

Legumes for Hill Country



Derrick Moot



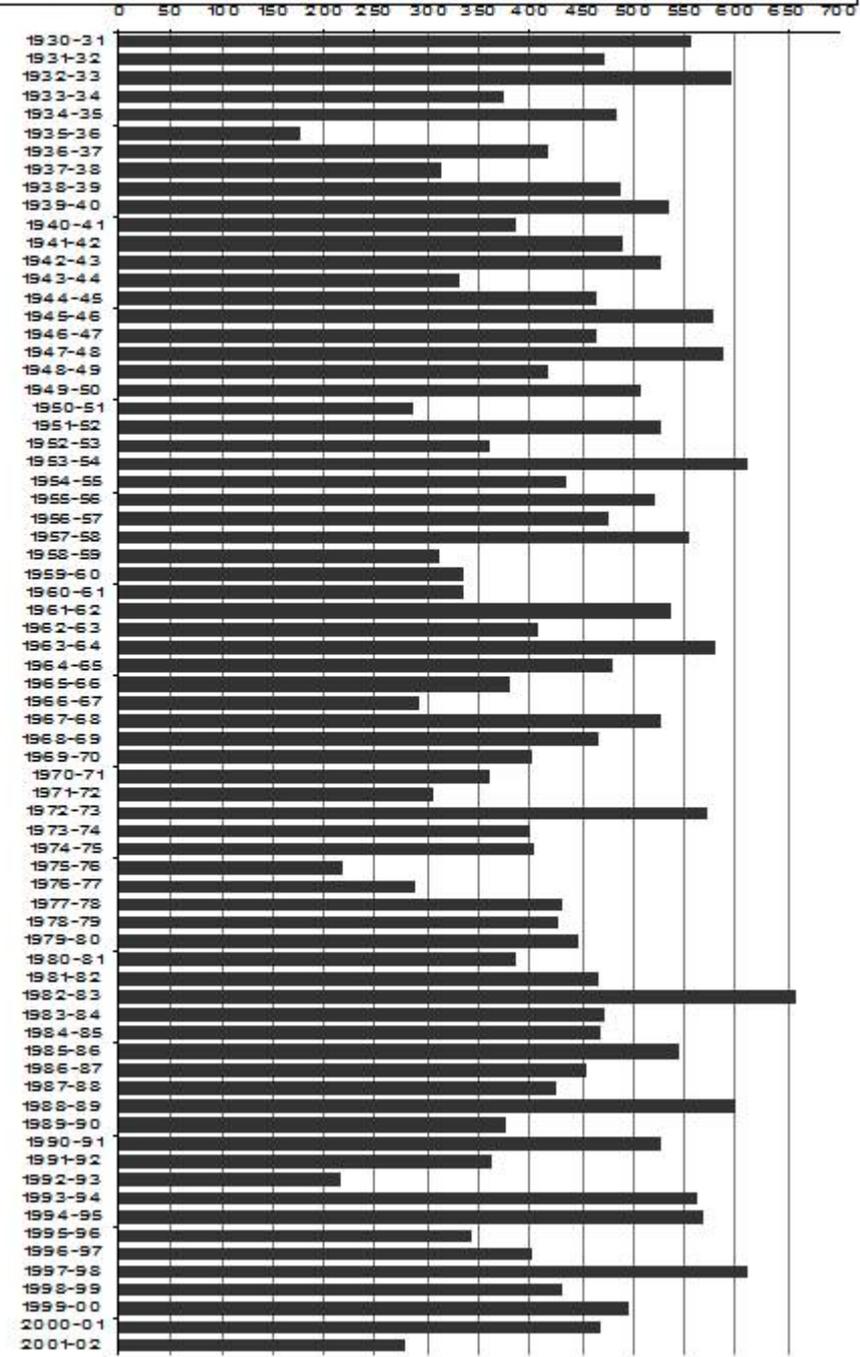
**Lincoln
University**

Te Whare Wānaka o Aoraki

CHRISTCHURCH • NEW ZEALAND

New Zealand's specialist land-based university

■ NAPIER NELS PK: Potential deficit (mm), July-June



Dryland – Hawke’s Bay

Napier average PSMD 444 mm

120 mm to over 650 mm in 1982/83

Significant PSMD (> 100 mm) in over 85% of years by 1 Dec.

Severe PSMD (> 150 mm) in 55% of years by 1 Dec.

(Source: Salinger 2003)



Need N to improve grazing of other grasses

4 S's of hill country development

1) Subdivision – *most important*

2) Stock – *to control additional feed*

3) Super – *for legumes*

4) Seed – *not a silver bullet!*



Photo: Derrick Moot
Lincoln University



Photo: Derrick Moot
Lincoln University

**Growth in the field
white clover
20 months old
– grazed by sheep**



Source: Brock *et al.* 2003

Photo: Keith Widdup
Agresearch



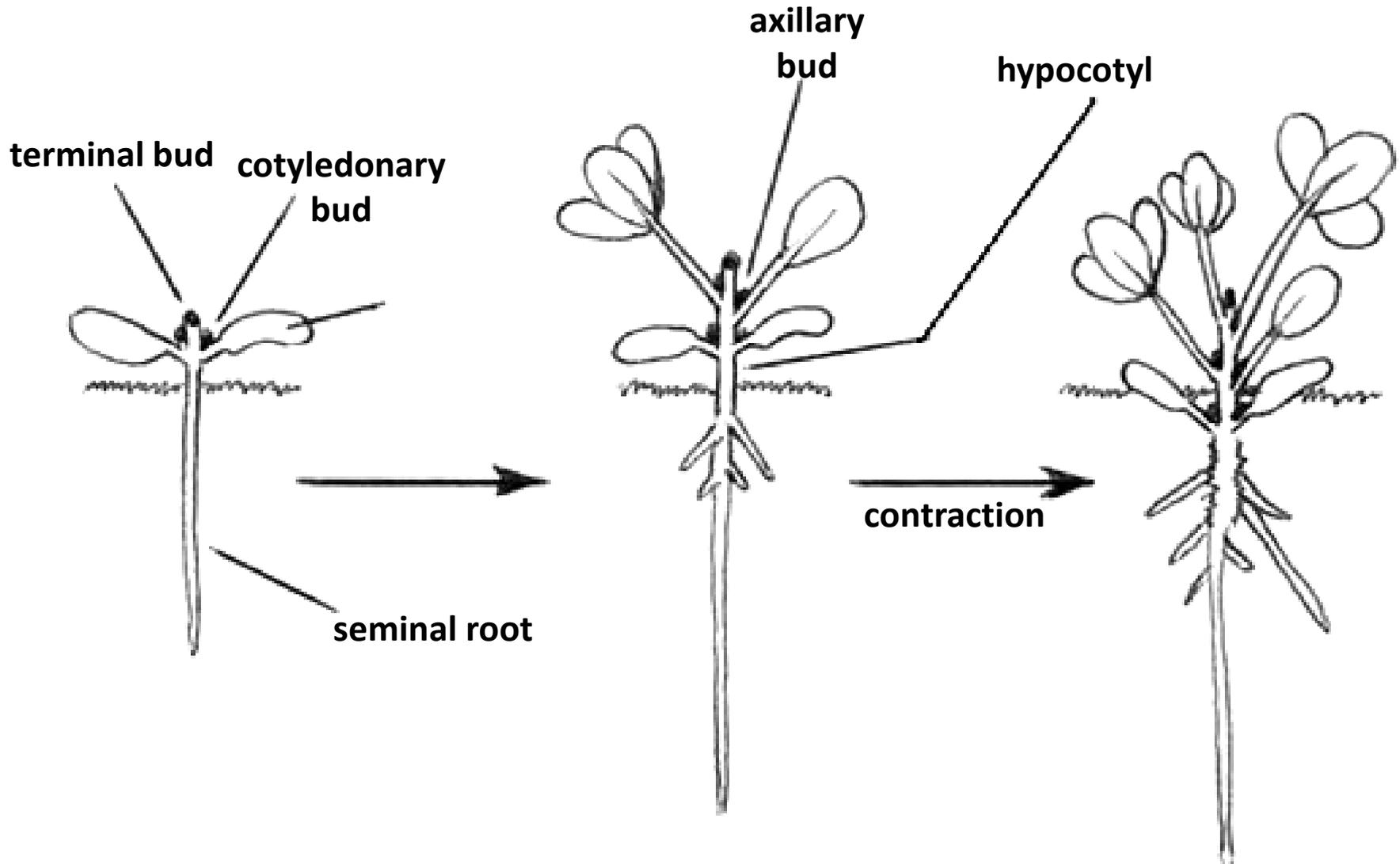
Subterranean Clover

- Large seed, 10x wc therefore 10x sowing rate
- Winter annual

autumn sow soil temp. <11°C

- Rapid but variable germination with rainfall from Jan-May
- When can seedlings be grazed in autumn?
- How to maximize summer seed set?

Seedling Development





- **Direct drill before rain**
- **Initial population for seed build up**



Autumn Management in later years

(200 seedlings/m² in pasture)

High strikes after extended hot periods

- bare ground for seedlings to establish in*
- high temperatures break dormancy*

January rains are often false break

- seedlings die (March is usual)*

Amount of cover in autumn is crucial



Photo: Tom Costello
Hawarden

1 April 2003



Photo: Tom Costello
Hawarden

5 April 2003



Photo: Tom Costello
Hawarden

9 April 2003



Photo: Tom Costello
Hawarden

12 April 2003

Seedling density is what gives us fast recovery



Photo: Tom Costello
Hawarden

1 May 2003

Source: Costello & Costello 2003



seedling

Photo: Tom Costello
Hawarden

Photo: Andrew Harris



Nth Canterbury – 12/03/12

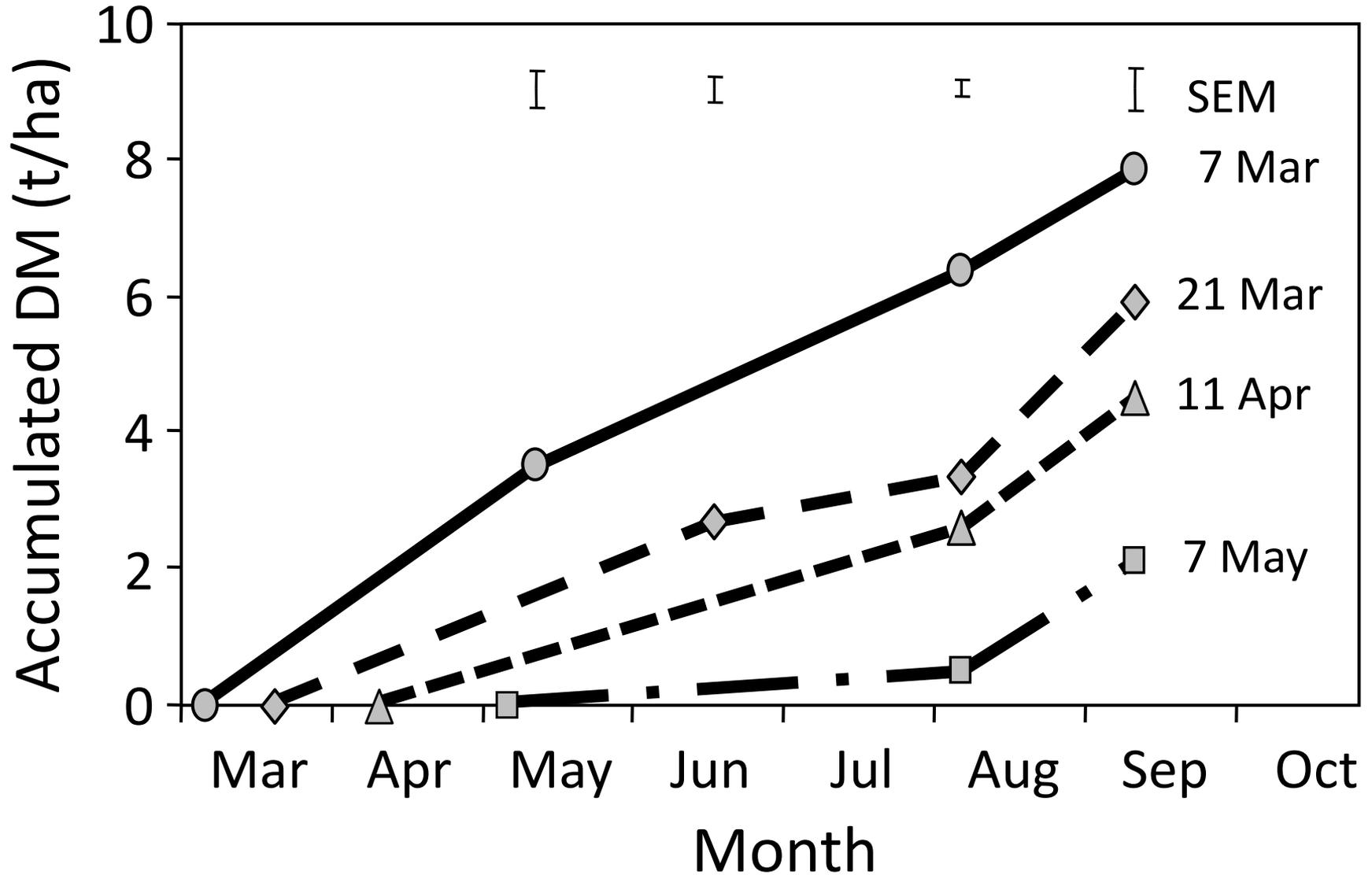
Time (days) to safe grazing of subterranean clover

PGPM >800 kg DM/ha

Date of opening rain

Location	1-Feb	1-Mar	1-Apr	1-May
Lincoln	26	29	37	53
Alexandra	26	30	46	102
Blenheim	25	27	34	47
Napier	23	25	30	39

Dry matter yields



Subterranean Clover



Photo: Tom Costello
Hawarden

20 Oct 2003

Source: Costello & Costello 2003

Takes several years to build seed reserves

Photo: Tom Costello
Hawarden

27 Oct 2003

Source: Costello & Costello 2003

Drilled pasture mix

8 kg AR1/AR37 perennial ryegrass

10 kg subterranean clover

early and late flowering cultivars

1½ kg white clover

1 kg cocksfoot

Hill country = 10 kg/ha sub. alone

Subterranean clover tool kit

- Autumn sowing (10 kg/ha = 150 seeds/m²)
- Difficult to oversow – manage current population
- “Finger and thumb” test - minimal seedling failure at six-leaf stage (~30 days after rain)
- Manage for seed set in 3-5 years (2000/m²)
 - light-moderate set-stock in spring PGPM >1200
 - cattle are great
 - flowering ~ 80 days before summer dry
 - hard graze cover before autumn rain PGPM=800

Balansa clover + annual forages



'Bolta' balansa clover: 25th Sept '06



Flowering is essential in estab. year



End of summer must have 50% bare





Photo: Evan Gibson

21 Feb

Build seed bank in first year



Early flower – late Sept



Late flower – mid Oct



Seed maturing – early Nov



Mature seed – late Nov

Gland clover

Photo: Kiwiseeds Ltd
Marlborough



Photo: Derrick Moot
Lincoln University



SFF Dryland Legume Tech Transfer

'Breach Oak' Seddon

**Unimproved,
resident hill pasture**



Photo: Warwick Lissaman

SFF Dryland Legume Tech Transfer

'Breach Oak' Seddon

Improved
pasture



Photo: Warwick Lissaman

SFF Dryland Legume Tech Transfer

'Breach Oak' Seddon

	Unimproved	Improved	Change
Ewe Tally (ha)	3.6	4.1	
Ewe tally (twin)	22 Ewes	30 Ewes	
Set Stocking rate (ewes/ha)	6.1	7.3	+1.2 ewes/ha (+20%)
Ewe LW (kg/hd) in (15/8/11)	74	72	-2.0 kg/hd
	452 kg/ha	525 kg/ha	+73 kg/ha
Ewe LW (kg/hd) out (18/10/11)	68	76	+ 8 kg/ewe
	415 kg/ha	550 kg/ha	+ 135 kg/ha
Avg. Condition score (18/10/11)	2.7	3.8	+ 1.1 C.S.
Lamb LW (kg/hd) avg. (18/10/11)	21.0	24.7	+ 3.7 kg/hd (+17%)
Lamb LW range (kg)	18-26.5	18-34	
Lamb LW Gain* (g/hd/d)	288	347	+ 59 g/hd/day (+20%)
*assuming 3.4 kg birth weight, avg birth date 28/08/11			
Lamb No.	41	55	
Lamb %	186	183	
Lamb kg/ha (18/10/11)	210	330	121 kg/ha (+ 58%)
Total LW/ha (18/10/11)	625	881	256 kg/ha (+ 41%)

Bog Roy – Lisa, Gundy Anderson

Quantify benefits of lucerne over resident pasture

- Monitoring lucerne growth in paired samples vs. unimproved
- Experimental oversowing of annual legumes





Photo: D & L Anderson
Bog Roy



Photo: D & L Anderson
Bog Roy

16 Oct 2011

Bog Roy

Experimental: Five annual clovers vs. lucerne

Individual species – 6 reps, hand broadcast

1. Prima gland
2. Bolta balansa
3. Seaton Park sub
4. Rosabrook sub
5. Trikkala sub
6. Force4 lucerne

Drilled mixture of same legumes + cocksfoot around edges

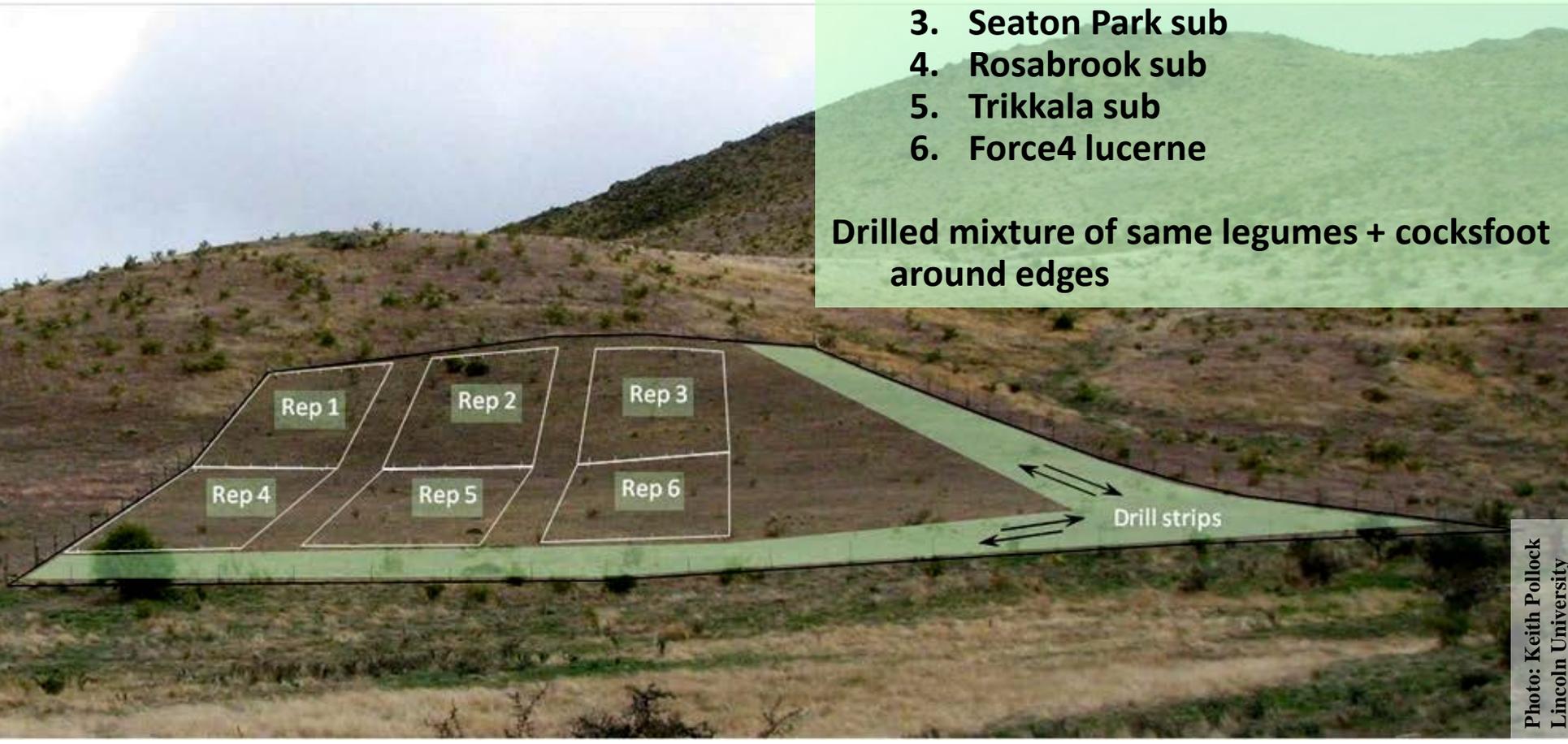




Photo: D & L Anderson
Bog Roy

24 Mar 2012

Photo: D & L Anderson
Bog Roy

24 Mar 2012

24 Mar 2012

Mt Grand Station – Evan Gibson

Establishing and utilizing annual clovers



Aerial over-sowing, 'Bolta' balansa,

Balansa hay (with seed) baled and fed out on steeper slopes

Photo: Keith Pollock Lincoln University

Mt Grand Station

Hard early spring grazing to open up weed competition



Mt Grand Station

Cottage paddock – ‘Bolta’ balansa clover trial

- Even with a reasonably *cool and dry spring the clover leapt out of the ground smothering any competition and was a foot tall and starting to flower by labour weekend, 24th October.*
- Flowering and growth continued until at least the *end of November when the plants were around 80 cm tall and a mass of flowers at different stages.*
- The ground on both the grazed and baled parts of the *paddock were littered with seed* and the hay bales have a lot of seed in them also.

Mt Grand Station



Photos: Evan Gibson

Flowering, 30th Nov.

Mt Grand Station

60 x 230 kg bales, mowed 22nd Dec, raked 26th Dec, photo taken 27th Dec



Mt Grand Station

Second generation seedlings 19th Jan 2012



Mt Grand Station

First strike (Jan) seedlings on 3rd March 2012



Mt Grand Station

Second strike of seedlings on 3rd March 2012



Photo: Evan Gibson

Mt Grand Station

Valley Block Hay experiment



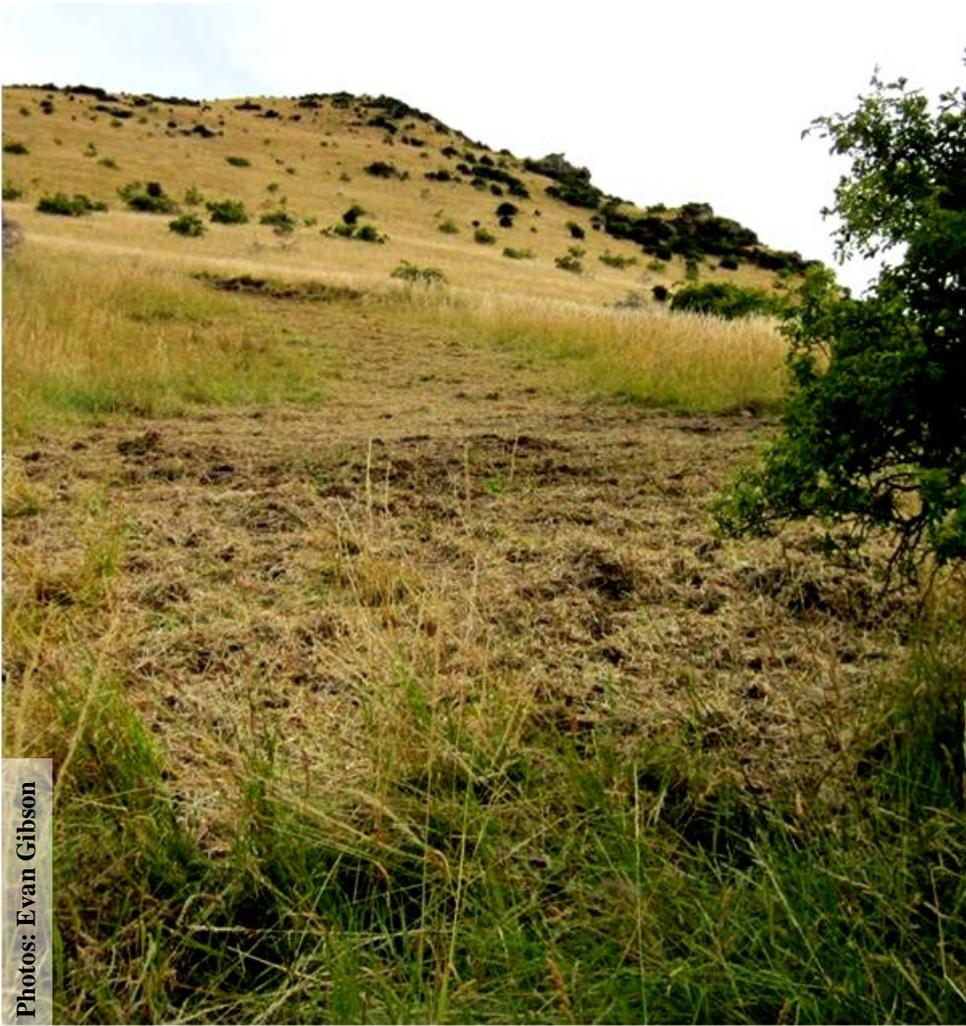
Twins on hay and salt strips
19th Jan 2012



Photos: Evan Gibson

Mt Grand Station

bare ground striptwo days later and seeds



Clover seedlings near top of the strip.

Tall oat grass more dominant because of less salt applied.



Mt Grand Station

Valley Block Hay experiment



Photos: Evan Gibson

Mt Grand Station

Valley hay experiment

The strip coming away again
(8 Mar 2012)

(Note: person not to give
scale, he is only 3 ft tall not 6
ft)

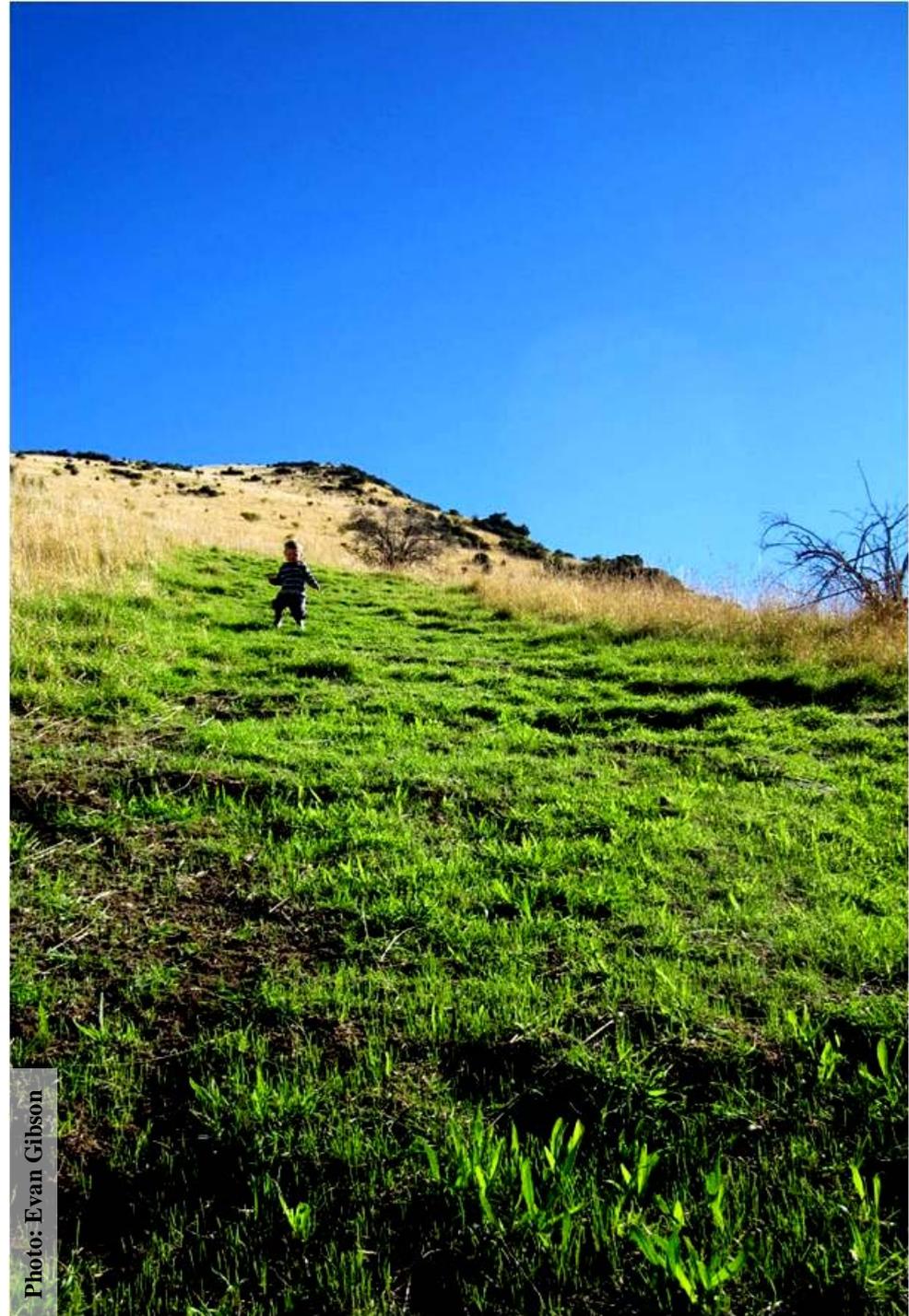


Photo: Evan Gibson

Mt Grand Station

Annual clover trial – Patterson's block



Photos: Evan Gibson

Traditionally, set stocked with 200 ewes for the tuppung then lambed onto through spring to early to mid January.

26 ha of steep sunny face
@ 500-600 m altitude



Mt Grand Station

Annual clover trial – Patterson's block

March 2011

- Grazed hard by 1400 ewes just prior to sowing.
- Top dressed 200 kg/ha of Maxi sulphur super.

End March 2011

- 13 ha at the eastern end of the block was over-sown.
- 6 kg 'Campeda' sub clover + 4 kg 'Prima' gland clover + 4 kg 'Bolta' balansa clover + 1 kg 'Tonic' plantain.

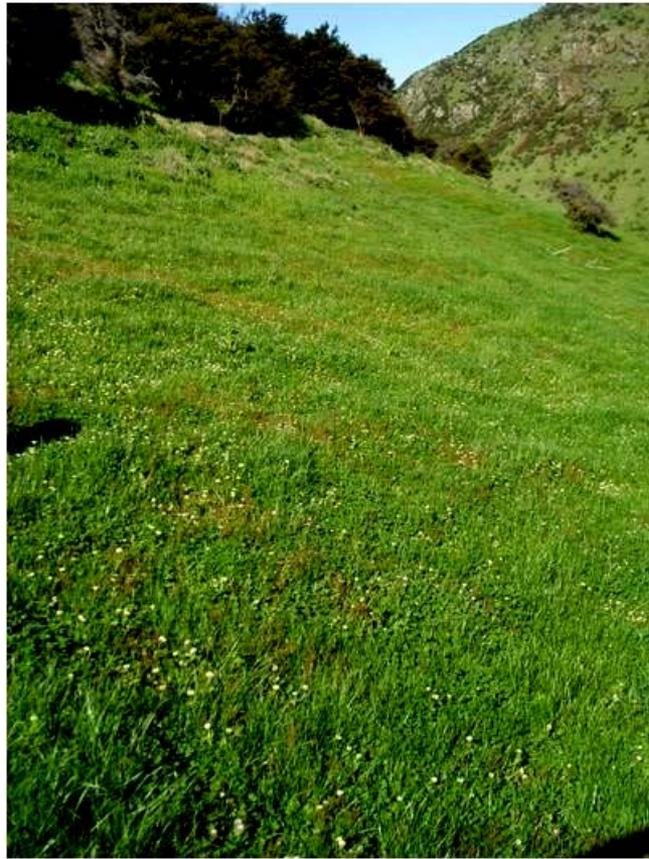
Early April 2011

- 750 2-tooths trampled in seed
- *Spelled until the 4th of May then 206 older ewes until the mid July.*

Mt Grand Station

Annual clover trial – Patterson's block

**Gland and balansa clovers flowering
(31 Oct 2011)**



**Smothered by
striated clover**

**Redoing 13 ha
(9 Mar 2012)**

± reseeding

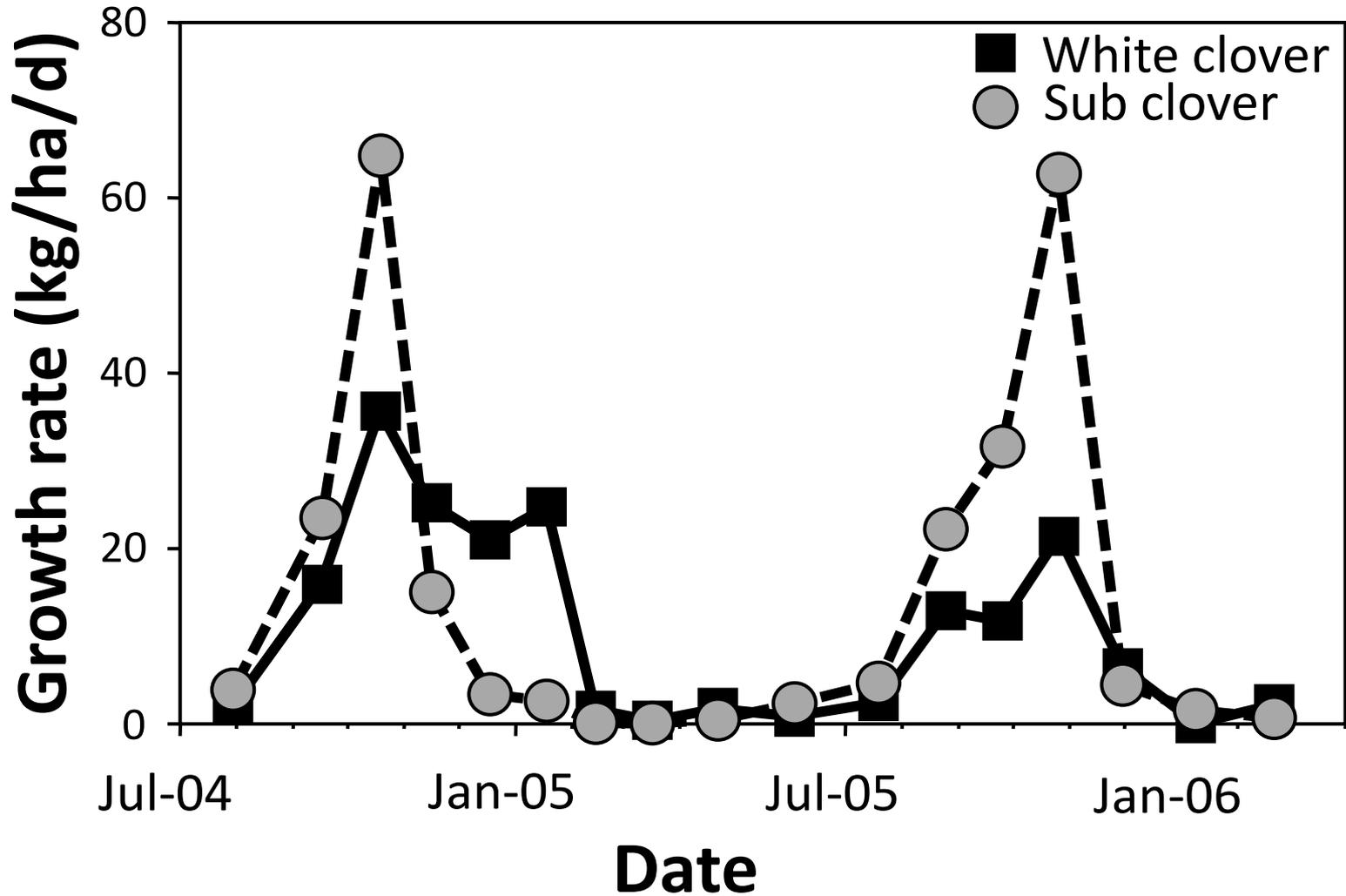


Photos: Evan Gibson

Conclusions

- Sub division - allows grazing mgmt
- Legumes for N to improve hill country
- Annual clovers require specialist mgmt
- If you can drill sub do so
- If over sowing – bare ground is key
- Build seed reserves for 2-3 years
- Try balansa in wet/dry regions!
- Diverse topography = diverse solutions

Seasonal clover growth



References

- Ates, S.; Tongel, M.O.; Moot, D.J. 2010. Annual herbage production increased 40% when subterranean clover was over-drilled into grass-dominant dryland pastures. *Proceedings of the New Zealand Grassland Association 72*: 3-9. Online: http://www.grassland.org.nz/publications/nzgrassland_publication_14.pdf
- Brock, J.L.; Hyslop, M.G.; Widdup, K.H. 2003. A review of red and white clovers in the dryland environment. pp. 101-107. In: *Legumes for dryland pastures. Proceedings of a New Zealand Grassland Association (Inc.) Symposium held at Lincoln University, New Zealand, 18-19 November 2003. Ed. Moot, D.J. Grassland Research and Practice Series No. New Zealand Grassland Association, Wellington, New Zealand.* Online: http://www.grassland.org.nz/publications/nzgrassland_publication_1668.pdf
- Brown, C. 1990. An integrated herbage system for Southland and South Otago. *Proceedings of the New Zealand Grassland Association 52*: 119-122. Online: http://www.grassland.org.nz/publications/nzgrassland_publication_929.pdf
- Costello, T.; Costello, A. 2003. Subterranean clover in North Canterbury sheep pastures. pp. 189-192. In: *Legumes for dryland pastures. Proceedings of a New Zealand Grassland Association (Inc.) Symposium held at Lincoln University, New Zealand, 18-19 November 2003. Ed. Moot, D.J. Grassland Research and Practice Series No. New Zealand Grassland Association, Wellington, New Zealand.* Online: http://www.grassland.org.nz/publications/nzgrassland_publication_1656.pdf
- Moot, D.J.; Black, A.D.; Scott, W.R.; Richardon, J. 2003. Leaf development and dry matter production of subterranean clover cultivars in relation to autumn sward management. pp. 193-200. In: *Legumes for dryland pastures. Proceedings of a New Zealand Grassland Association. New Zealand Grassland Association, Palmerston North New Zealand.* Online: http://www.grassland.org.nz/publications/nzgrassland_publication_1655.pdf
- Moot, D.J.; Mills, A.; Pollock, K.M. 2010. Natural resources for Canterbury agriculture. *Proceedings of the New Zealand Grassland Association 72*: IX-XVII. Online: http://www.grassland.org.nz/publications/nzgrassland_publication_6.pdf
- NIWA. 2010a. Climate Explorer – New Zealand Median Annual Rainfall and Median Summer Soil Moisture Deficit Maps. Accessed 1/10/2010. Online: <http://climate-explorer.niwa.co.nz>
- Salinger, J. 2003. Climate reality - actual and expected. pp. 13-18. In: *Legumes for Dryland Pastures. Proceedings of a Symposium held at Lincoln University, 18-19 November 2003. Grassland Research and Practice Series No. 11. Ed. Moot, D.J. New Zealand Grassland Association, Wellington.* Online: http://www.grassland.org.nz/publications/nzgrassland_publication_1678.pdf

Acknowledgements

The following organisations provided financial support for the research presented here:

The New Zealand Merino Company



Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere