Lincoln University
Te Whare Wānaka o Aoraki
AOTEAROA • NEW ZEALAND

Dryland Pastures

7 July 2015

Professor Derrick Moot

Website: http://www.lincoln.ac.nz/dryland
Blog: https://blogs.lincoln.ac.nz/dryland/

New Zealand's specialist land-based university


Rain fed 300-800 mm
East coast - summer dry

By 2030 - Drier:

Drought – increased duration and frequency

Experiment site

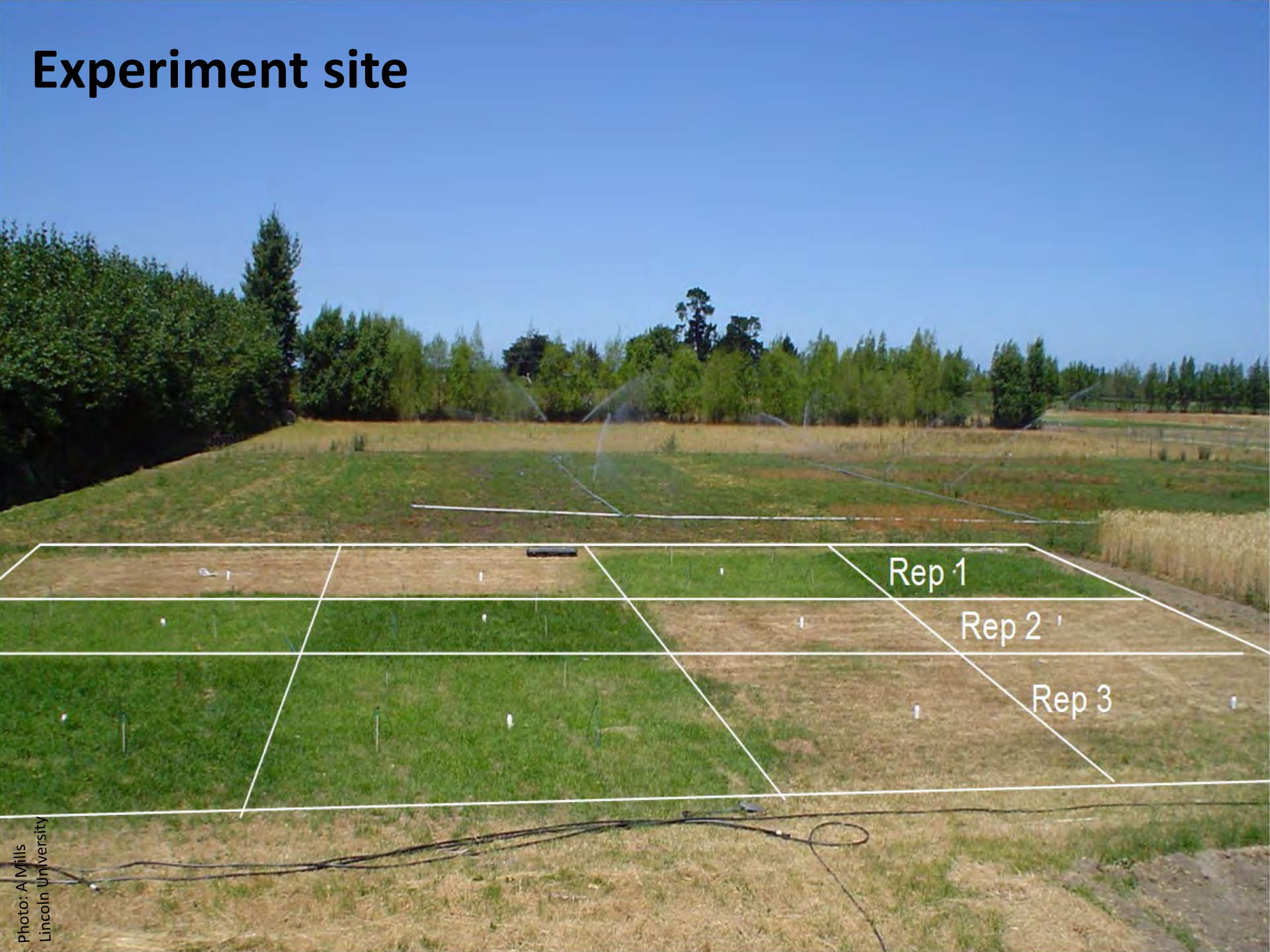
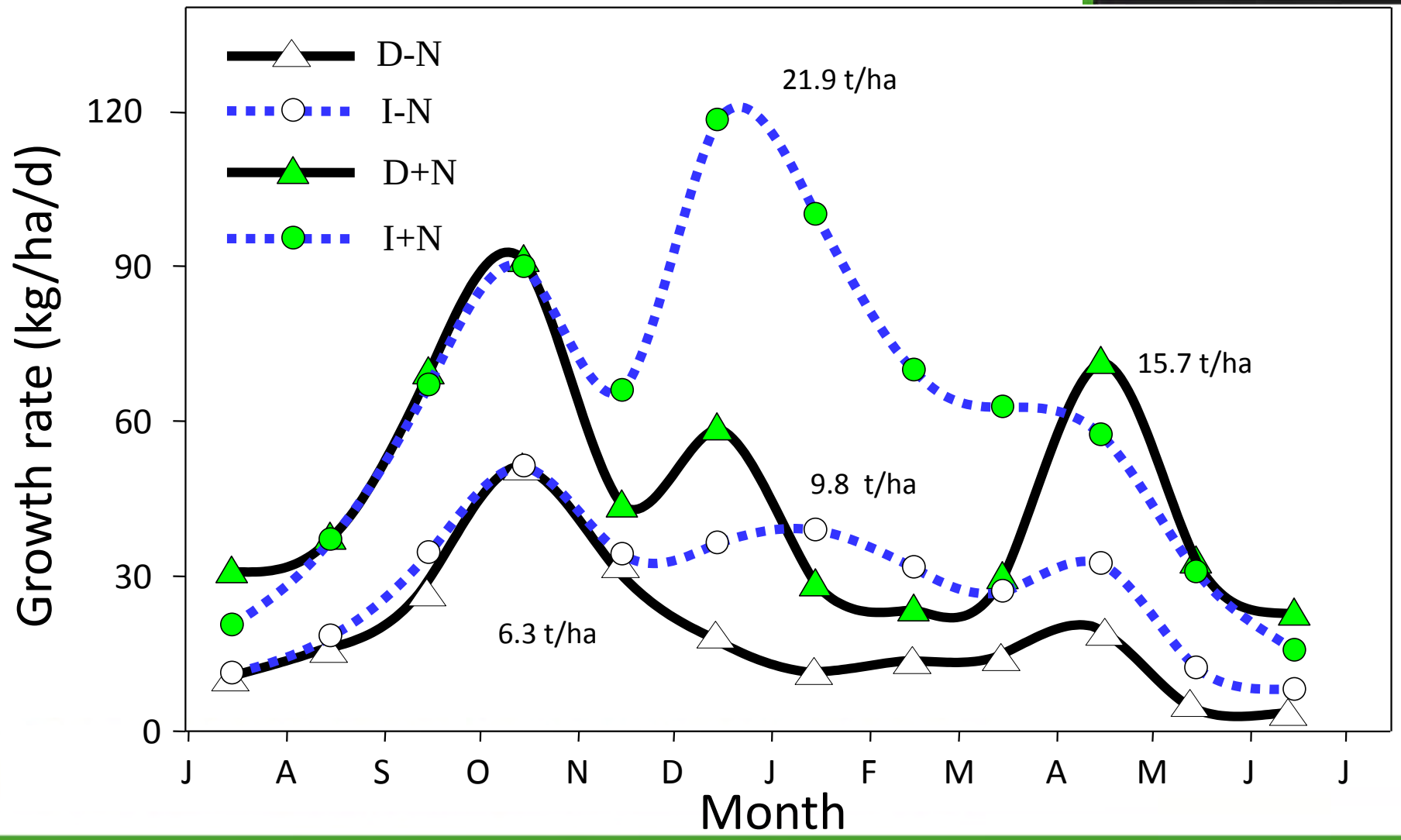


Photo: A Mills
Lincoln University

Growth rates (2 year means)



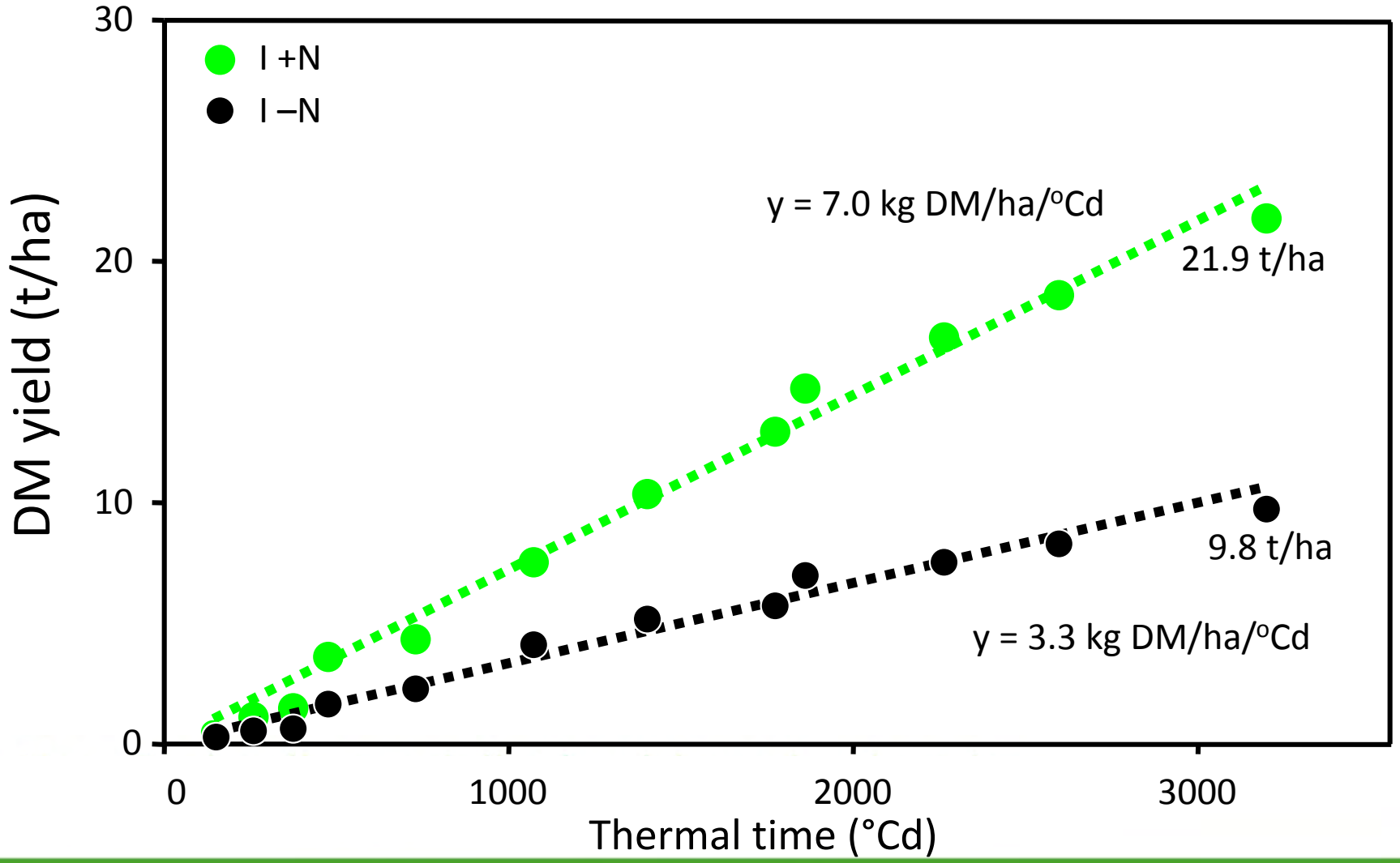
Mills *et al*. 2006, 2009

Winter

⇒ temperature response

Photo: KM Pollock
Lincoln University

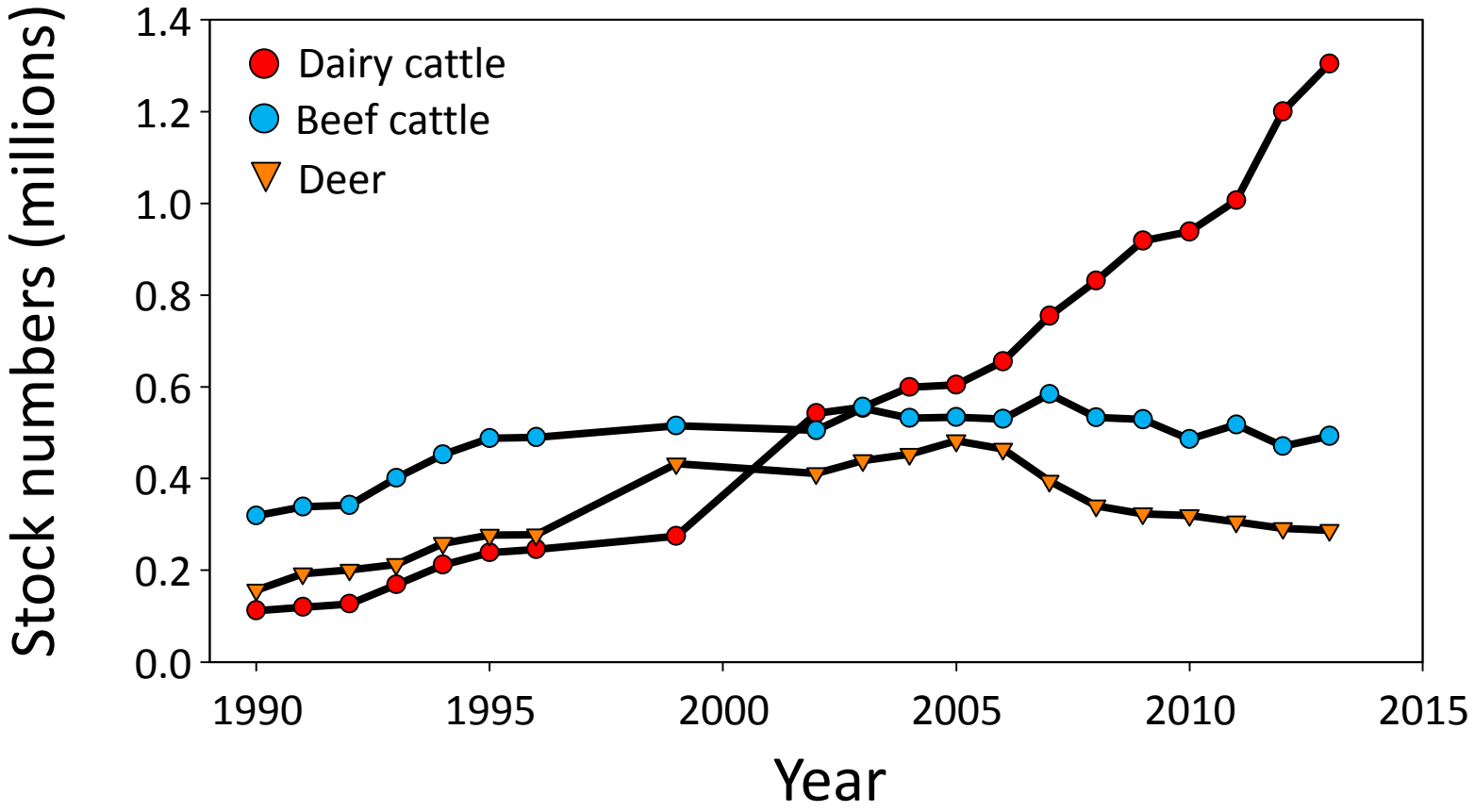
The Nitrogen gap



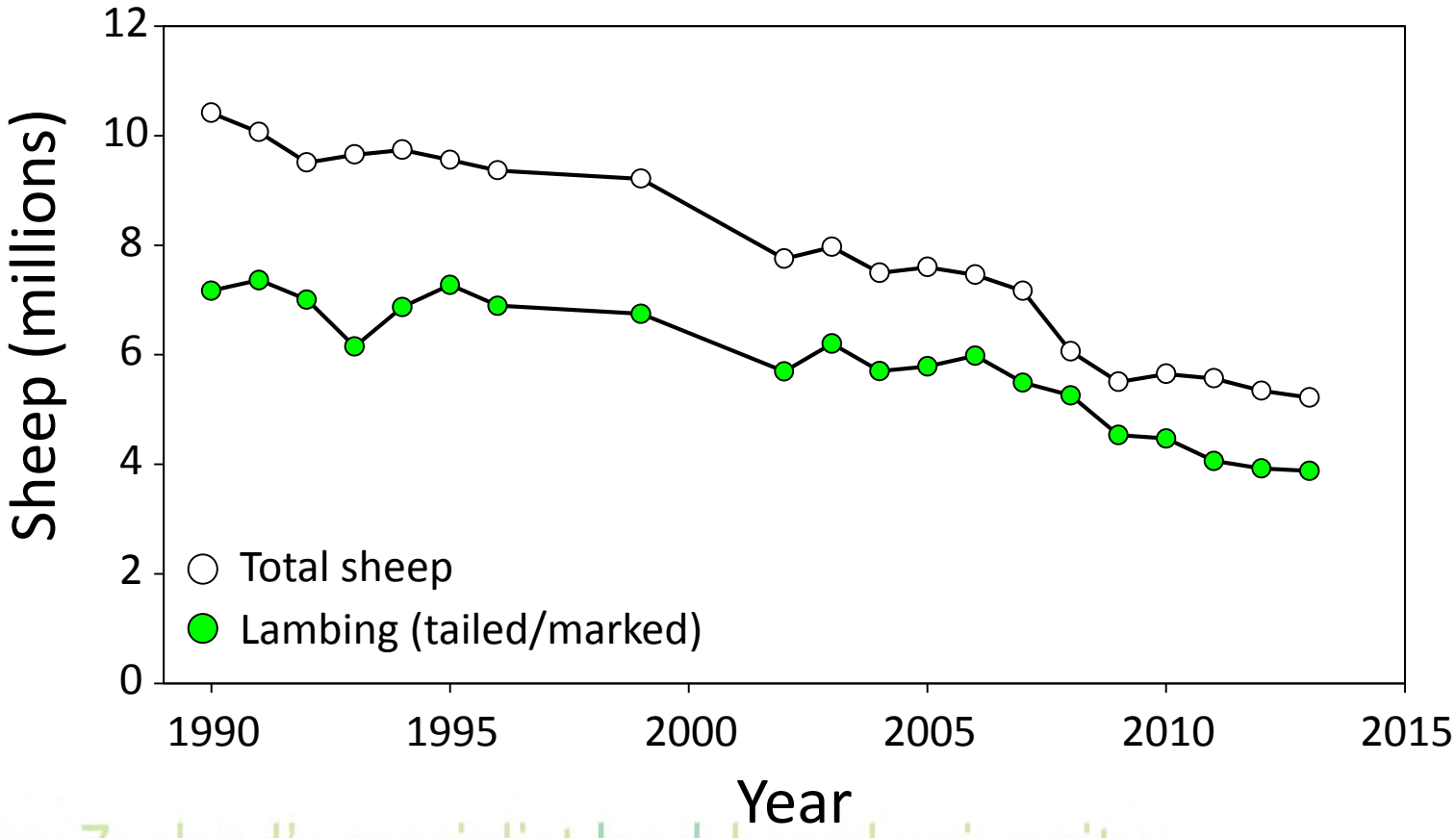
Mills *et al*. 2006; 2009

Water and nitrogen = ryegrass

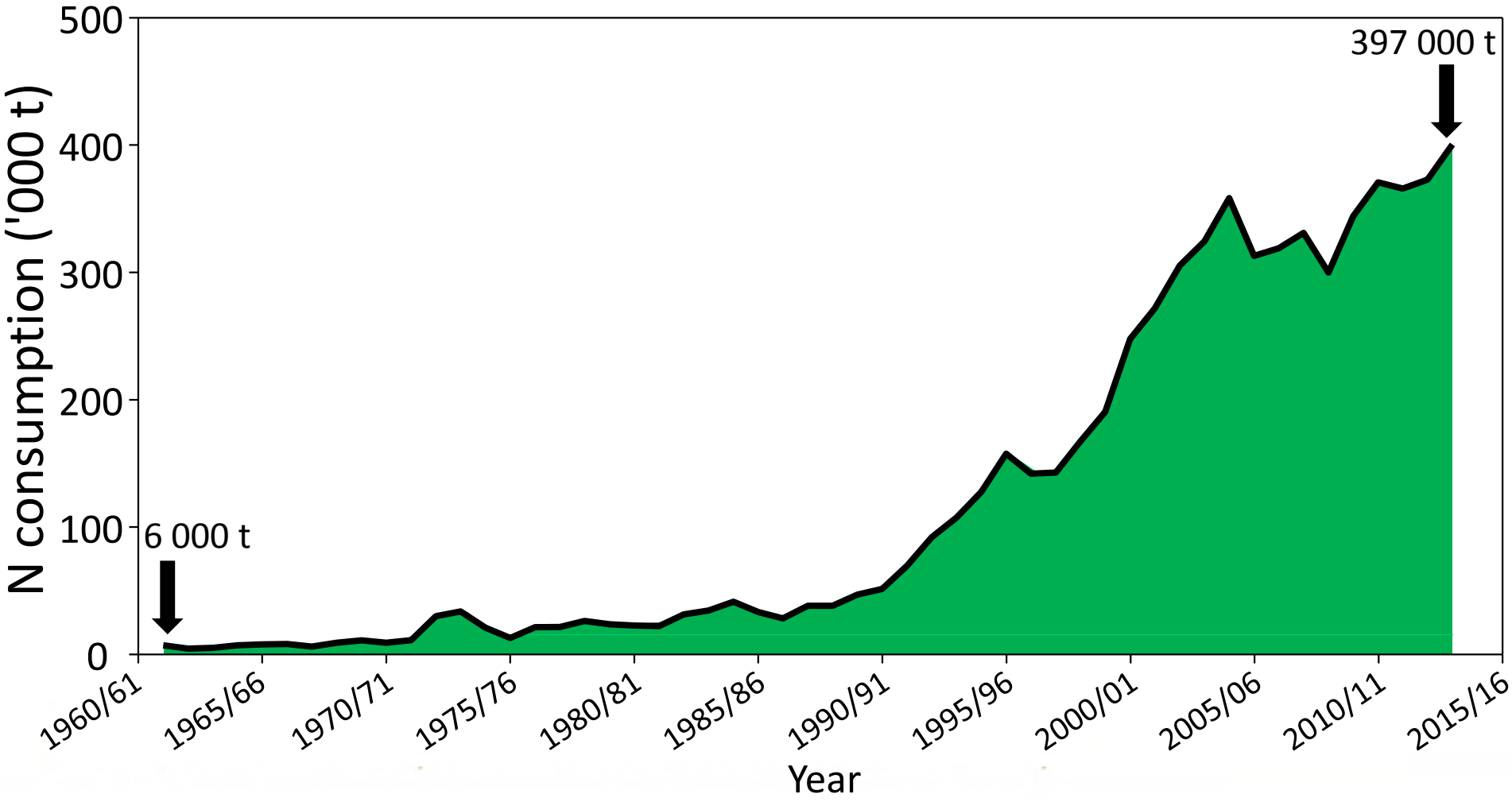
Cattle and deer numbers in Canterbury



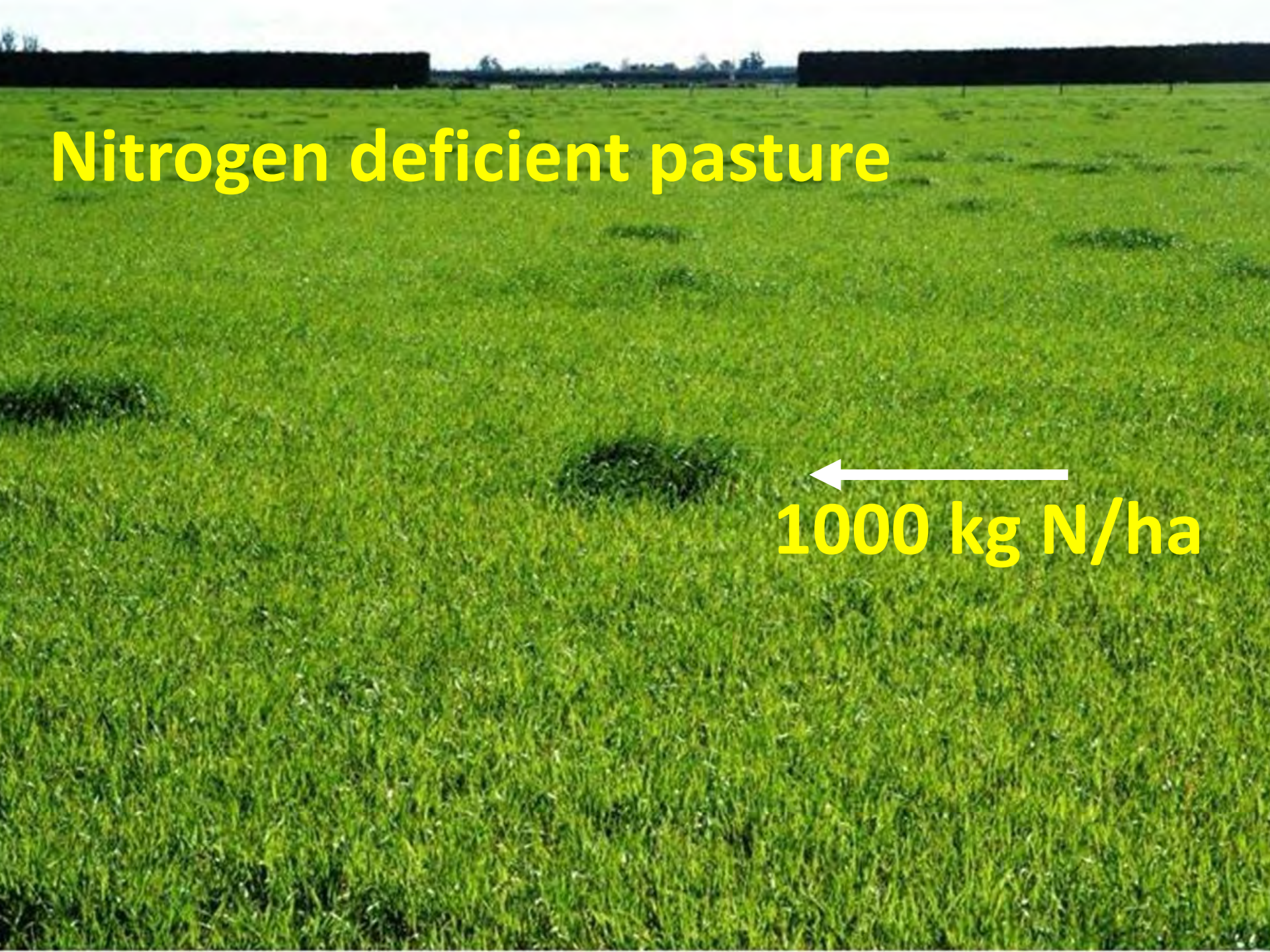
Sheep numbers in Canterbury



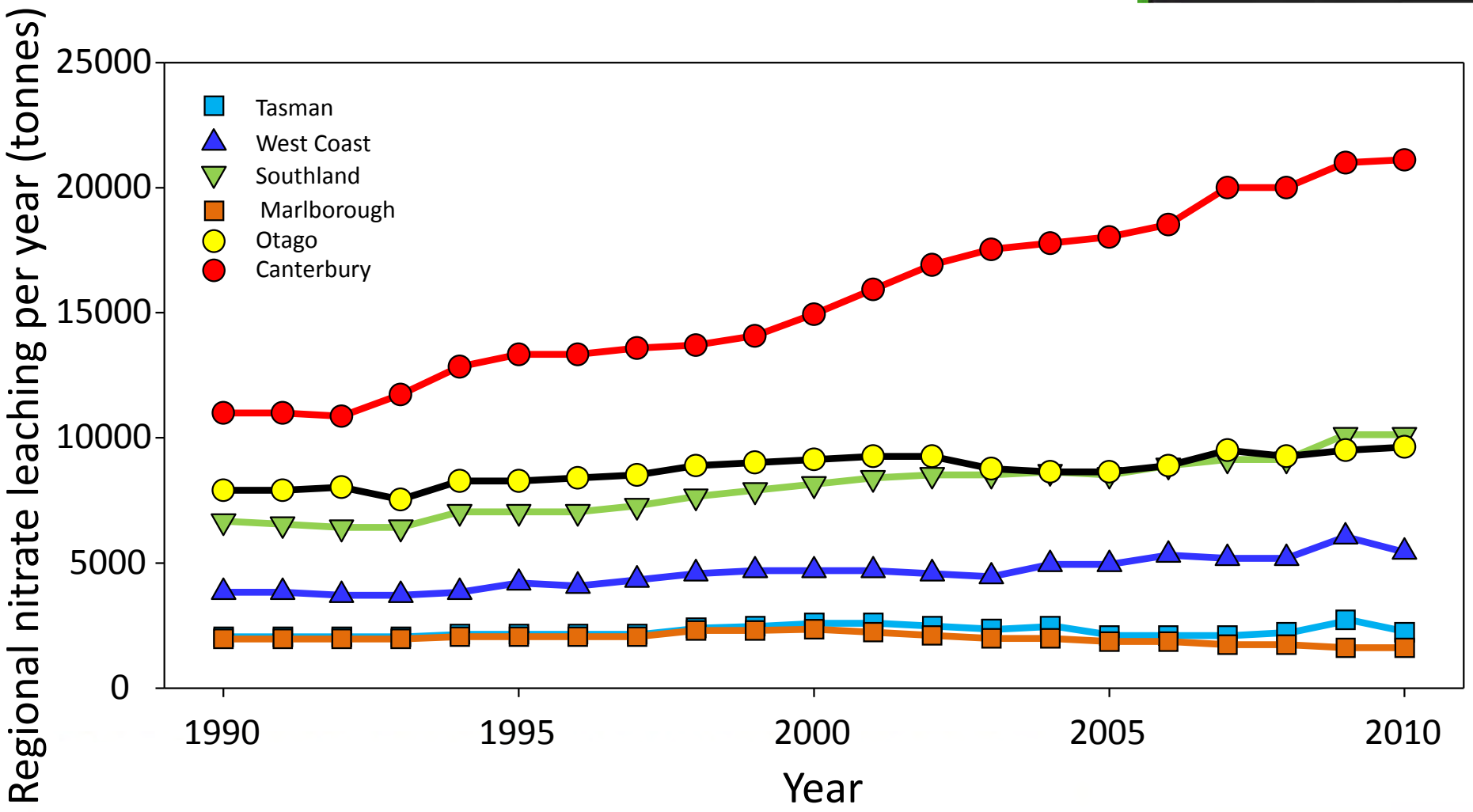
Nitrogen applied in NZ



NZ Fertiliser Association, 2015


Nitrogen deficient pasture
1000 kg N/ha

Regional annual nitrate losses



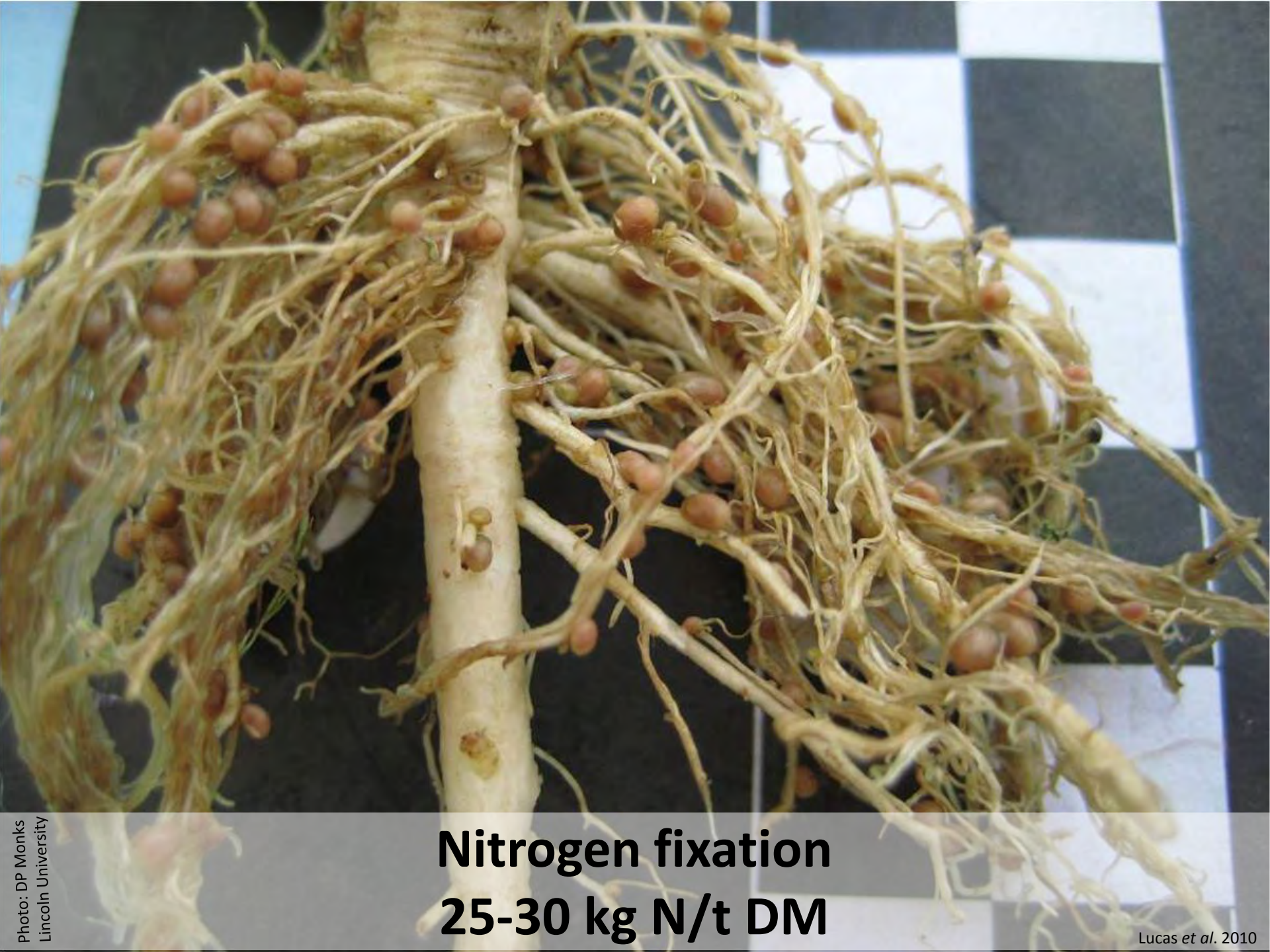
Redrawn from Dymond *et al.* 2013

High feeding value pastures have;

- **high legume content**
- **high leaf content**
- **low stem content**
- **young herbage age**

Sheep prefer 70% legume, 30% grass

Photo: Jo Grigg
Tempello, Marlborough



Nitrogen fixation
25-30 kg N/t DM

Photo: DP Monks
Lincoln University

Lucas *et al*. 2010

Photo: D Hollander
Lincoln University

Lincoln University
Te Whare Wānaka o Aoraki
AOTEAROA • NEW ZEALAND

Lucerne

~8 months after sowing

> 1.5 m length


Where to plant

Resilient drought-proofed landscape

SI Farmer of the Year 2010

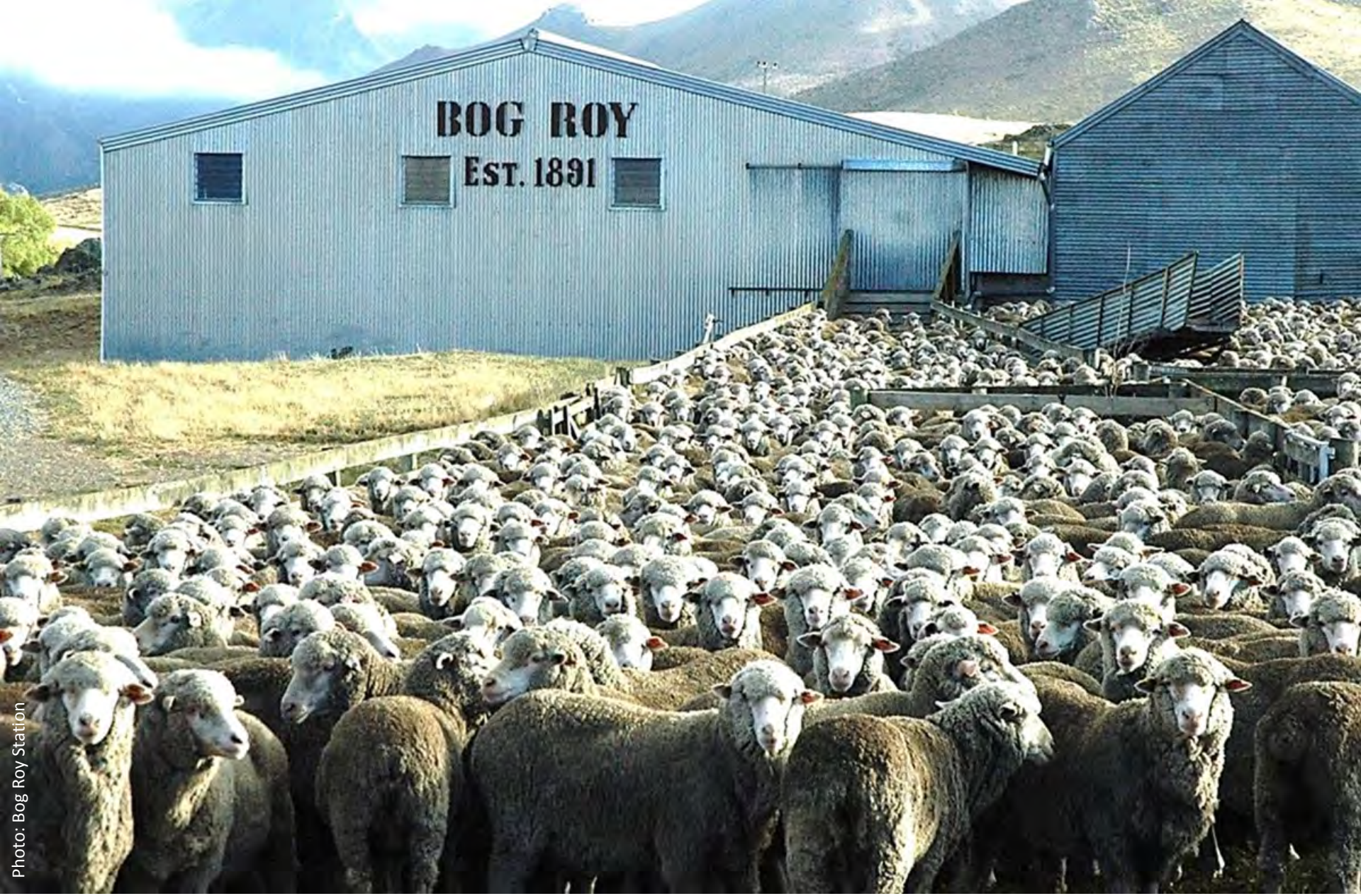


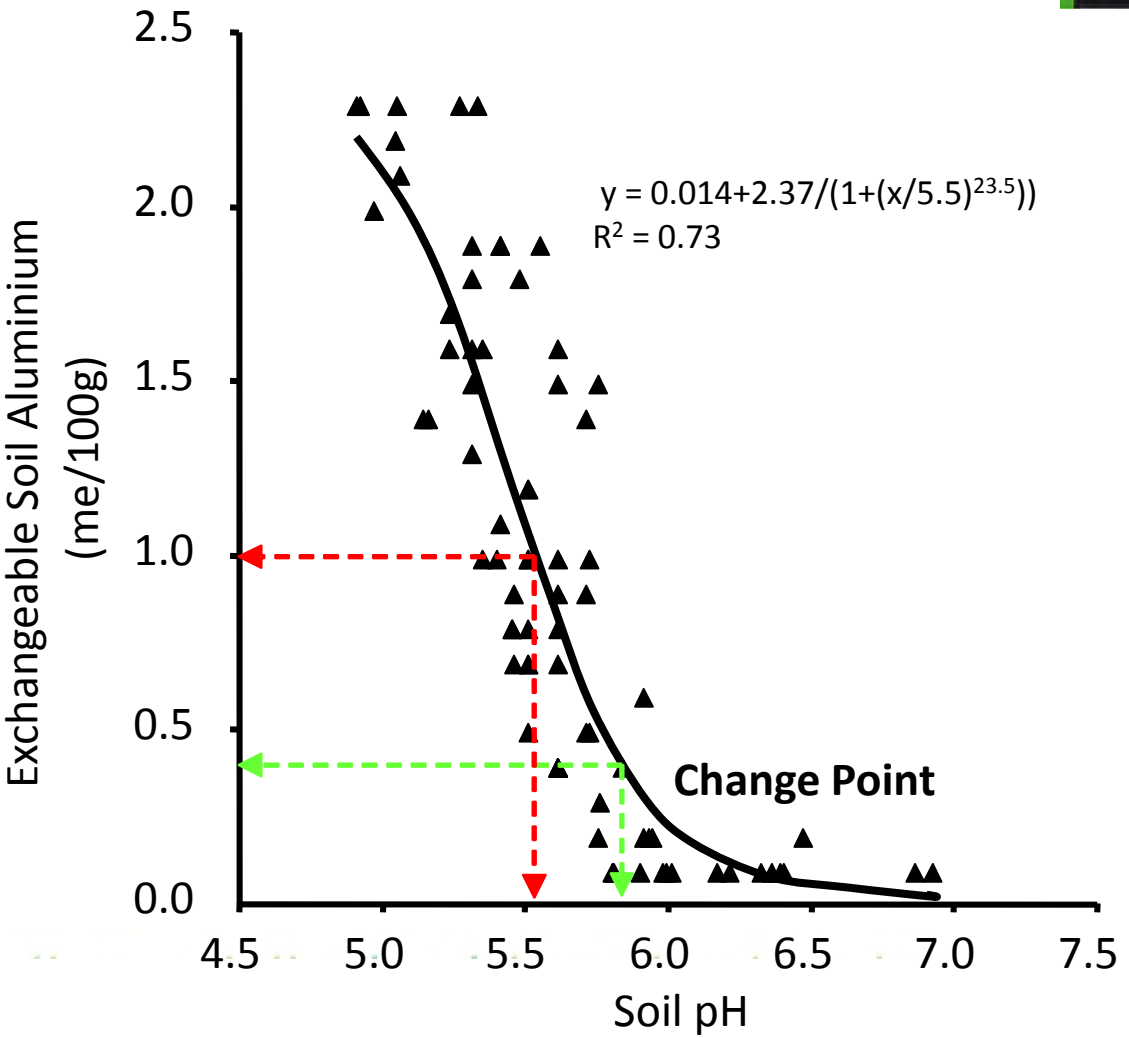
Photo: Bog Roy Station

New Zealand's specialist land-based university

Landscape farming

Photo: Bog Roy Station

Soil pH & exchangeable Aluminium



Moir & Moot, 2010


No Lime - Lucerne


Lucerne

Year 2: 1 October 2013

Year 2: 3 December 2013

9 December 2013 - 1200 Merino 2-tooths.

Year 2: regrowth to end of March 2014

Paddocks of lupin

- Sown December 2013
- After 1 year of ryecorn

31 October 2014


Dec 2012


Roots are functioning


Dec 2012
Deep taproot = summer survival
Root nodules = nitrogen fixation

References & Links

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

Lincoln University Dryland Pastures Blog: https://blogs.lincoln.ac.nz/dryland/

Anderson, D., Anderson, L., Moot, D. J. and Ogle, G. I. 2014. Integrating lucerne into a high country merino system. *Proceedings of the New Zealand Grassland Association*, **76**, 29-34.

Brown, H. E., Moot, D. J., Lucas, R. J. and Smith, M. 2006. Sub clover, cocksfoot and lucerne combine to improve dryland stock production. *Proceedings of the New Zealand Grassland Association*, **68**, 109-115.Carberry, P. S. 2001. Are science rigour and industry relevance both achievable in participatory action research? *In*: B. Rowe, D. Donaghy, N. Mendham (Eds.). "Science and Technology: Delivering Results for Agriculture?". Proceedings of the 10th Australian Agronomy Conference, January 2001, . 29 Jan - 1 Feb 2001, Hobart, Tasmania. Australian Agronomy Society. Online: http://www.regional.org.au/au/asa/2001/plenary/2005/carberry.htm#TopOfPage.

Cosgrove G. 2005. Novel grazing management: making better use of white clover. Proceedings of the 2005 SIDE Conference.

Department of Statistics. 2015. Agriculture Variable by Regional Council. Date Accessed: 22/6/2015. http://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TABLECODE7423#. Last Updated: Not Specified.

Dymond, J. R., Ausseil, A. G. E., Parfitt, R. L., Herzig, A. and McDowell, R. W. 2013. Nitrate and phosphorus leaching in New Zealand: a national perspective. *New Zealand Journal of Agricultural Research*, **56**, 49-59.

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.

Lucas, R. J., Smith, M. C., Jarvis, P., Mills, A. and Moot, D. J. 2010. Nitrogen fixation by subterranean and white clovers in dryland cocksfoot pastures. *Proceedings of the New Zealand Grassland Association*, **72**, 141-146.

Mills, A. 2007. Understanding constraints to cocksfoot (*Dactylis glomerata* L.) based pasture production, PhD thesis, Lincoln University, Canterbury. Online access: http://researcharchive.lincoln.ac.nz/dspace/bitstream/10182/32/1/mills_phd.pdf. 202 pp.

Mills, A., Moot, D. J. and Jamieson, P. D. 2009. Quantifying the effect of nitrogen of productivity of cocksfoot (*Dactylis glomerata* L.) pastures. *European Journal of Agronomy*, **30**, 63-69.

Mills, A., Moot, D. J. and McKenzie, B. A. 2006. Cocksfoot pasture production in relation to environmental variables. *Proceedings of the New Zealand Grassland Association*, **68**, 89-94.

Moir, J. L. 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. and Avery, D. 2013. Sustainable intensification of livestock grazing systems in low rainfall regions of New Zealand. *In*: First International Conference on Global Food Security, 29 September - 2 October 2013, Noordwijkerhout, The Netherlands. Elsevier Ltd. p O3.O3 (4 pgs).

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.

New Zealand Fertiliser Manufacturers' Research Association. 2011. Annual update (New Zealand Fertiliser Manufacturers' Research Association). 15 pp. Date Accessed: 5/5/2011. http://www.fertresearch.org.nz/resource-centre/annual-updates. Last Updated: Dec 2009.

NIWA. 2014. CliFlo Database - National Climate database. Date Accessed: 31/08/14. http://cliflo.niwa.co.nz/. Last Updated: Not Specified.