

# High Country Forage Improvement Project

Professor Moot gave this presentation at:

**Christchurch**

**Danseys Pass**

On:

**13 March 2012**

**16 March 2012**



New Zealand's specialist land-based university



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**Commenced spring 2011**

***Professor Derrick Moot***

***Dr Alastair Black - Pastures***

***Dr Jim Moir - Soils***

***Mr Dick Lucas – High country***

***Dr Keith Pollock - Technician***

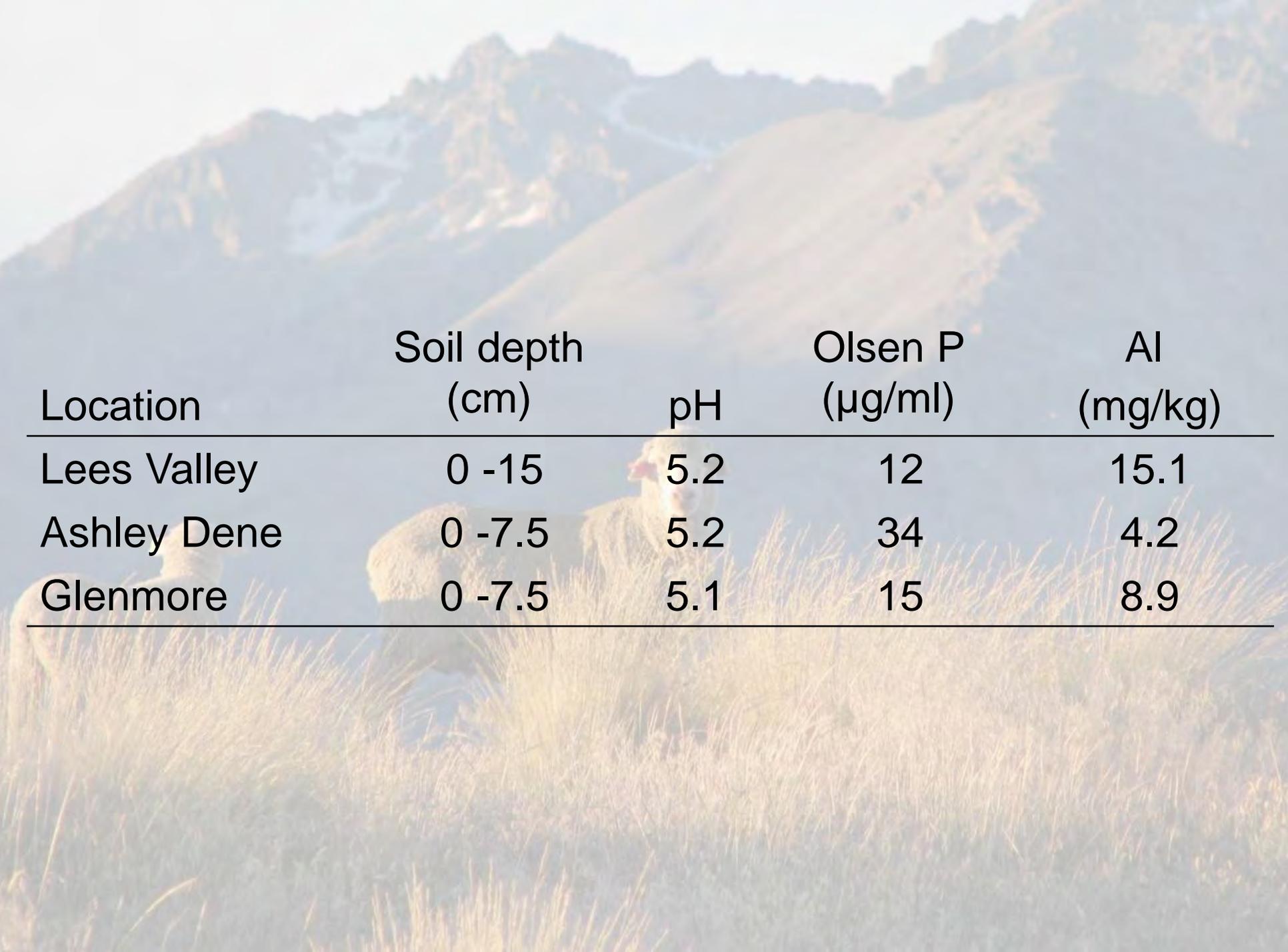
***PhD: Saman Berenji, Travis-Ryan Salter***

***Honours: Lucy Murray, Scott Harvey***

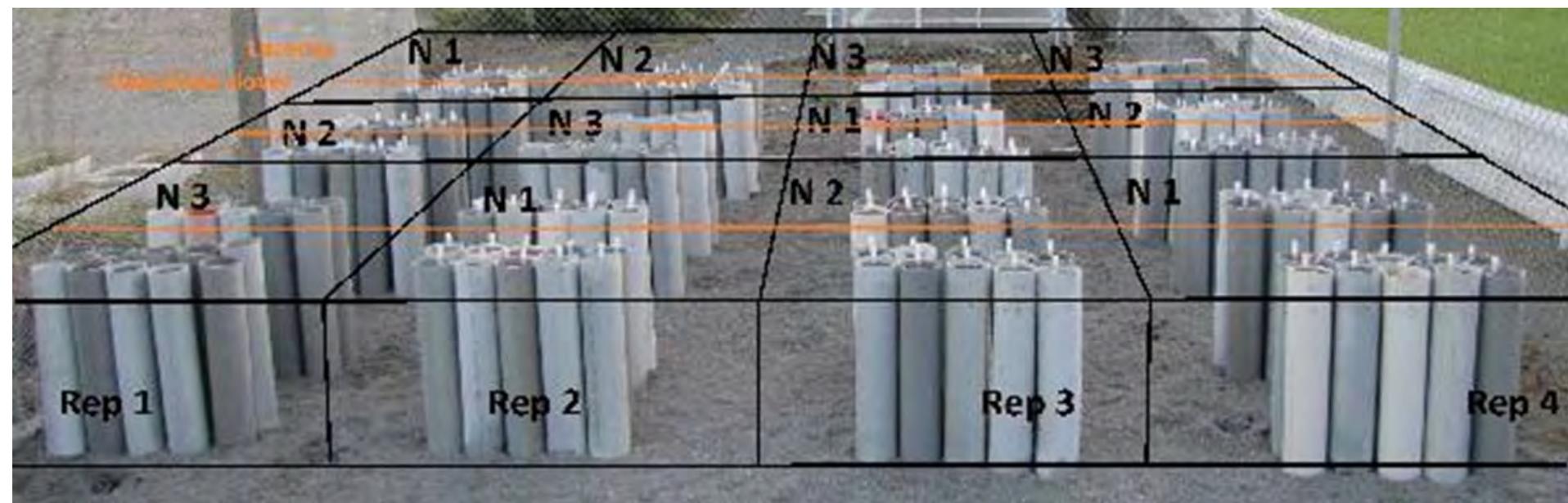
***Farmer coordinator: Denis Fastier***

# Complimentary student research

- Production and persistence of legume species in unimproved hill and high country soils – Lees Valley, Ashley Dene, Glenmore
- Enhancing legume establishment and growth in these regions (interactions of soil pH, Al, and P).
- Understanding BNF in these regions – efficacy and fitness
- Genotyping indigenous rhizobia strains
- Ecology of oversowing, and resident annual legumes



Location	Soil depth (cm)	pH	Olsen P ( $\mu\text{g/ml}$ )	Al (mg/kg)
Lees Valley	0 -15	5.2	12	15.1
Ashley Dene	0 -7.5	5.2	34	4.2
Glenmore	0 -7.5	5.1	15	8.9



At Lincoln University – rapid growth responses



0 t lime/ha



2 t lime/ha



1 t lime/ha

At Ashley Dene

(7/02/2012)

**+ Rhizobia**



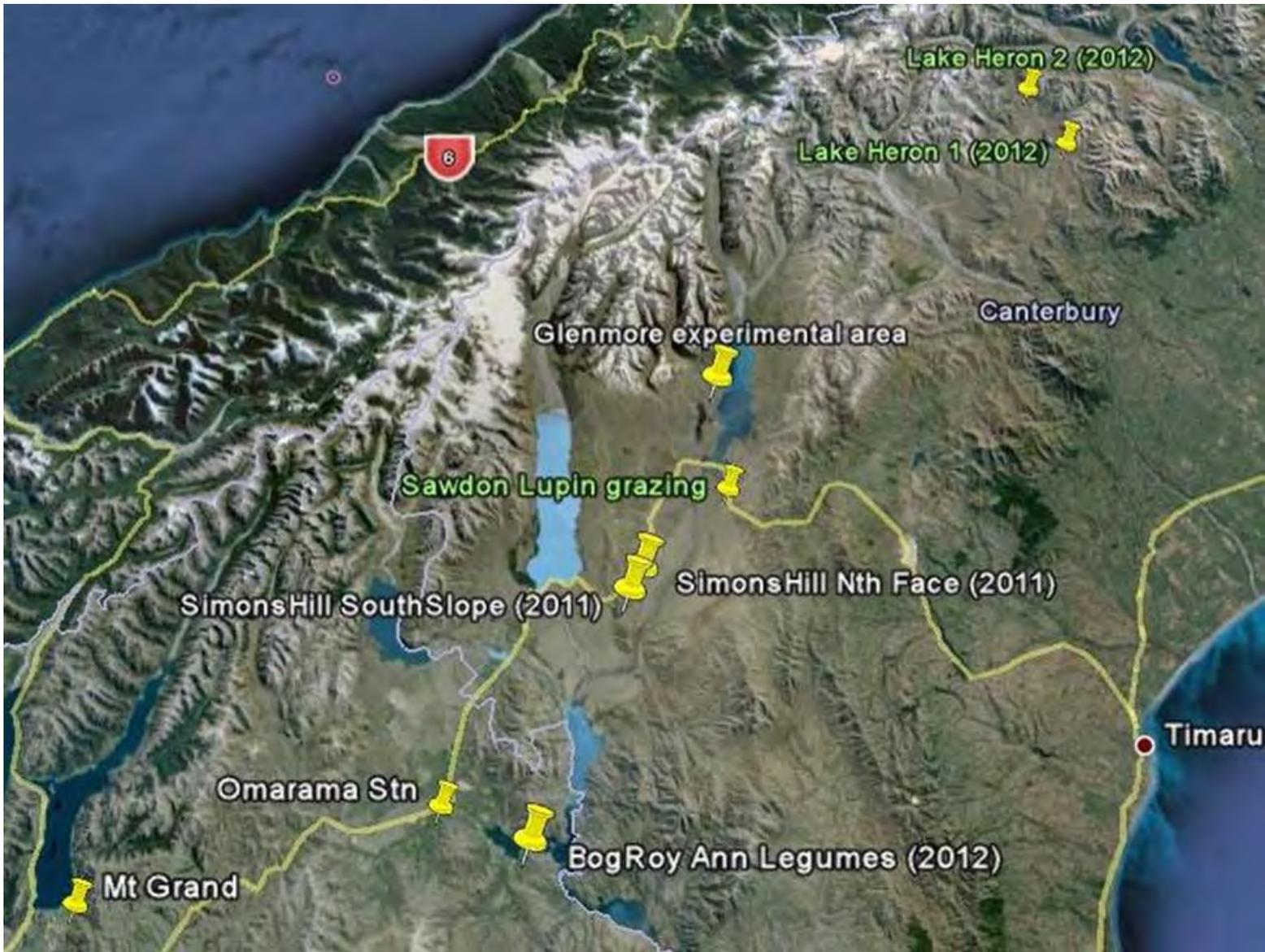
**Control**



**Ashley Dene - 9/03/2012**

# Merino forage projects

- Lake Heron*
- Sawdon*
- Glenmore*
- Simon's Hill*
- Bog Roy*
- Omarama*
- Mt Grand*



Timaru

# Lake Heron – Phillip Todhunter

**1) *Can legumes be established economically in undeveloped tussock lambing blocks?***

- ***Nitrogen (20 kg N/ha) vs. super (110 kg/ha)***

**2) *Caucasian clover survives – how to make it thrive?***

- ***Lime (0, 5 t/ha) vs. super (0, 100, 200, 400 kg/ha)***

# Duncan Enviro Drill





**Cocksfoot and Caucasian clover seedlings 7/3/12**



**Resident Caucasian clover on 28/02/12**





# **Future research**

- **Growth, development and survival of species**
- **Cross rates of additional fertilizer treatments**
- **Timing of introduction of grass species**
  - **compliment nitrogen fixing**
  - **suppress reinvasion of browntop**

# Sawdon – Snow Loxton

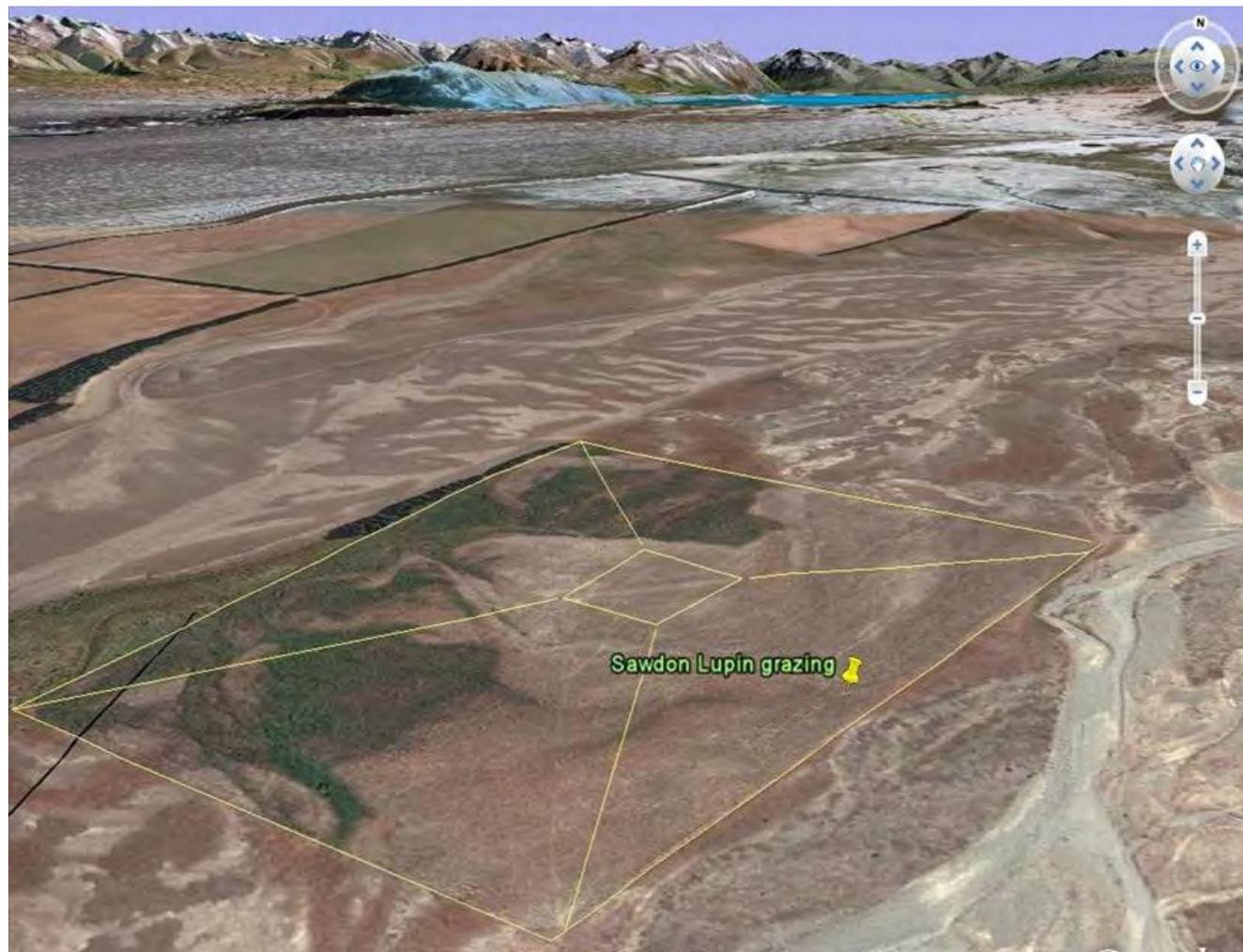
***Can lupins provide a productive feed source for merinos? Still to be answered.....***

- Ewe fertility
- Lamb growth rates – pre and post grazing
- Lupin grazing preference, pasture composition, nutritive value
- Lupin/perennial grass balance

# Sawdon grazing experiment

***Paddock divided into four grazing blocks.***

- Start 17/12/2011
- Graze 14 days  
42 day spell
- Lambs weaned  
10/02/12
- Lupin DM yield  
and component  
nutritive value



# Sawdon – ~ 10 t DM/ha (7 yr)

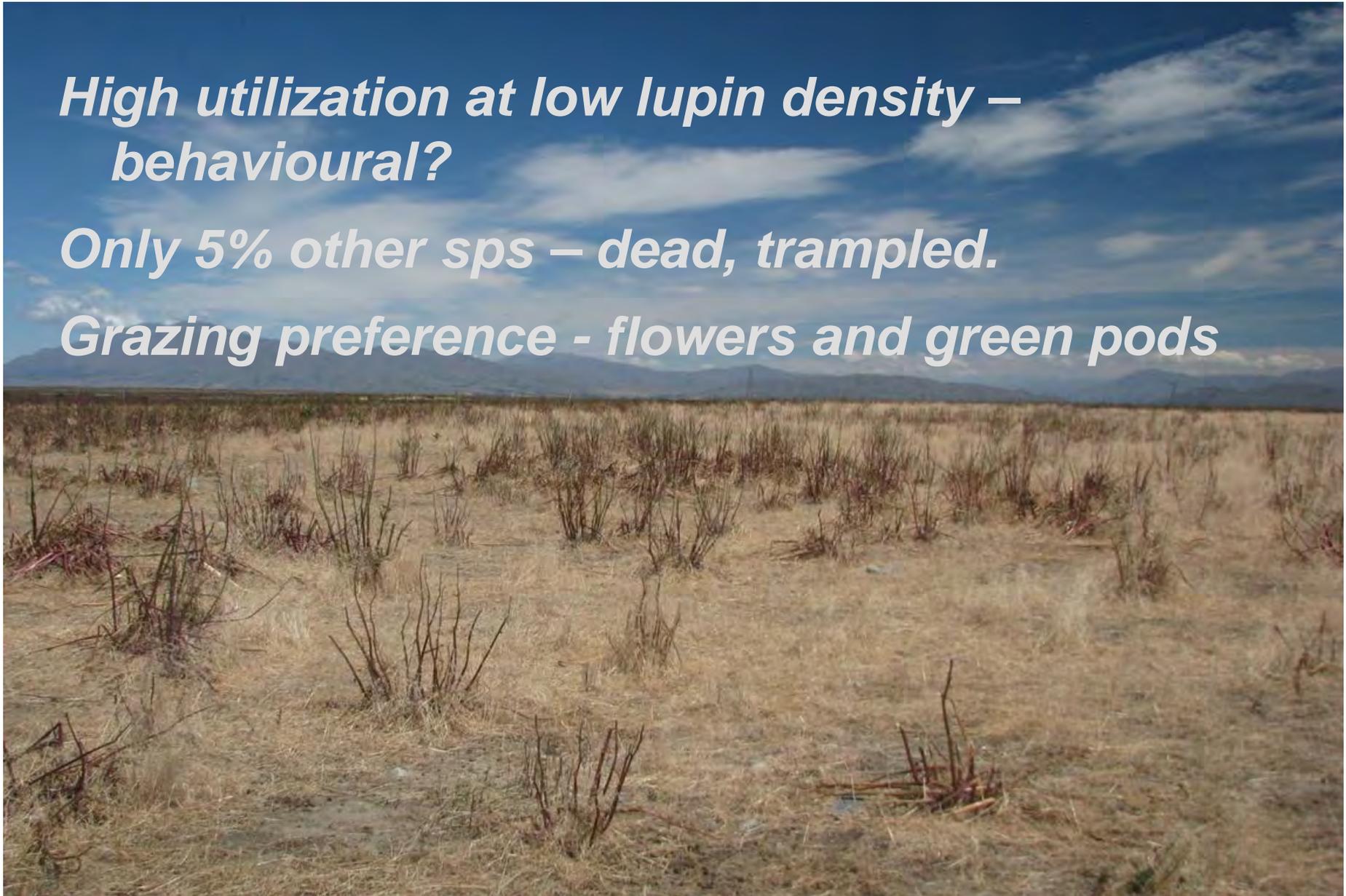


# Sawdon

*High utilization at low lupin density –  
behavioural?*

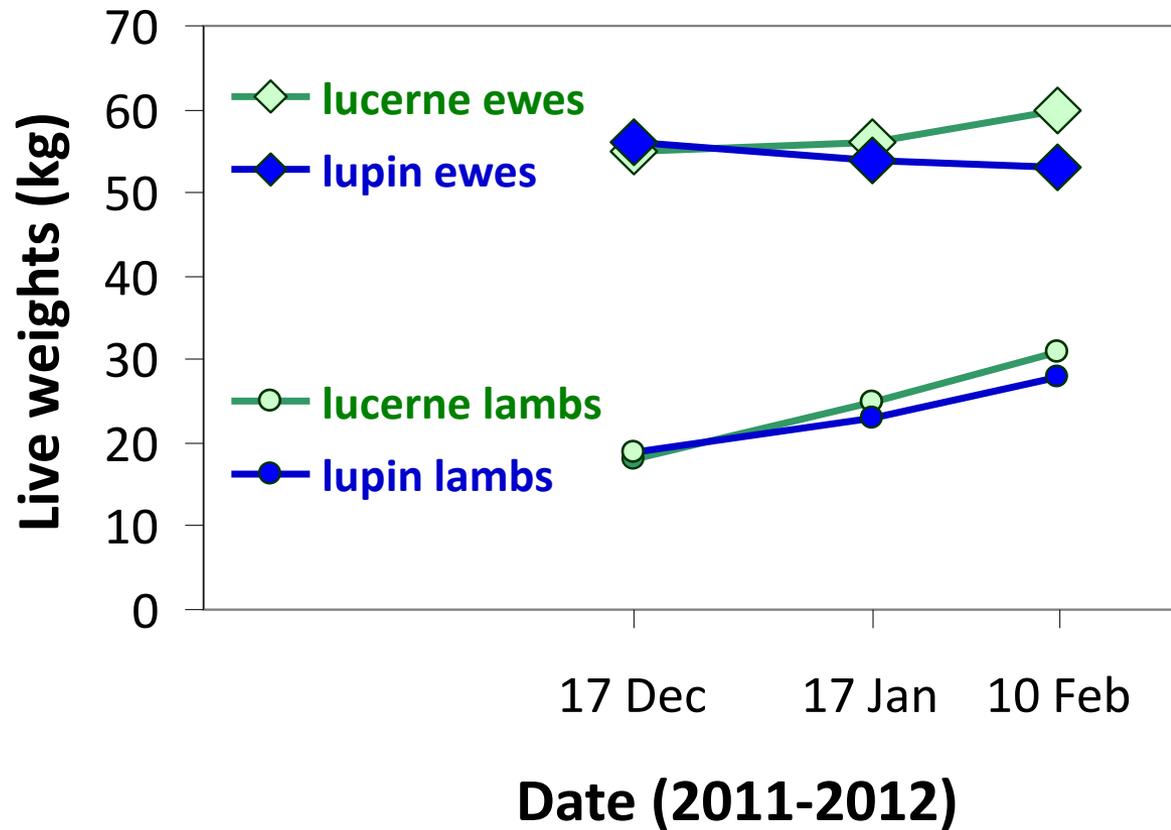
*Only 5% other sps – dead, trampled.*

*Grazing preference - flowers and green pods*



# Sawdon

## *Live weights on lupin vs. lucerne*



# Sawdon

## *Live weights on lupin vs. lucerne*

- Weight gains over total trial time (55 days)
  - Lupin ewes lost 3 kg (- 55 grams/ day)
  - Lupin lambs gained 9 kg (+ 164 grams/ day)
  - Control ewes gained 5 kg (+ 91 grams/day)
  - Control lambs gained 12 kg (+ 218 grams/day)

*“...I predict that the lupin result will still be above the average, and the control mob on lucerne is outstanding. A couple of ewes were staggering around with lupinosis, but otherwise stock were clean as a whistle, and blooming.” – Denis Fastier*

# **Glenmore – Will Murray**

***Can legumes be successfully established through zero cultivation on previously unimproved land?***

***Double sprayed – autumn and spring***

**Expt 1: 2 t/ha lime - 3 species, 3 drill types**

**Expt 2: 4 t/ha lime - 3 species, 3 drill types**

***Single spray – spring***

**Expt 3: - 3 species, 3 drill types**

**Expt 4: no spray – 3 species, 3 coulter types**

# Glenmore

## *Browntop dominated pasture*

Also

- *Poa pratensis*
- Haresfoot trefoil
- Sweet vernal
- Suckling clover
- White clover
- Hawkweed



# 3 Coulter types



# Trial site – drilled 15 Nov 2011



# Soil testing

***A hole 3 m deep and sampled every 0.5 m.***

***pH increases and aluminium decreases after first 0.5 m***



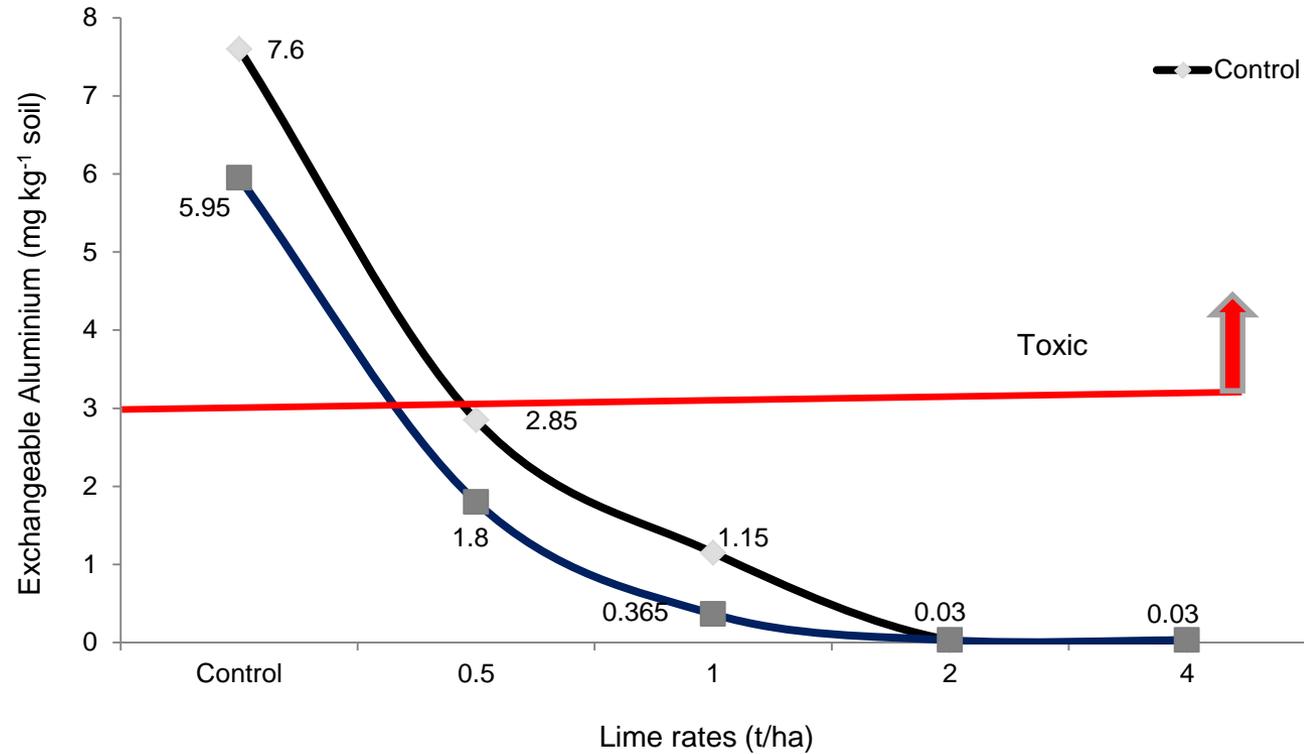
## Glenmore Station soil test results (Nov 2011)

Soil depth (cm)	pH	Al (mg/kg)
0-5	5.1	8.2
5-10	5.3	4.9
10-20	5.6	4.1
20-30	5.5	4.9

Lime (t/ha)	Soil depth (cm)	pH	Olsen P ( $\mu\text{g/ml}$ )	Al (mg/kg)
0	7.5	5.1	15	8.9
2	7.5	5.6	32	3.0
4	7.5	5.8	48	1.5

Lime application: Autumn 2011

# Effect of P and Lime treatment on Al level



# Glenmore

## *A range of establishment success*

- kill the browntop
- Species – sowing rate, growth form, growth rate, inoculation
- Drill type –depth of sowing
- Variable soil – yellowing of leaves



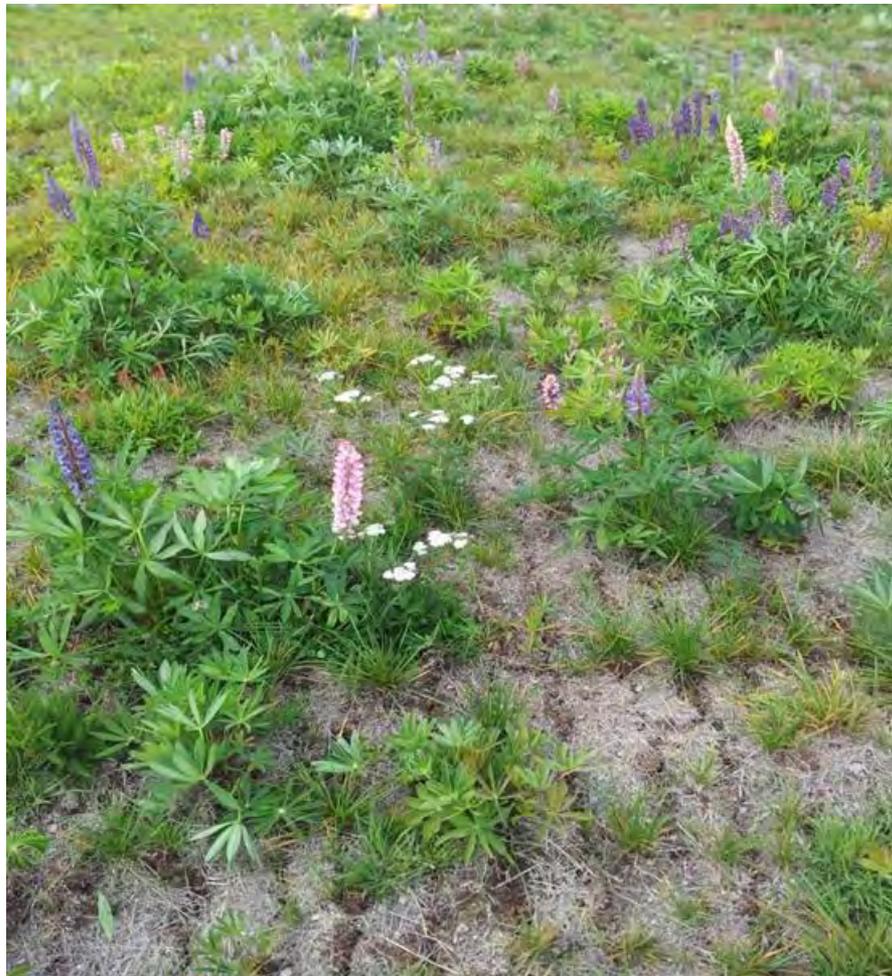
# Large variation- lucerne



# Caucasian clover



# Lupins



# No Lime - Lucerne

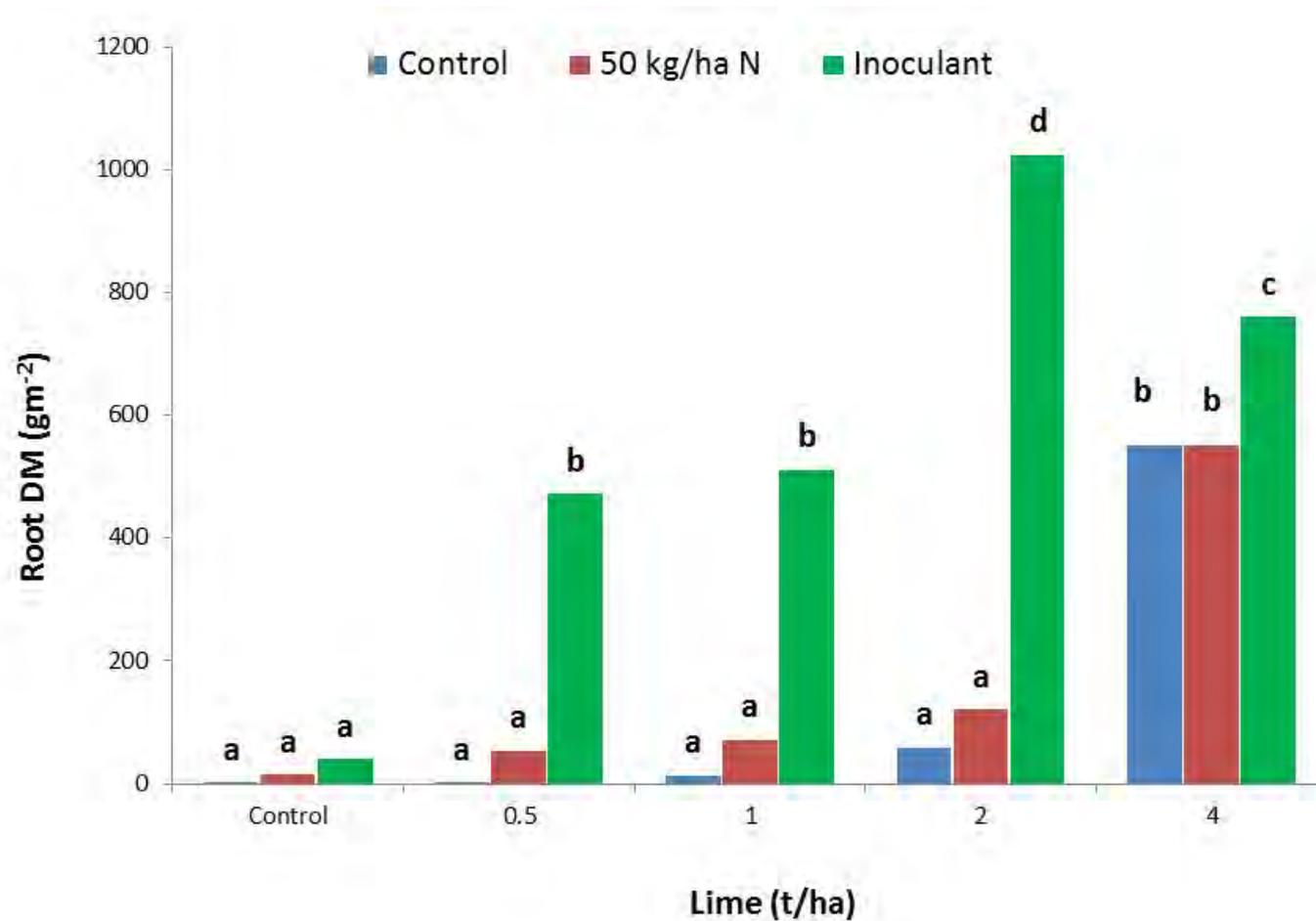




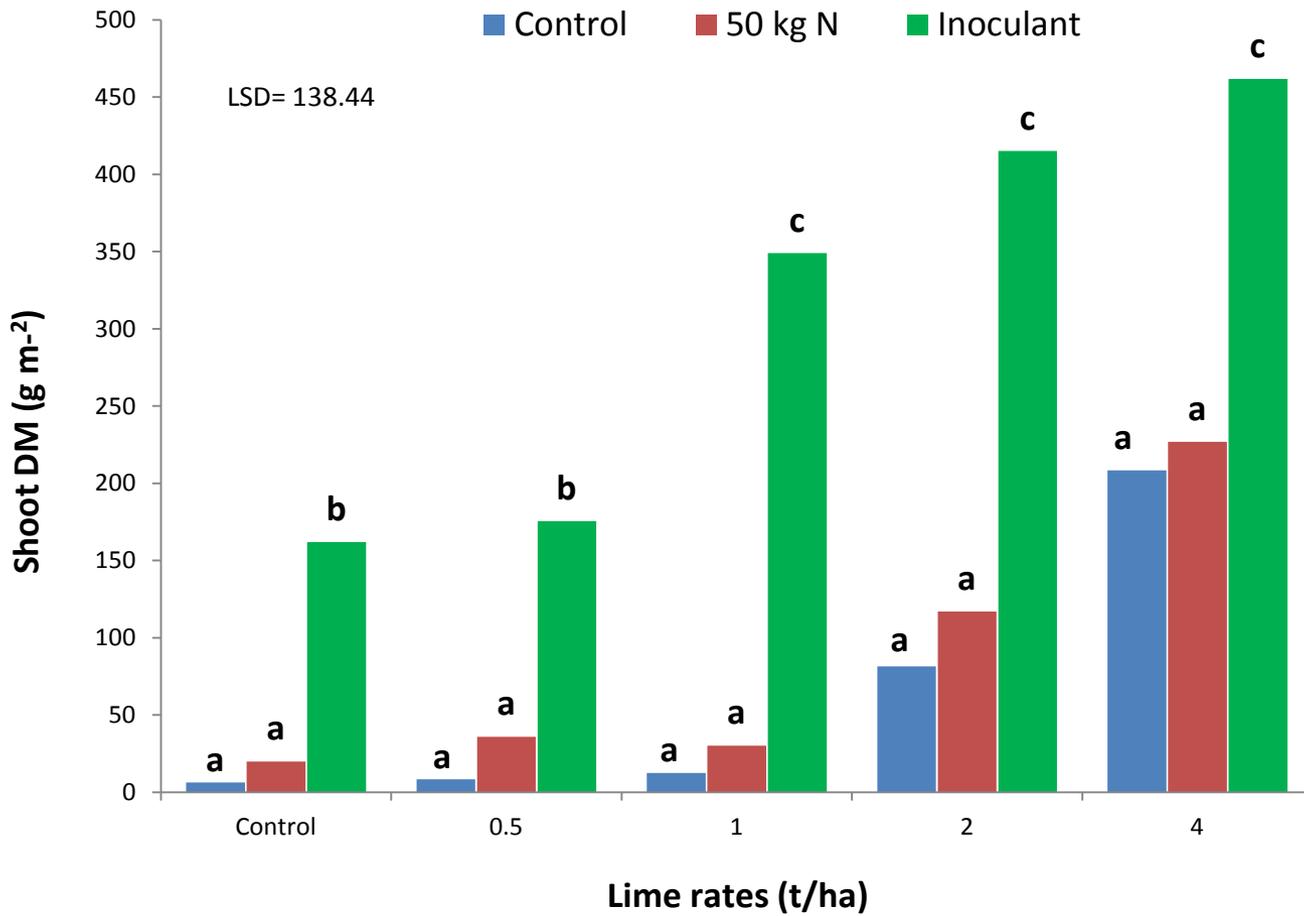
# Glenmore

***Success - but can we get more consistency?***





**The effect of Nitrogen source and lime rates on root DM of lucerne .**



**The effect of Nitrogen source and lime rates on shoot DM of Caucasian clover .**

# Future research

*How do we get greater consistency?*

- *Resow failed areas – water logging?*
- *Monitor lime effects in Expts 1 + 2.*
- *Continue coulter development*
- *Spray new area – sow lucerne and Cc with low rates of lime (0, 0.5, 1 t/ha) + inoculant*

# Simons Hill – Denis Fastier

*Establishing Caucasian clover in AOSTD  
country with a High Country, No Spray,  
Direct Drill*



# Peels back competition and leaves tilth



***Improvements over conventional AOSTD***

***New technology for slow to establish legumes***

***4 Fert types and 3 rates at establishment***

***A sunny and dark site***

***Results:***

***No match for conventional double spraying***

***Sunny site swamped by Haresfoot trefoil***

***Dark side swamped by white clover***

# **Annual clovers – autumn 2012**

***Balance of the sunny block was hard grazed,  
aerial sown with annual clovers and trampled.***

***200 kg 30% sulphur super***

***0.5 ha direct drilled trial of these species on  
easier part of block***

***Sowing date 24<sup>th</sup> Feb, 2012***

***Question still remains – Did the season beat us?  
Was it atypical?***

***What role can lupins play?***



# Bog Roy – Lisa, Gundy Anderson

## *Quantify benefits of lucerne over resident*

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







2011 10 16

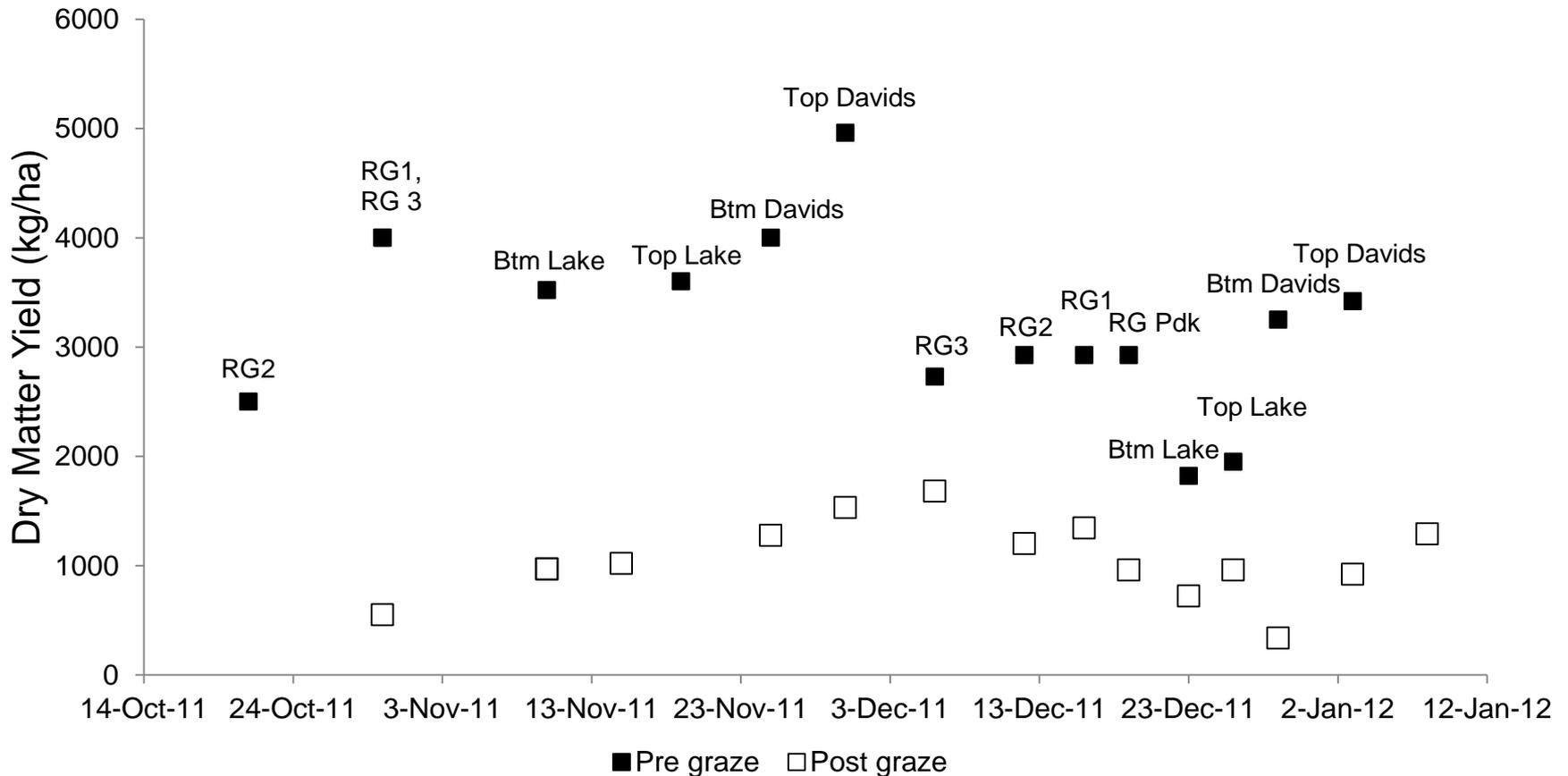


2011 10 16

# Bog Roy- Lucerne paddock rotation

## *On-farm paddock yields and utilization.*

Mobs 4, 5 & 6



# 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



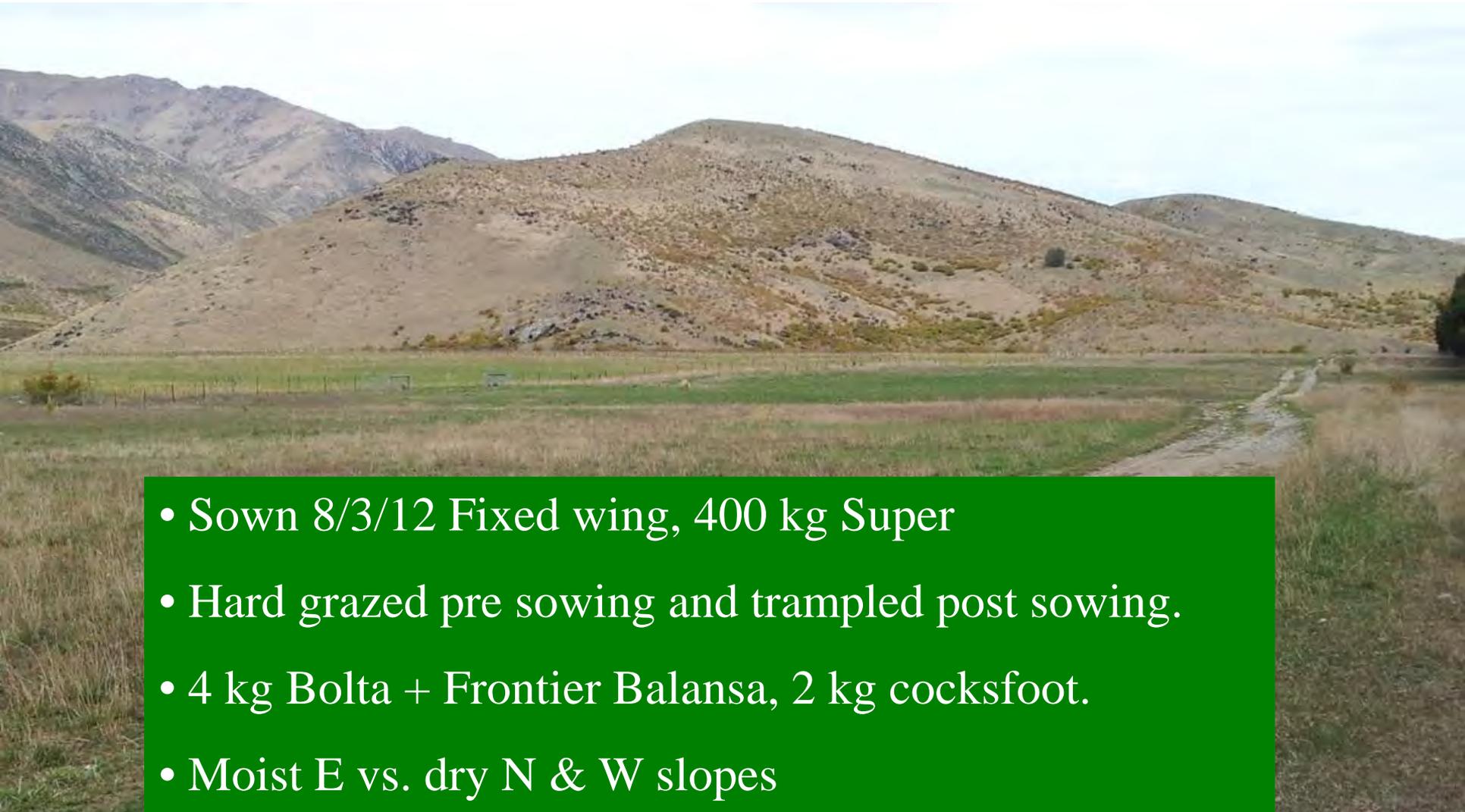
# Bog Roy

## *Future research:*

- Improve lucerne grazing utilization – make money
- Flowering and reseeding of annuals - survive
- New irrigation block – make money!?!

# Omarama Station – Richard Subtil

## *Aerial sowing annual clovers 30 ha on hill*



- Sown 8/3/12 Fixed wing, 400 kg Super
- Hard grazed pre sowing and trampled post sowing.
- 4 kg Bolta + Frontier Balansa, 2 kg cocksfoot.
- Moist E vs. dry N & W slopes





# Hard grazed



# 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

# Mt Grand Station

Hard early Spring Grazing to open up weed competition.



# Mt Grand Station

Flowering, 30th Nov.



# 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

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.



# Mt Grand Station

## *Bolta balansa hay bales fed out on hill country - Valley block*

Southeast and south facing – 60 ha, one third dominated by tall oatgrass.

Granule salt used for a number of years to lure stock to this less desirable face with great success but as soon as the smell of salt disappears so do the stock.

# Mt Grand Station

## *Valley Block Hay experiment*



Twins on hay and salt strips, 19th Jan 2012



# Mt Grand Station

## *Valley Block Hay experiment*

Jan-Feb 2012, every second or third day, a hay bale from our Cottage paddock, Balansa clover trial was rolled down the steep S face spreading feed and seed as it went.

In Evan's words "... cut two of the four strings and proceeded to push the bale off the back of the truck and over the edge of the track and sat back watching (and smiling) as they would roll away down the face gathering speed in a cloud of dust, straw and seed until the rpm would get too great and the two remaining strings would be shaken free and the bales pretty much exploded. I would then walk down the hay bales path hand spreading 9 -10 kg of granule salt over the tall oat grass to encourage the stock to return and bare the strip to hopefully enable the bales seeds a chance to strike".

After five or six bales some stock pretty much stayed on the face waiting for their next delivery.

# Mt Grand Station

*bare ground strip two days later and seeds*



Clover seedlings near top of the strip. Tall oat grass more dominant because of less salt applied.



# Mt Grand Station

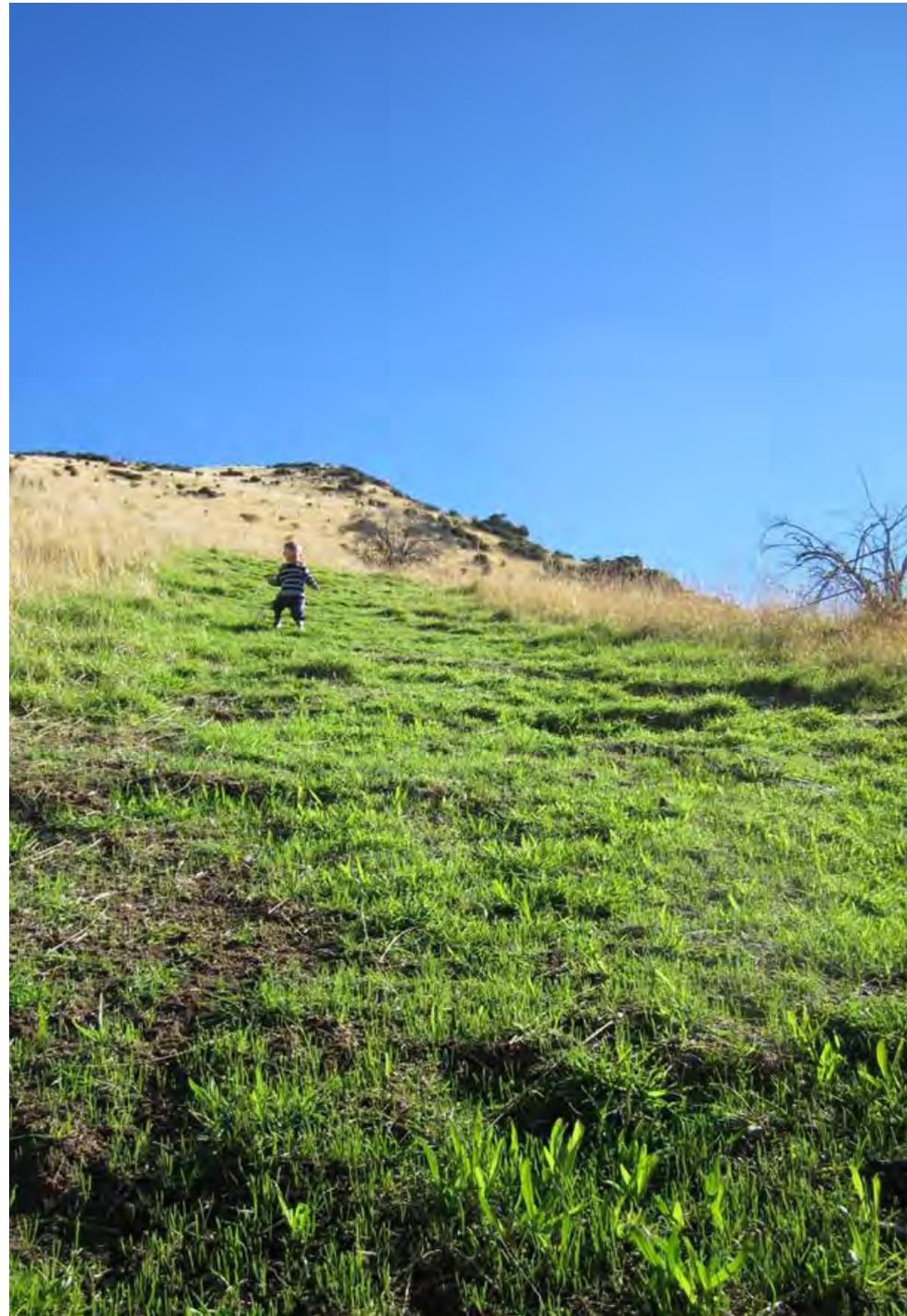
## *Valley Block Hay experiment*



# Mt Grand Station

## *Valley hay experiment*

The strip coming away  
again, 8-3-12. (Note: Person  
not to give scale, he is only  
3 ft tall not 6 ft)



# Mt Grand Station

## *Annual clover trial – Patterson's block*

- 26 ha of steep sunny face @ 500-600m altitude
- Traditionally, set stocked with 200 ewes for the tuppings then lambed onto through spring to early to mid January.



# Mt Grand Station

## *Annual clover trial – Pattersons block*

March 2011 - Grazed hard by 1400 ewes just prior to sowing. Top dressed 200 kg/ha of Maxi sulphur super.

End March -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 – Pattersons block*

Gland and Balansa clovers flowering,  
31 Oct 2011

Smothered by  
Striated clover  
Redoing 13 ha  
9/3/12  
± reseeding



# Conclusions

- Wide range of research across a geographically large area
- Identified farmer questions –
- Designed experiments to investigate these
- Integrated on-farm and LU research
- Early stages of data collection – promising
- Scope for introducing other interested parties
- No definitive answers – yet but.....promising
- Scope for transformational change akin to dryland

# Mt Grand Station

## *Cottage paddock - Bolta balansa clover trial*

- Mt Grand Stations Cottage paddock is a dry land nor-west facing paddock on a alluvial fan with approximately a 10 degree slope over most of the paddock and has a creek bed flowing through the middle of it, and with a annual rainfall of around 700 mm.
- Sown on the 24th of March 2011, 8 mm rain on the 26th and 13 mm on the 27th - a good strike.
- We sowed it ourselves using a contractors roller drill with a light cover harrow behind, it was sown at 5 kg Bolta Balansa, 1 kg Plantain and 1 kg Timothy per ha over the 5.8 ha that is cultivatable in the paddock.
- After a reasonably dry April (30 mm) a lot of competition from Shepherds purse and Poa annua was starting to impact on a fair portion of the paddock but after a skif of snow on the 17th of April and some frosts slowing growth a spray was ruled out as a option to help free up the clover so we elected not to autumn graze in favour of a hard early spring graze.
- On the 13th of September the paddock was cut into 3 blocks and 900 single ewes were run onto hard graze the pdk, they stayed here until lambing started, finishing two of the three blocks, the third block was grazed by shorn hoggets finishing on the 1st of October.
- In order to get the sheep to open up the Poa annua and shepherds purse all three blocks were grazed to the point where barely a clover leaf was evident, the paddock was then heavy rolled to enable us to mow it at a later date and a few days later I weed wiped a couple of patches of stinging nettle, then the gates were shut for clover flowering.

# Merino forage projects

## *Farmer's questions*

1. What role are lupins able to play as a feed source for merinos?
2. What is the trade-off between full preparation and short cut methods of establishment for introducing improved pasture species?
3. How can we successfully establish Caucasian clover with cocksfoot in unimproved fragile country with zero tillage, no spray and at low cost?
4. Having developed unimproved country – has it been cost effective?
5. What is the best approach to over-sowing hill country?
6. Why is the clover on shady faces so poor performing?
7. Can livestock be used to accelerate the seed spread of annual clovers species onto steep hill country?
8. Can legumes be established in undeveloped tussock lambing blocks?
9. What role can annual clovers play on over-sown dryland high country?