Soil pH, Exchangeable Aluminium and Lucerne Yield Responses to Lime in a South Island High Country Soil

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Lucerne: November 2009

Canterbury Plains

Canterbury High Country

Horizontal Lucerne Roots: Canterbury High Country, Lees Valley

Background

- Island hill country is typified by a short, often soil moisture limited growing season

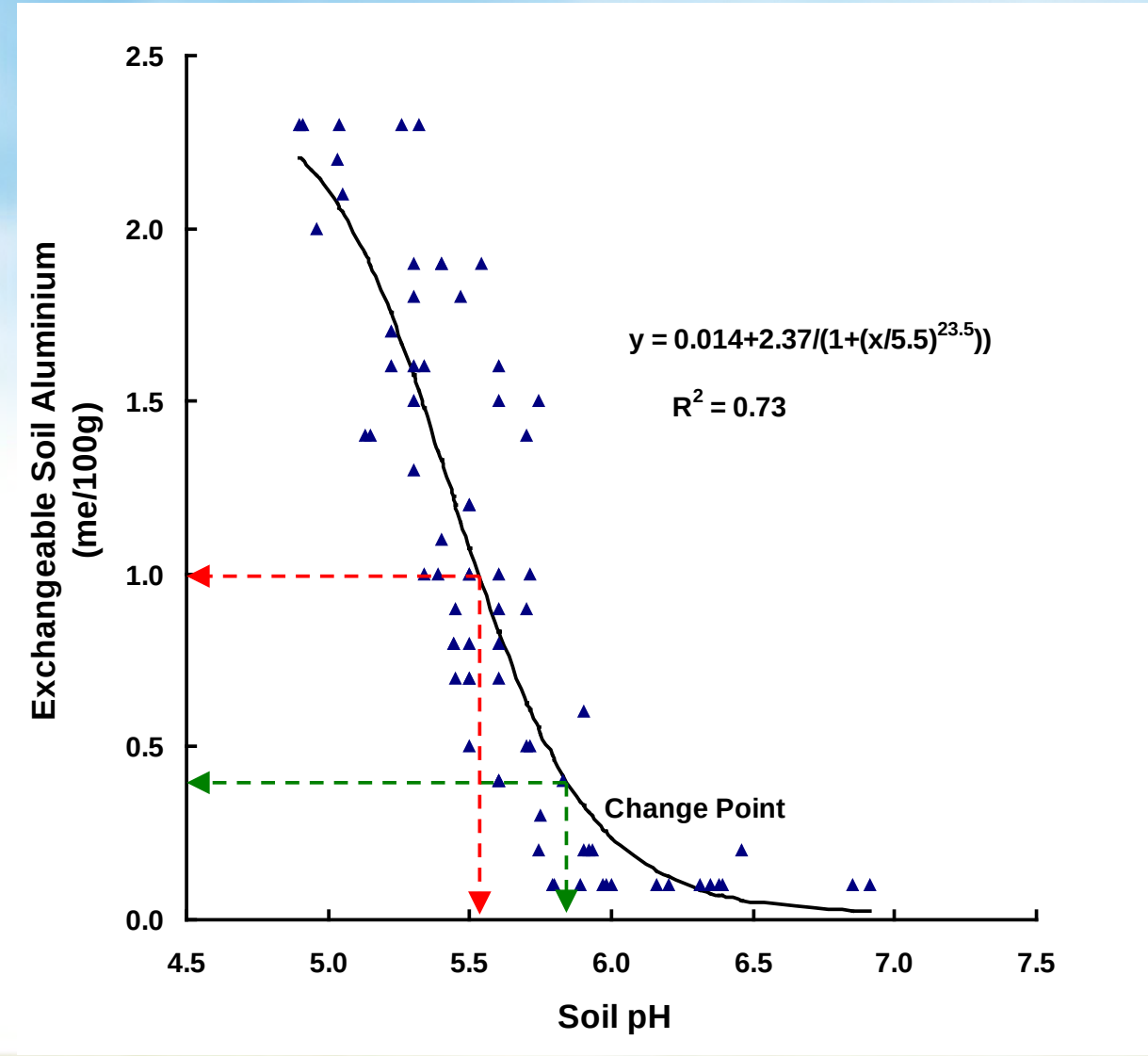
- The deep-rooting nature of lucerne has highlighted this species as being high-value in dryland environments

- However, many high country soils have low soil pH and possibly high exchangeable soil Al
  - Lucerne is intolerant of soil acidity and is sensitive to Al toxicity

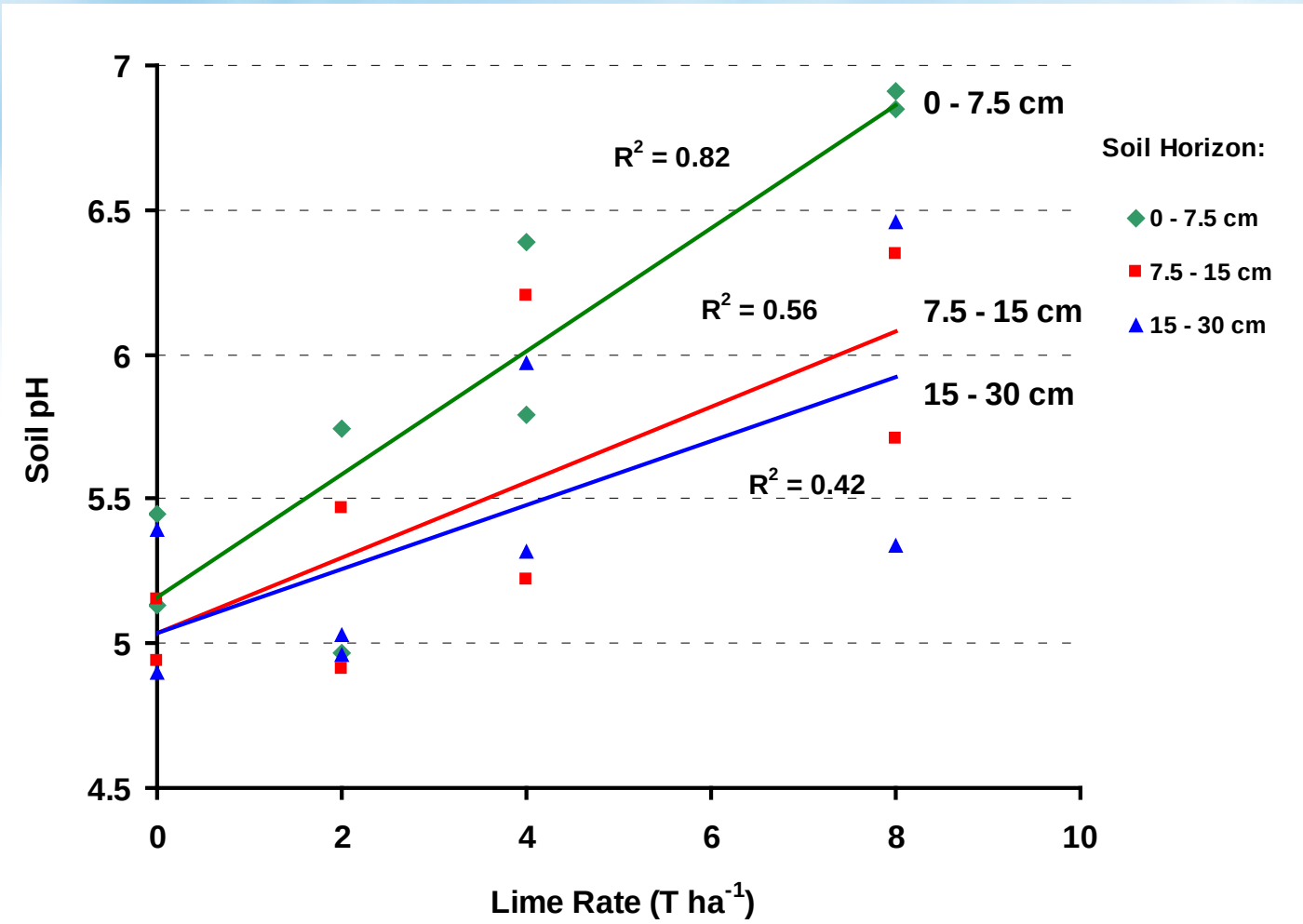
Methods

- Lees Valley, North Canterbury (430 m.a.s.l.; 600 mm annual rainfall; High country Brown soil)
- Trial site: 16 x (10 x 20) m plots, Treatments = standard 'AgLime' ($CaCO_3$) or 'Quicklime' (CaO), at 4 rates (0, 2, 4 and 8 t/ha) in March 2008
- Plots soil sampled, at 3 depths, to 30 cm in October 2008
- Soils samples analysed for pH & exchangeable Al
- Lucerne cv. 'Grasslands Kaituna' direct-drilled (14 kg ha^{-1} of coated seed) in December 2008
- Lucerne DM yield measured at regular intervals over 2 years on all plots using a 'pasture capacitance probe' calibrated to DM cuts at each measurement

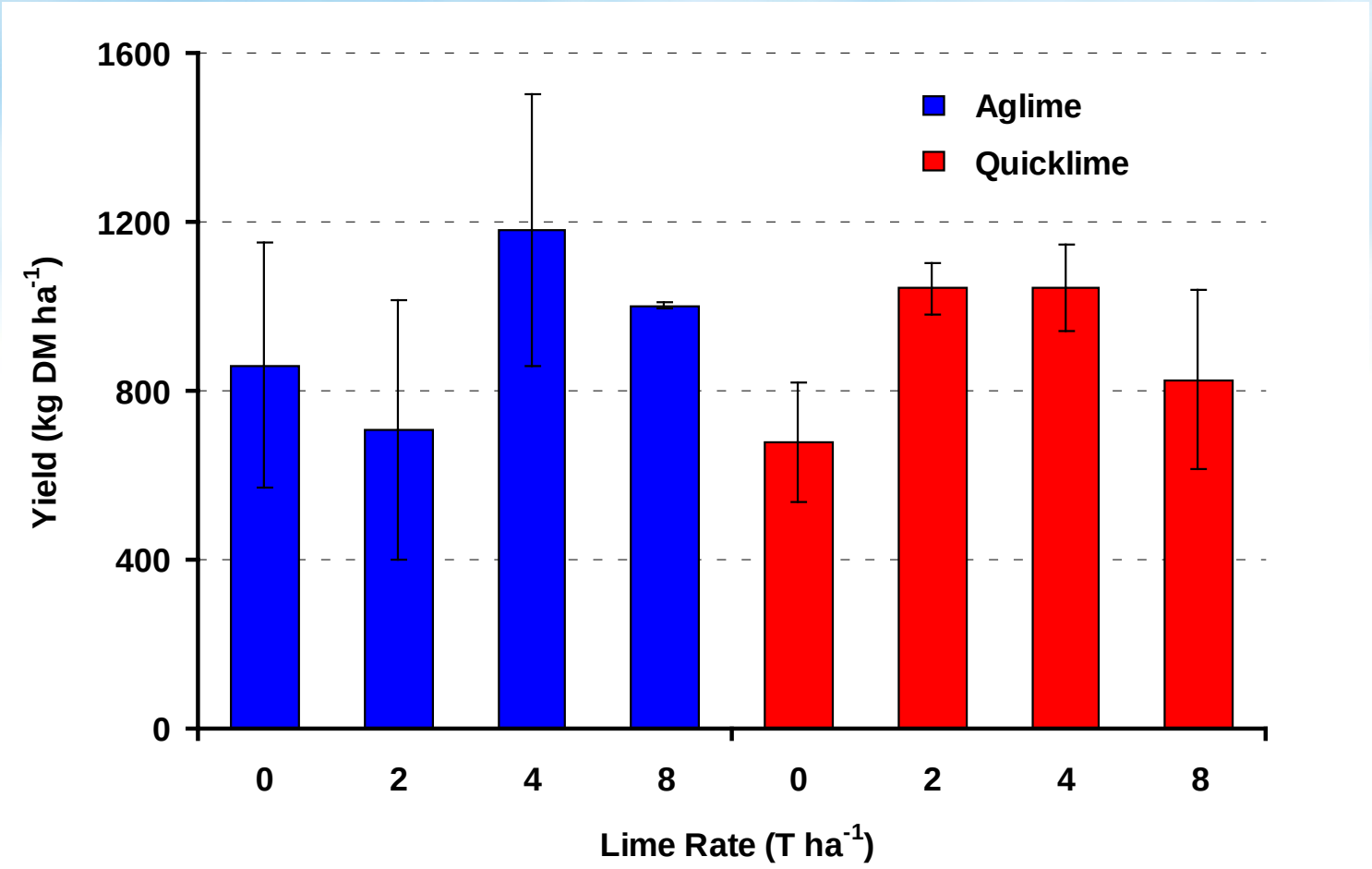
Relationship Between Soil pH & Exchangeable Soil Aluminium



Lime Rate, Soil pH & Horizon Relationships (Quicklime)



Lucerne Yields: 19.3.09



Why are soil pH / yield relationships variable at this site?

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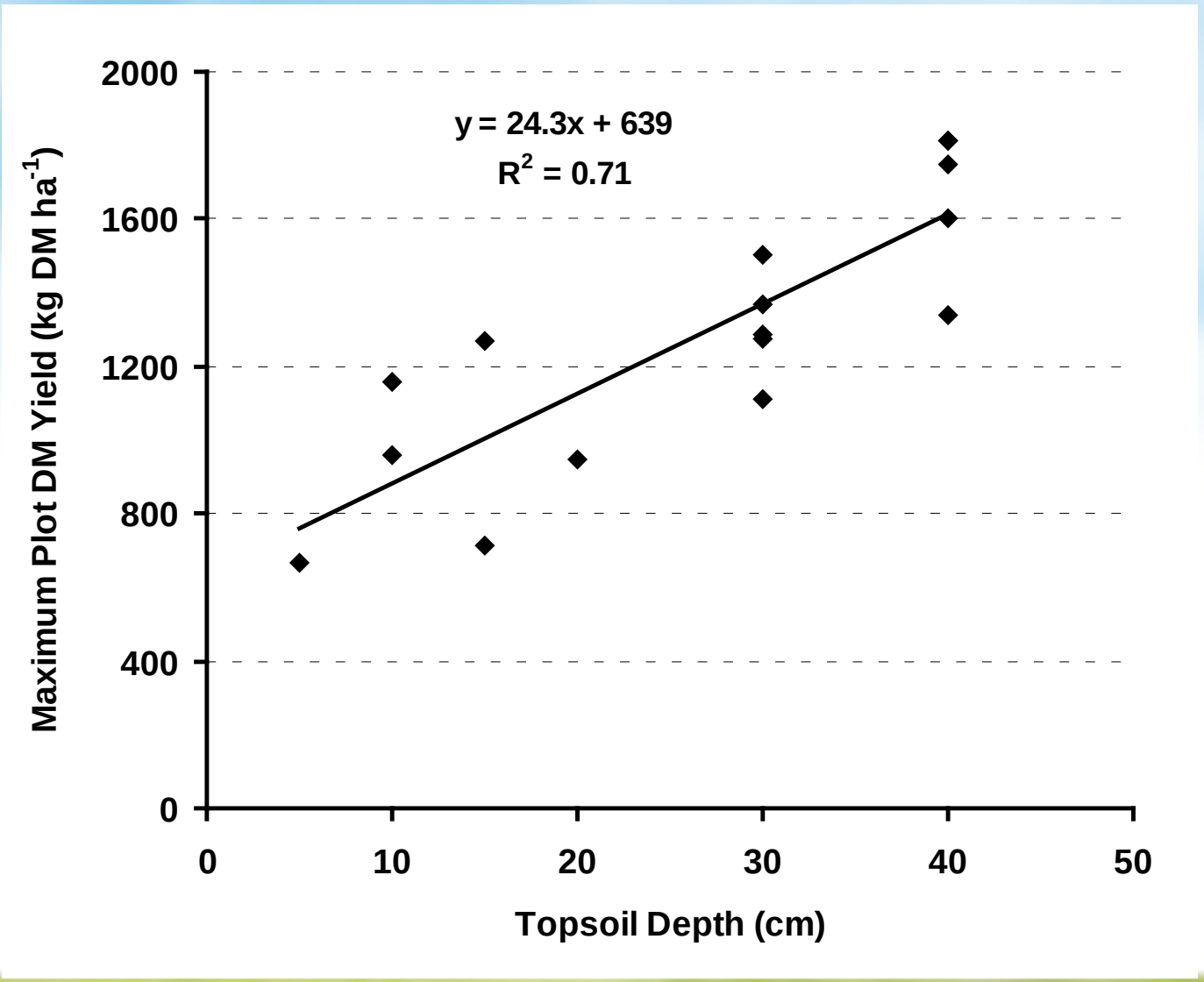
Relationship Between Topsoil Depth & Lucerne Yield



Conclusions:

- Soil pH was strongly related to levels of soil plant-available aluminium
- Liming increased soil pH and reduced soil plant-available aluminium
  - less effective at depth (15 – 30 cm)
- Higher rates of lime were more effective, though data were variable
- So far; Soil pH and Al levels were not related to lucerne yield (variability in topsoil depth?)

Where to from here?

- Long-term measurements at Lees Valley; soil indices, yield, plant analyses
- Examine other species; Perennial and Annual clovers
- Detailed climate-controlled studies; pH, P, Al, Mo, rhizobium

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