedings of the New Zealand Grassland Association*, **75**, 137-144.

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Sim, R.E. 2014. Water extraction and use of seedling and established dryland lucerne crops. Ph.D thesis, Lincoln University, Lincoln, Canterbury. 264 pp.