



**Lincoln
University**
Te Whare Wānaka o Aoraki
AOTEAROA • NEW ZEALAND



Caucasian clover responses to fertiliser, lime and rhizobia inoculation at Lake Heron Station, Canterbury

Alistair Black, Alan Harvey, Jim Moir, Derrick Moot



New Zealand's specialist land-based university



This work by [Alistair Black and the Lincoln University Dryland Pastures Research Team](#) is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](#).

Note:

This presentation was made by Dr Alistair Black on 7 Nov 2014 in Alexandra at the New Zealand Grassland Association Annual Conference.

It is associated with the following scientific publication:

Black, A. D., Harvey, A. J., Moir, J. L. and Moot, D. J. 2014.
[Caucasian clover responses to fertiliser, lime and rhizobia inoculation at Lake Heron Station, Canterbury.](#)
Proceedings of the New Zealand Grassland Association,
76, 105-109.

Caucasian clover



Lake Heron Station

- 
- A photograph of two men standing in a field of tall, dry grass and low shrubs. The man on the left is older, with white hair, wearing a dark long-sleeved shirt and light-colored trousers. The man on the right is wearing a green hat, a dark jacket, and dark trousers. They are facing each other as if in conversation. In the background, there are large, rugged mountains with some snow on their peaks under a clear blue sky. A dog is partially visible on the left side of the frame.
1. Yield of a mature stand of Cc and its response to superphosphate and lime
 2. Use of nitrogen fertiliser to improve establishment of a new stand of Cc



★ Mature stand of Cc

★ New stand of Cc

Mature stand of Cc

680 m a.s.l.

Sown 2002

No fertiliser since sowing

pH 5.5, Olsen P 5





Super: 0, 100, 200 & 400 kg/ha
Lime: 0 and 5 t/ha of lime
Four replicates, 12 x 20 m plots



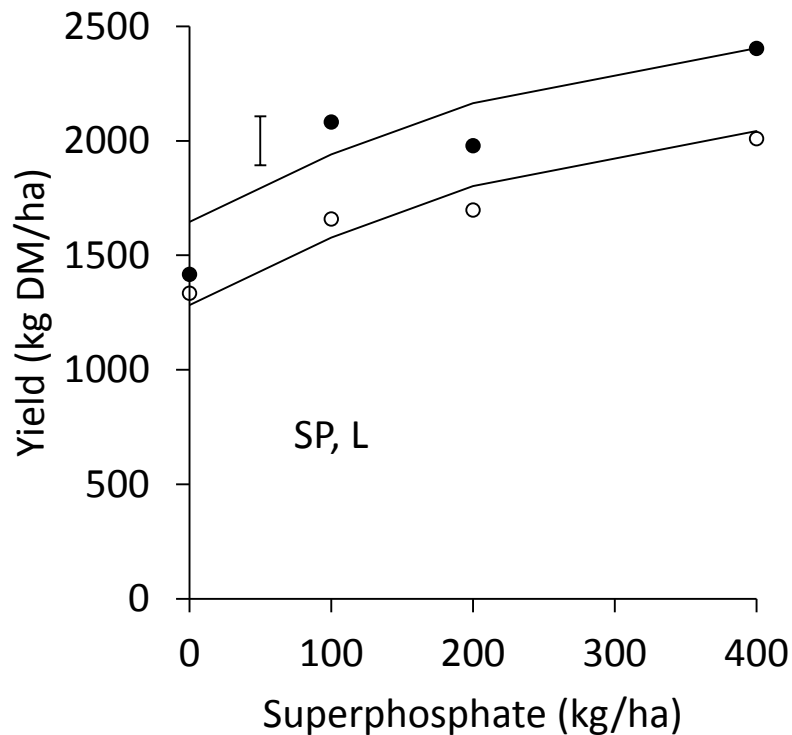
Imagery ©2012 Cnes/Spot Image, DigitalGlobe,



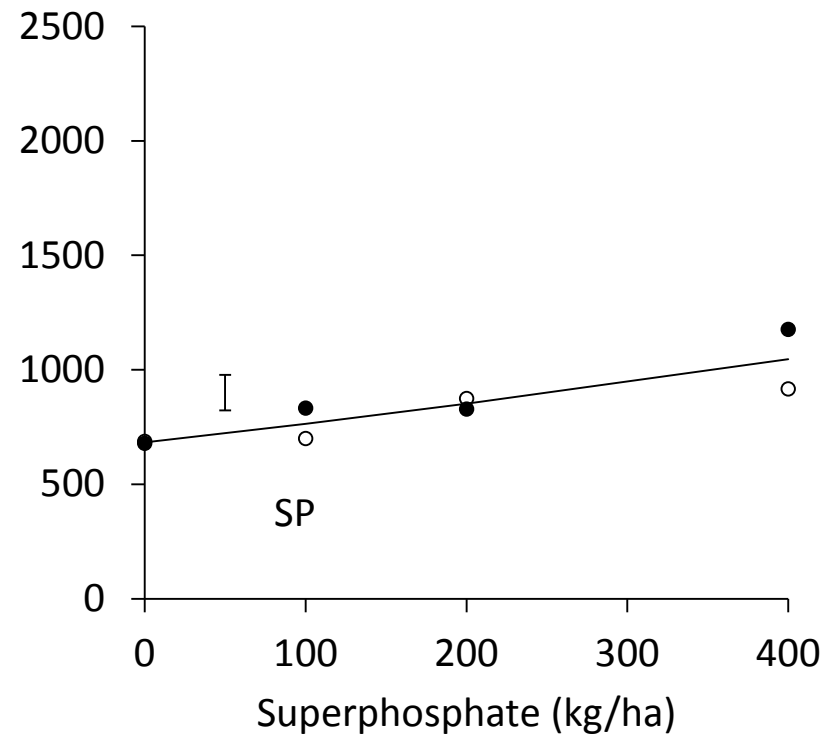
**DM yield in spring, summer and autumn
2012/13 and 2013/14**

Caucasian clover yield

9 months (Nov 2012)



23 months (Nov 2013)



Nov 2012

Control

**400 kg/ha super
5 t/ha lime**

**Olsen P 11
pH 5.5**

**Olsen P 14
pH 6.0**



Nov 2013

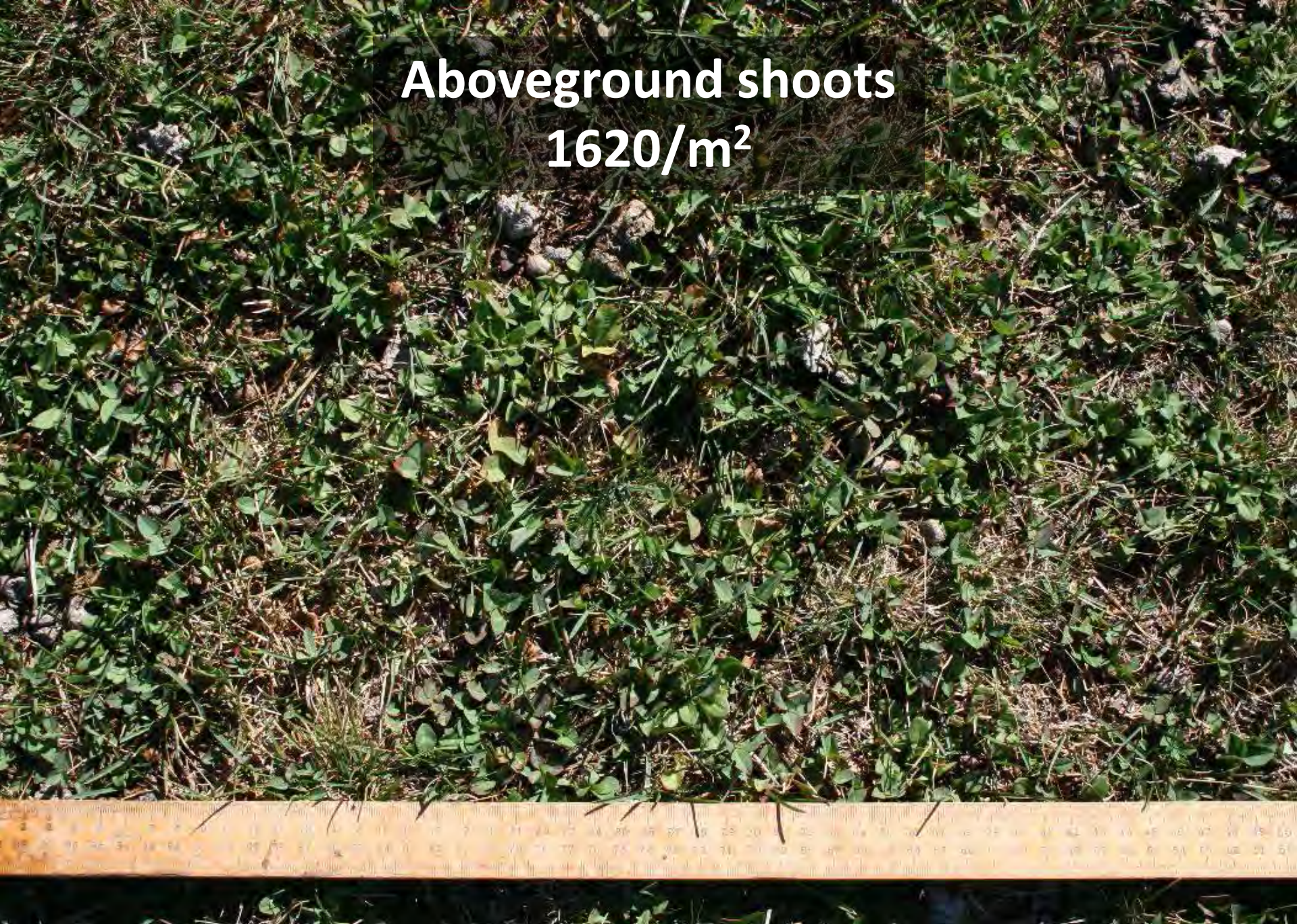
Summer 2014



A wide-angle photograph of a grassy field, likely a pasture or research site. The field is covered in green grass with some patches of brown, dry grass. In the background, a fence line runs across the middle ground, and beyond that, rolling hills or mountains are visible under a clear blue sky. The text "Autumn 2014" is overlaid in a white, bold font on a dark rectangular background in the upper center of the image.

Autumn 2014

**Aboveground shoots
1620/m²**



Biomass 5.1 t DM/ha
Taproots 9/m²



New stand of Cc

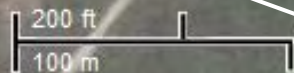
765 m a.s.l.

‘Native’

pH 5.5, Olsen P 7



- 1) 110 kg/ha super (nil N)
- 2) 100 kg/ha Cropmaster 20 (20 kg N/ha)



Super

Plot 1

Super

Plot 2

Crop20

Plot 3

Crop20

Plot 4

Super

Plot 5

Super

Plot 6

Crop20



Cc plants 11 weeks after sowing (Mar 2012)

	Starter N (kg/ha)		P value
	0	20	
Plants/m ²	45	43	NS
Shoot dry weight (mg)	6	17	<0.01
Nodulation†	1.0	1.2	<0.05
†1 = no nodules, 5 = abundant nodules			

11 weeks (Mar 2012)





11 weeks (Mar 2012)



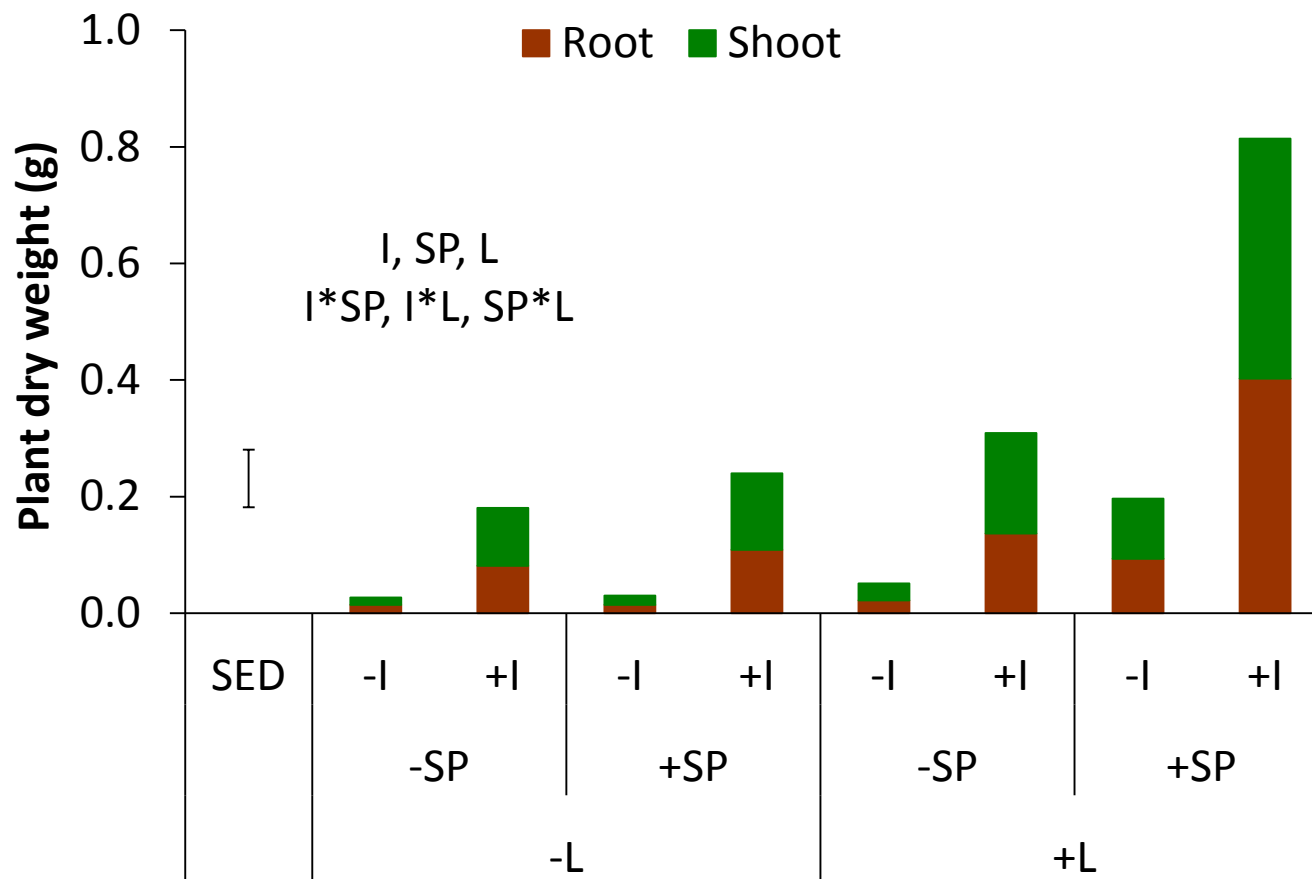
A photograph of a grassy field with mountains in the background. The field is covered with patches of green and brown grass. In the background, there are large, dark mountains under a blue sky with some clouds. A fence line is visible in the distance on the right side.

11 months (Nov 2012)

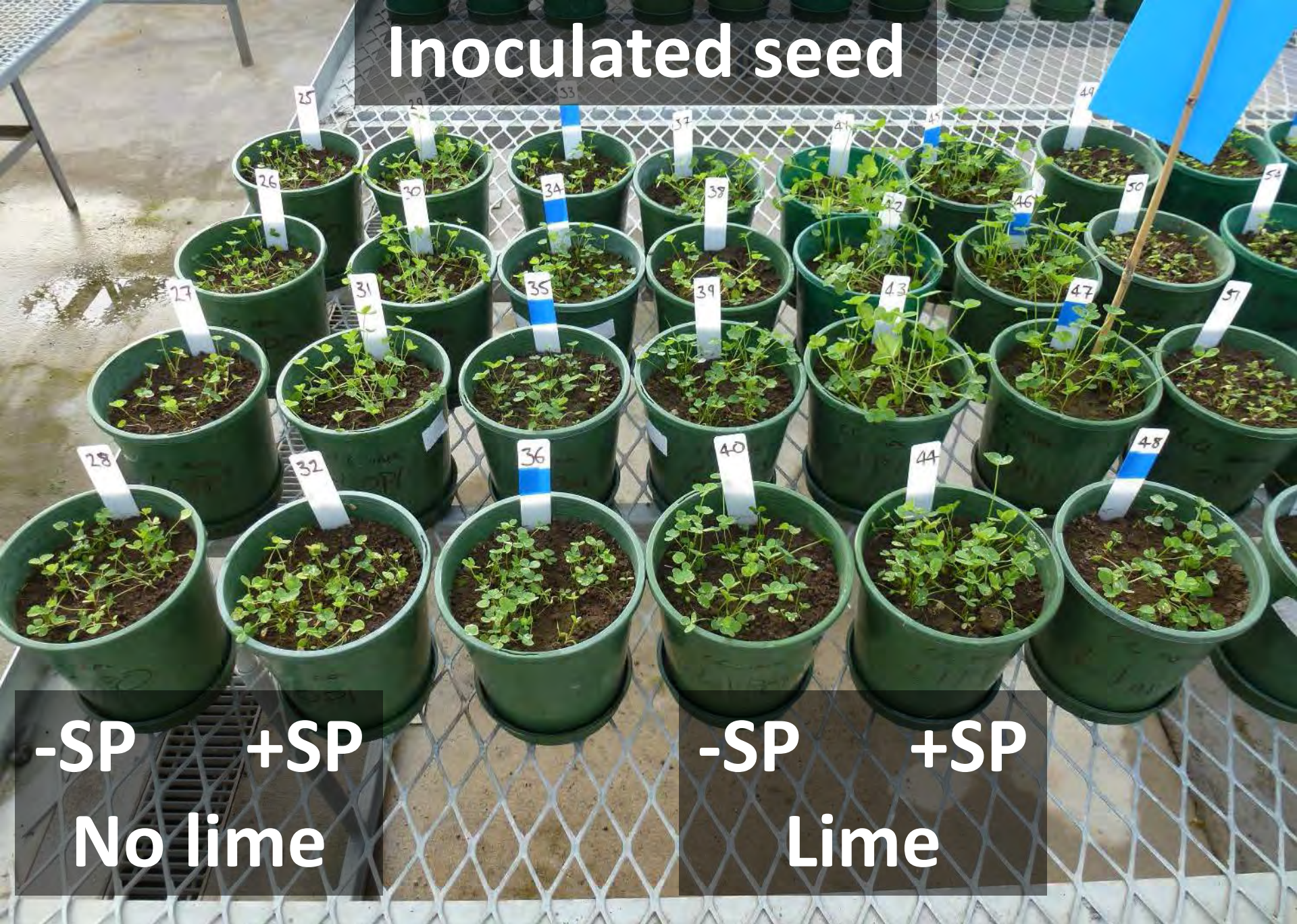
20 kg N/ha



Rhizobia effectiveness



Inoculated seed



-SP **+SP**
No lime

-SP **+SP**
Lime

Bare seed



-SP

+SP

No lime

-SP

+SP

Lime

Conclusions

1. Mature stand

- Persisted for 10 years without fertiliser since sowing
- 2400 and 1000 kg DM/ha of clover per year at this site
- Cc yield requires P and S as for other clovers

2. New stand

- Cc must be freshly inoculated with specific rhizobia
- Poor inoculation was not overcome by N fertiliser

