Ashley Dene Grazing Experiments

Prof. Derrick Moot, Dr Annamaria Mills, Mr Malcolm Smith

Farm purchased in 1909.
Consists of Home Block = 47.9 ha,
Cemetery Block = 103.9 ha and
Main Block = 204.9 ha
Soils on Home and Cemetery Blocks:
Lowcliffe moderately deep, Lowcliffe stony, Ashley Dene deep and Lismore stony soils.

Figure 1 Map of Home and Cemetery Blocks at Ashley Dene Farm, Canterbury. Shaded areas are active experiments monitored for P21.

Pastoral 21

"This work was undertaken as part of Phase II of the Pastoral 21 Programme, funded by the Ministry for Business, Innovation & Employment; DairyNZ; Beef + Lamb NZ; and Fonterra."

The ‘MaxClover’ Photo Diary

DJ Moot, A Mills, RJ Lucas, KM Pollock, M Smith

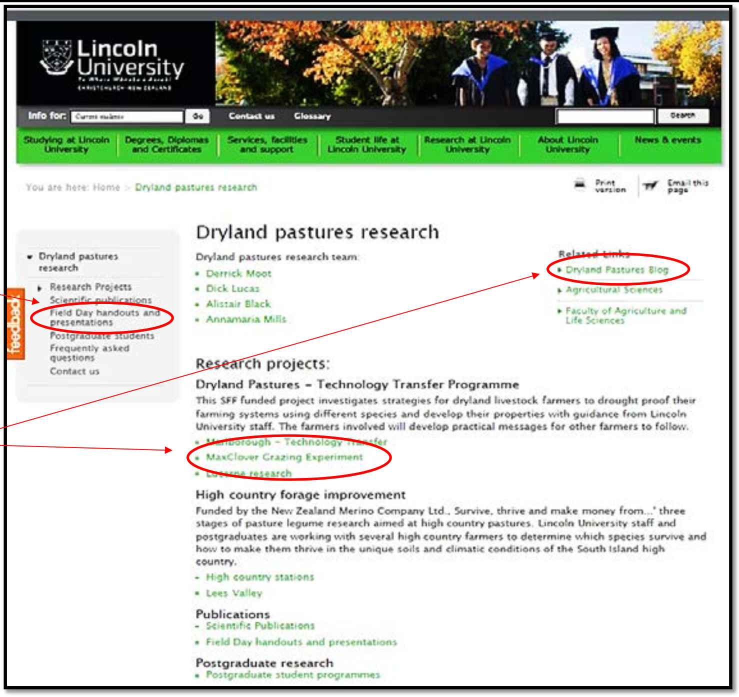
- Documents changes in LWt production, DM yield and pasture composition over nine years.
- Provides data and commentary with photos to show the changes over time
- Located on the ‘MaxClover’ page of our website: www.lincoln.ac.nz/dryland

The website…

Info on:

- Current projects
- Field day presentations
- Scientific publications
- FAQs
- Postgraduate study
- Photo Diary
- Direct link to BLOG

www.lincoln.ac.nz/dryland



Dry matter yield:

- Annually DM yields ranged from 5.7 to 18.5 t DM/ha.
- Lucerne out yielded grass based pastures in 8 out of 9 years.
- CF/Sub was the most productive and persistent grass based pasture with sub clover yields >3 t DM/ha in 5 out of 9 years. The majority of sub clover was produced in the critical spring period when 64-70% of all animal liveweight was produced from the grass pastures.

Pasture composition:

- Lucerne monocultures remained >90% pure due to the winter weed control program.
- In the cocksfoot pastures the originally sown grass and companion clover species disappeared from the pasture at about 3% per year (Figure 2).
- Ryegrass and white clover were lost at a rate of 10% per year in these dryland grazed pastures (Figure 3).

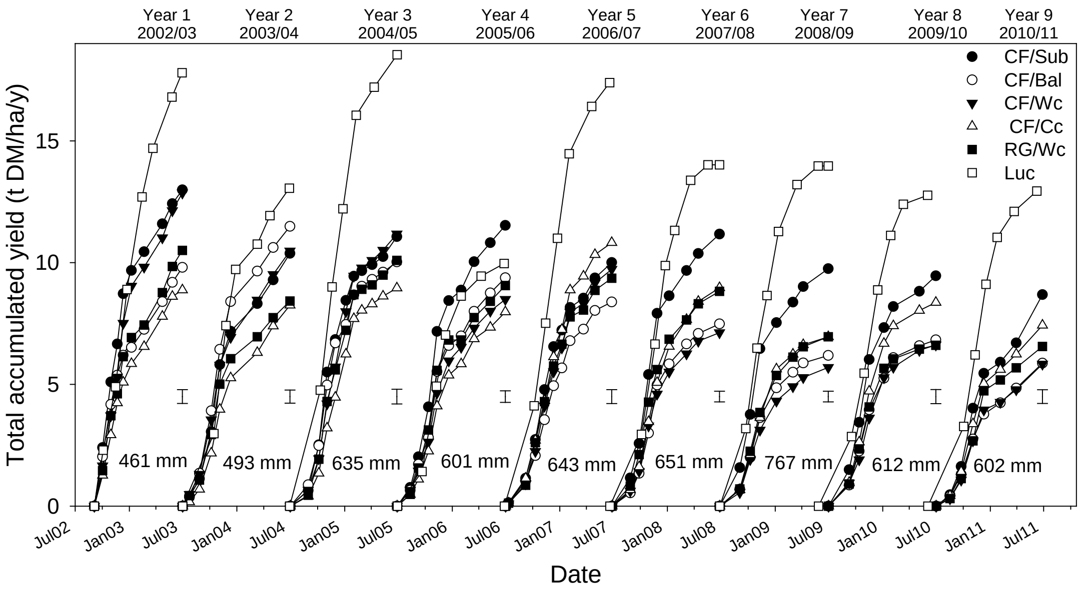


Figure 2 Total annual accumulated DM yields of six dryland grazed pastures at the 'MaxClover' grazing experiment at Lincoln University over nine years.

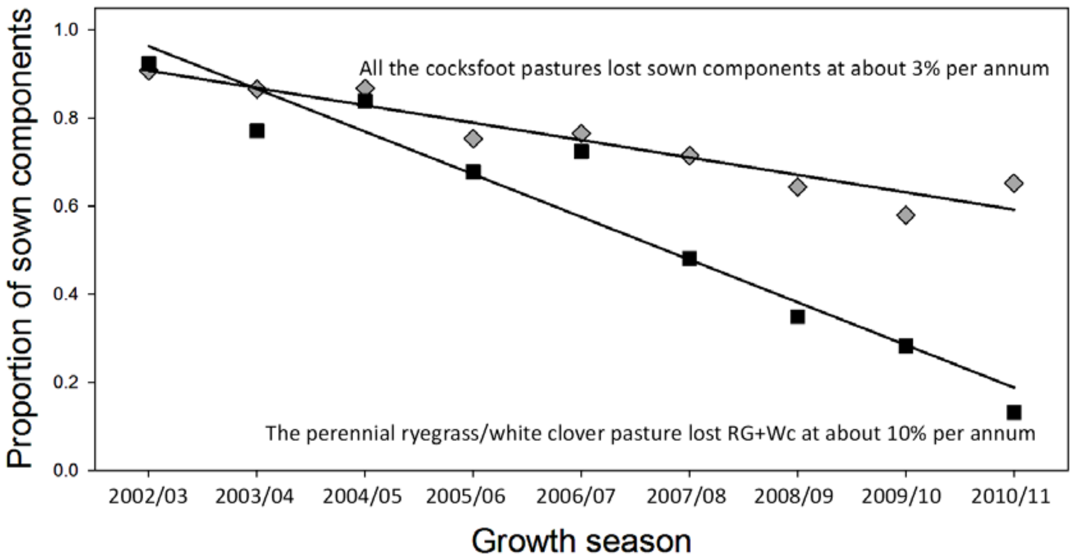


Figure 3 Rate of loss of the originally sown pasture components (grass+companion clover) from the five grass based dryland pastures at the 'MaxClover' grazing experiment at Lincoln University.

P21 – lifting profitability for mixed livestock systems

Objective 5:
P21 Project 3
Spring management of lucerne (Site H7)

- Established Nov 2008 at a bare seed rate equivalent of 10 kg/ha.
- Grazing treatments first applied in spring 2010.

Context:

- Farmers want greater flexibility for grazing management in the early season at lambing which will not compromise stand production or longevity.
- Although not proven, there remains a perception about potential mis-mothering during shifts if ewes and lambs are moved to a rotational grazing system when lambs are <3 weeks of age.
- This experiment will quantify the differences in liveweight production, DM yield, stand composition and persistence of lucerne monocultures subjected to set-stocking, semi set-stocking (2 paddock 20 day rotation with a 10 day return period) and the recommended 6-paddock rotational grazing system.

Research questions:

- Will set stocking/semi set stocking provide superior LWt production in spring?
- Can lucerne be set stocked in spring without compromising long-term production and persistence of the stand?
- Is there a difference in production and persistence between lucerne cultivars under different grazing managements?

Methodology

Location

- At Ashley Dene, Canterbury a 4.2 ha farmlet study was established in November 2008 in H7.
- Soils are classified as Lowcliffe moderately deep and Lowcliffe stony soils. There is some site variation that is accounted for by neutron probe tube installation (2.3 m deep).

Experimental design

- In Paddock H7 two grazing areas were established (Figure 4).
- The 6-paddock rotationally grazed farmlet has six paddocks each with four replicates of seven lucerne cultivars (Table 1).
- In the adjacent grazing area three cultivars (‘Stamina 6’, ‘Stamina 5’ and Runner’) were established in each of four replicate paddocks.
- These paddocks are divided in half in spring. One half is set stocked. The other half is halved again to create a semi set-stocked grazing treatment. Stock graze for 10 days and shift to the other half of the paddock for 10 days to create a 10 day regrowth before re-entry.

- After weaning the set-stocked and semi set-stocked treatments are merged, weaned lambs are grouped and the area becomes a 4-paddock rotational grazing system.
- The emphasis is on lucerne recovery in autumn.

Table 1 Treatments in the farmlet grazing experiment investigating spring grazing management strategies for lucerne at Ashley Dene, Canterbury.

Cultivar:	**Spring grazing management strategy:**
'Kaituna'	6-paddock rotational grazing system
'Stamina 6' GT	2-paddock semi set stocked
'Stamina 5'	Set stocked
AgR grazing tolerant	
AgR high preference	
'Rhino',	
'Runner'	

Cultivar plots measured 6.3x24.5 m (24 reps, seven cvs in 6-pdk) or 16x89 m (4 reps, three cvs in SS or SSS pdks).

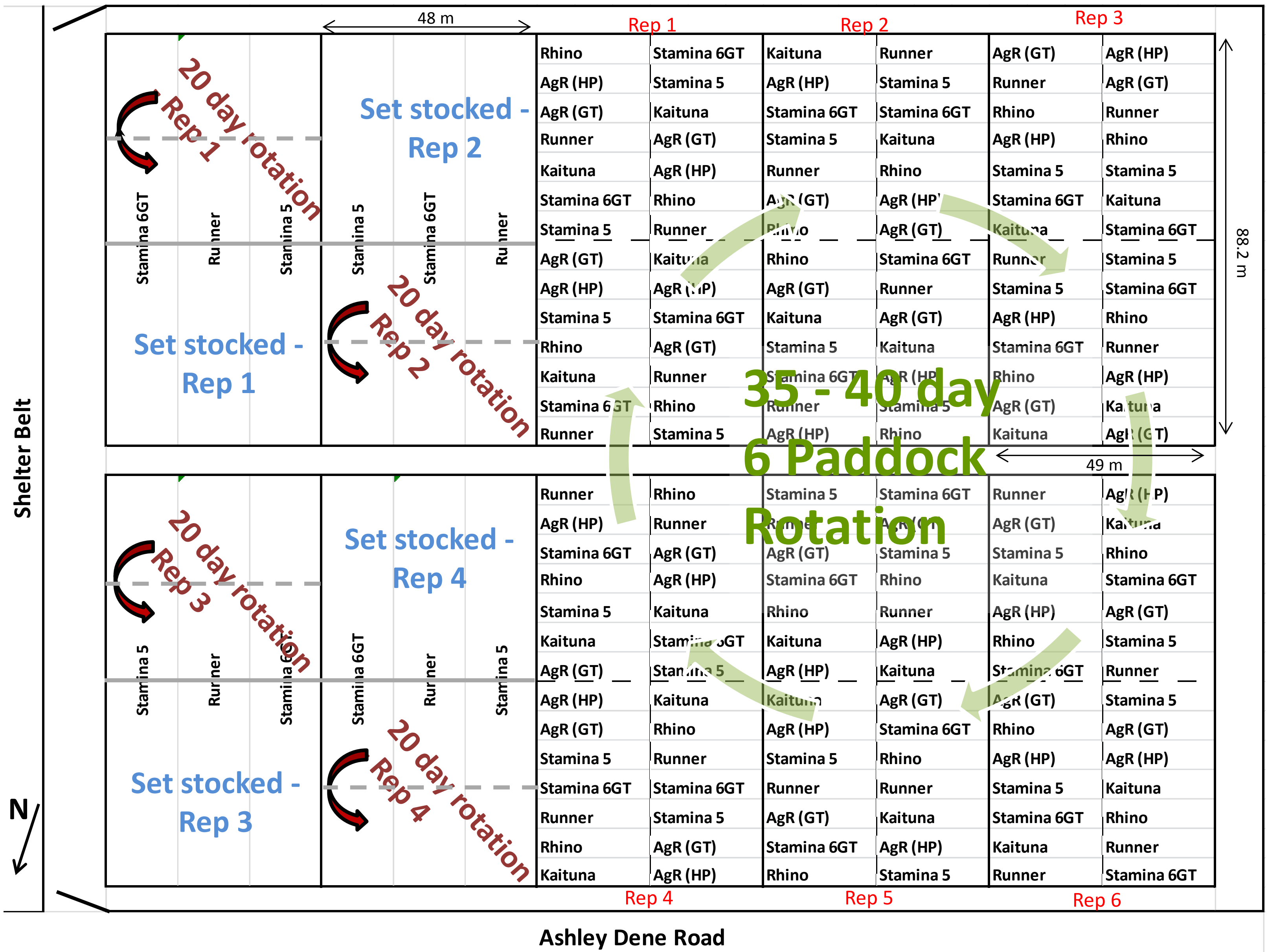


Figure 4 Experimental design for spring grazing management of lucerne farmlet experiment at H7, Ashley Dene, Canterbury.

Measurements

- Environmental data monitored on-site (C Block).
- DM yield (calibrated relationship between lucerne height and DM yield).
- Exclosure cages in set stocked and semi set stocked grazing treatments.
- LW production (weighed full pre-weaning, weighed empty post weaning).
- Perennial reserves (root biomass and nutritive information) and plant population.
- Soil moisture (TDR and neutron probe to 2.3 m).

Animal LWt production

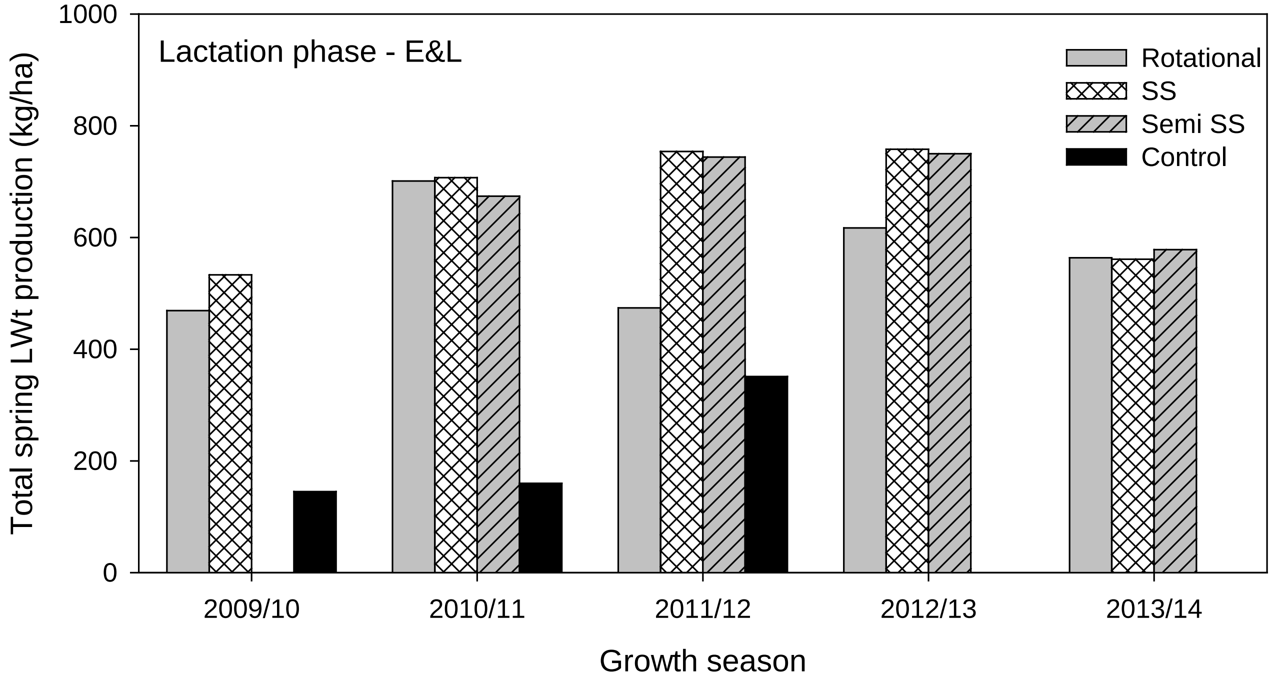
- Grazed by Coopworth ewes with twin lambs at foot in spring (weighed full).
- Put & Take system allows stocking rates to match feed supply and animal demand.
- Post-weaning the set stocked and semi set stocked treatment areas are combined to form a 4-paddock rotational grazing system grazed by weaned lambs or hoggets (weighed empty).
- Destocked in winter or when feed supply unable to meet animal demand.

Water use

- TDR (0-0.2 m) and neutron probe access tubes (0.2-2.3 m) in 20 plots across the site ('Kaituna' and 'Stamina 6GT' cultivars).

Prelim Results

Total Liveweight production during spring (to weaning)



- In two years set stocking or semi set stocking increased LWt production prior to weaning. In three years there was no difference from lucerne grazing treatments.
- LWt production from all lucerne pastures was superior to the runout pasture in the adjacent paddock in three years.

DM yield from 6-paddock rotational grazing treatment

In the 6-paddock rotation accumulated yield from the 'Stamina 6' lucerne was 15.9 t/ha in 2010/11 and 12.1 t DM/ha in 2013/14 (Figure 5).

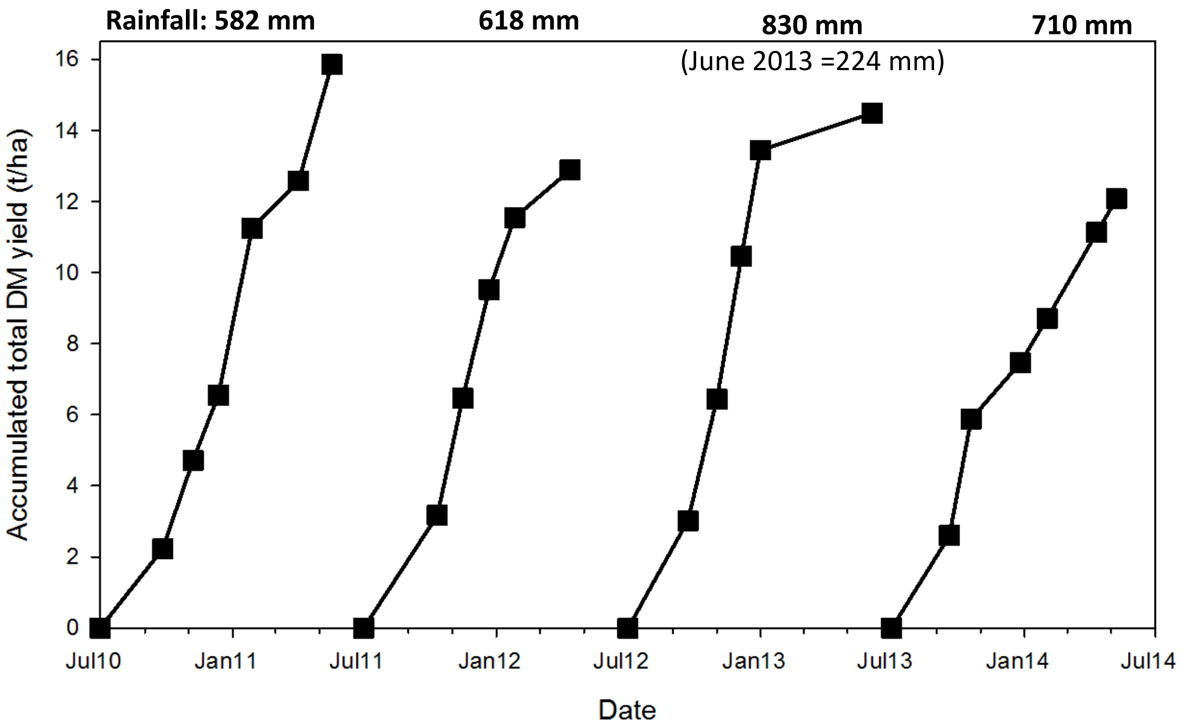


Figure 5 Accumulated dry matter yield of 'Stamina 6GT' lucerne (■) under a 6-paddock rotational grazing system at Ashley Dene, Canterbury.

Guidelines for set stocking lucerne

Dr Derrick Moot

1. Manage lucerne pure swards first.

2. Choose paddocks to lamb on early in autumn
   – shelter, older, early clean-up graze and winter herbicide application.

3. Lucerne grass mixes – grass transition.

4. Early and late for condensed lambing (1 cycle).

5. Drift onto lucerne ~14 d prior to lambing

6. Lucerne ~20 cm tall and keep it there.

7. Stock at about half the rotational grazing rate

8. Set stock for 4-5 weeks – then rotate

9. Set stock lambs use the taller feed as shelter.

10. Stocking rate to keep closed canopy!

11. Canopy gets taller over 4-5 weeks not shorter

12. Once canopy reduces begin rotational grazing

13. Open canopy = twitch, yarrow, dandelions.

14. Paddocks need autumn (6 wks) recharge.

Field survival of inoculant rhizobia in lucerne and white clover

Kathryn Wigley; Derrick Moot; Hayley Ridgway

Background Work at Ashley Dene

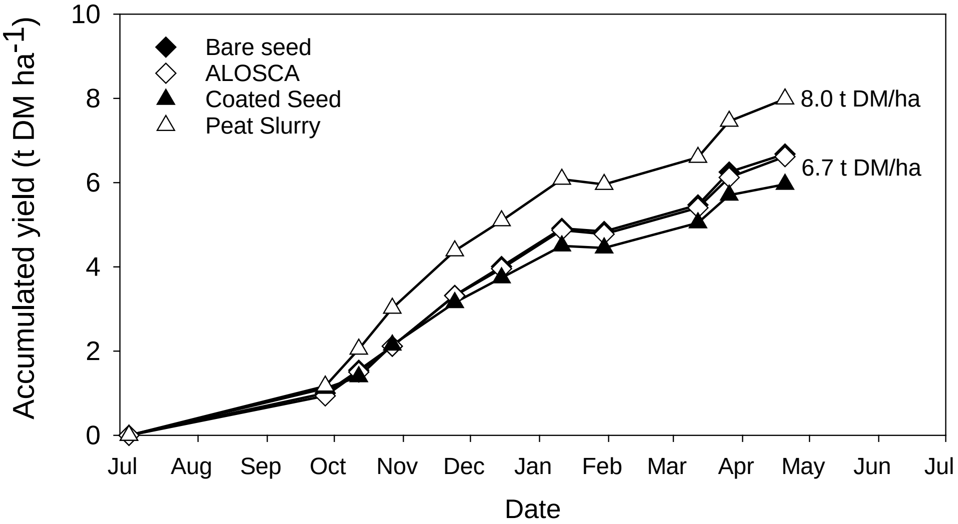


Figure 6 Effect of seed treatment on dry matter year in the 1st year after sowing

After the first year plants from the peat treated seed produced 8 t DM/ha which was more than the other 2 seed treatments, coated seed and ALOSCA® and the bare seed control.

Table 2 Frequency of the 7 most commonly found genotypes found in the nodules of lucerne plants treated with ALOSCA® (AS), lime coat (CS), peat inoculant (PS) or left as a bare seed control (BS).

	Treatment			
Genotype	**BS**	**AS**	**CS**	**PS**
Rhizobium sp.	29	25	22	8
Ensifer meliloti	0	4	23	19
Rhizobium sp.	2	1	3	1
Pseudomonas sp.	0	3	1	2
Pseudomonas sp.	3	0	1	2
Serratia sp.	2	4	0	0
Rhizobium sp.	0	2	0	2

Isolation, DNA extraction, genotyping and sequencing revealed 7 commonly found genotypes. Of these, *Ensifer meliloti* and *Rhizobium* sp. were the most commonly found species. *Ensifer meliloti* was confirmed as the commercial inoculant applied to the seed at sowing and *Rhizobium* sp. is naturalised rhizobia already present in the soil.

Objectives of My PhD

- Investigate the longevity of commercial white clover and lucerne inoculants in the field.
- Examine the relative persistence and saprophytic ability of commercial and naturalised strains rhizobia.
- Determine some of the factors that affect the persistence and saprophytic ability of commercial and indigenous rhizobia.

Quantifying phyto-oestrogens in lucerne and their impact on sheep ovulation rates

Rachel Downward; Derrick Moot; Graham Barrell

Lucerne:

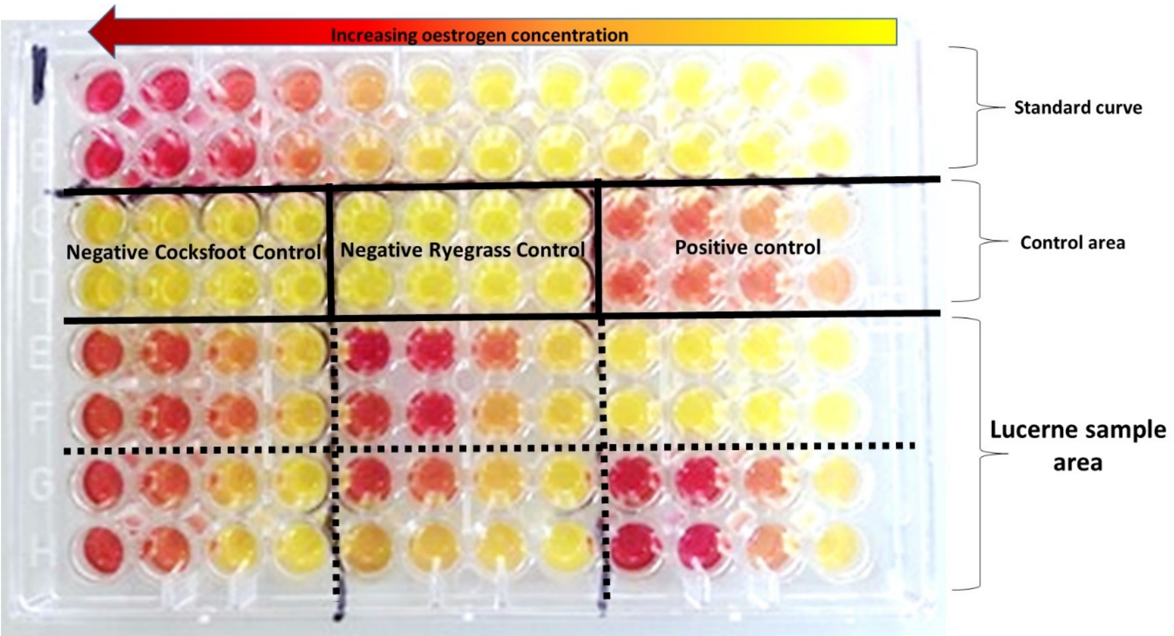
- high quality feed,
- uses water efficiently
- long taproot

However, lucerne can contain an oestrogenic compound called coumestrol.

- Coumestrol can lower the fecundity of ewes if they eat lucerne containing high levels during the mating period.
- This results in fewer twins and more singles, decreasing lambing rates.

Measuring oestrogenicity of lucerne

For this project I have a fast, cost-effective method of screening lucerne for its oestrogenicity. This method uses yeast modified with an oestrogen receptor. When an oestrogenic compound binds to the receptor the yeast produces a compound that causes a colour change from yellow to red, this takes about three days. By measuring how red the solution is I can determine how oestrogenic the material is.



Factors causing elevated coumestrol in lucerne:

- Fungal infection
- Aphids?
- Flowering?

Comparison of new and old cultivars as most research was done prior to the 80s, when lucerne was more susceptible to aphids and disease.

Sheep Experiments

- Begin next autumn.
- One experiment will involve feeding sheep lucerne hay of different coumestrol contents.
- The second experiment will involve removing sheep from high coumestrol lucerne pasture and putting them onto grass at different times prior to mating. This will let us know how long coumestrol affects the sheep for.

Cemetery Block – Legume/grass mixes

A) Lucerne/grass mixes

- Established autumn 2012.
- Age structure created by utilising an established runout lucerne sward in C7(W)
  – allowance for covariate analysis

Context & Objectives:

- P21 Phase II experiments were designed to aid dryland farmers by offering improved spring flexibility within lucerne-based sheep and beef systems.
- In particular, on-farm and at field days interest has been shown for information on productivity, management and persistence of lucerne/grass mixes.
- 'MaxLucerne' will quantify differences in yield, composition, nutritive value and water use of rotationally grazed lucerne/grass mixes compared with a lucerne monoculture.

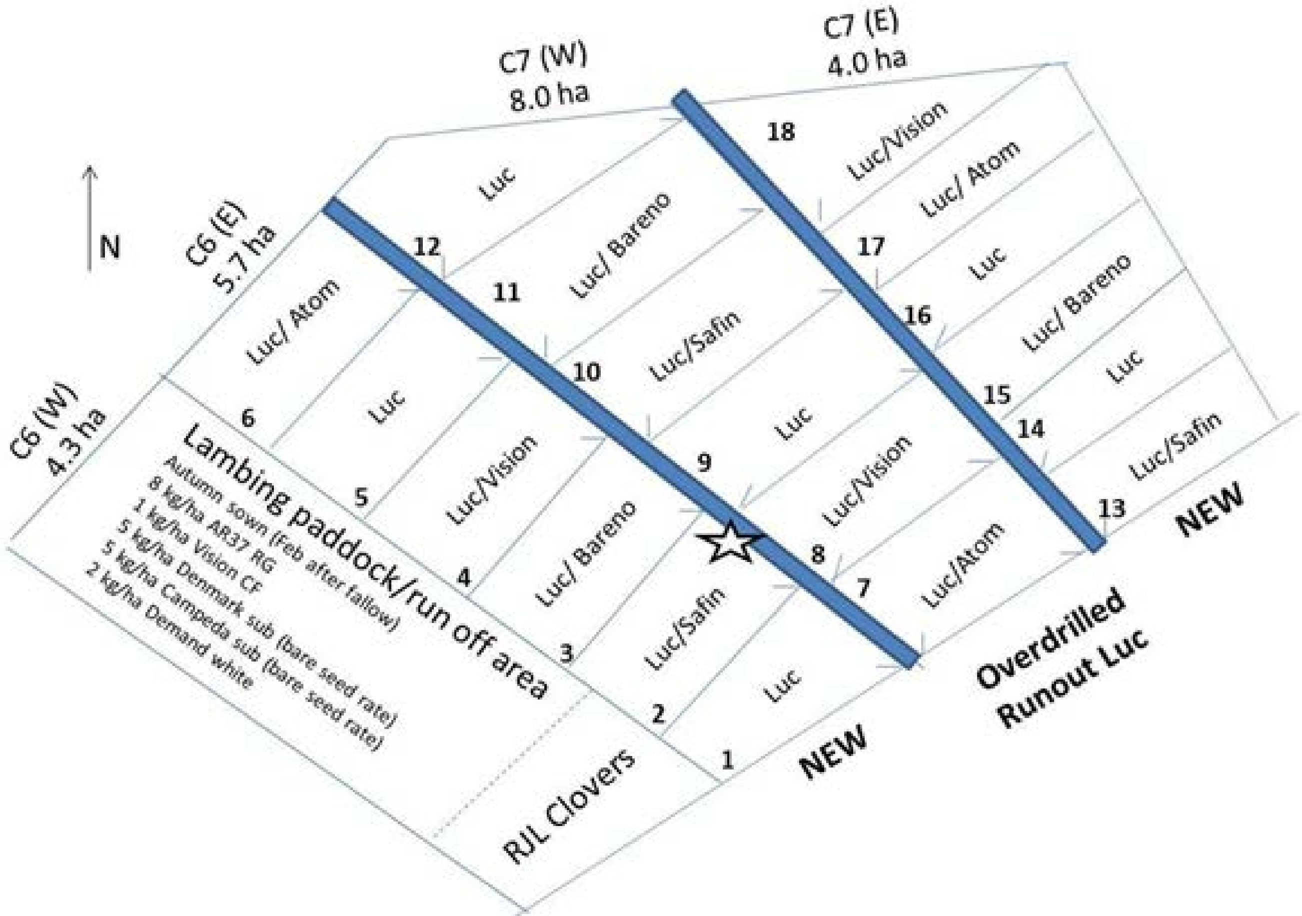


Figure 7 Experimental plan for the grazed lucerne/grass experiment in Cemetery Block at Ashley Dene, Canterbury.

Methodology

Location

- The 'MaxLucerne' lucerne/grass experiment is a 17.7 ha grazed farmlet experiment established on the Cemetery Block (Figure 7).
- Soils are classified as Ashley Dene deep, Lowcliffe stony and Lismore stony soils. They are stony and have variable depth to gravels, typical of a floodplain.

Experimental design

- Paddocks C6(E) and C7(E) established as new pastures in autumn 2012. In C7(W) a runout lucerne stand was oversown with grass to create an age structure (covariate analysis).
- There are a total of 18 paddocks. This allows for two lucerne/grass mixes to be compared with a lucerne monoculture under a 6-paddock rotational grazing system. The experiment is a randomised complete block experiment with three pasture types.
- There are two cocksfoot cultivars ('Safin' and 'Vision') and two bromes ('Atom' prairie grass or 'Bareno' brome) within the design. This effectively gives three replicates of each cultivar. Orthogonal contrasts will allow differences in yield, pasture composition and quality parameters between cultivars to be identified.

Measurements

- Environmental data monitored on-site (C Block).
- DM yields measured from pre-grazing quadrat cuts and botanical composition quantified.
- Destructive samples retained for nutritive analysis of pasture components by NIRS.
- LW production (weighed full pre-weaning, weighed empty post weaning).
- Soil moisture (TDR and neutron probe to 2.3 m).

Animal LWt production

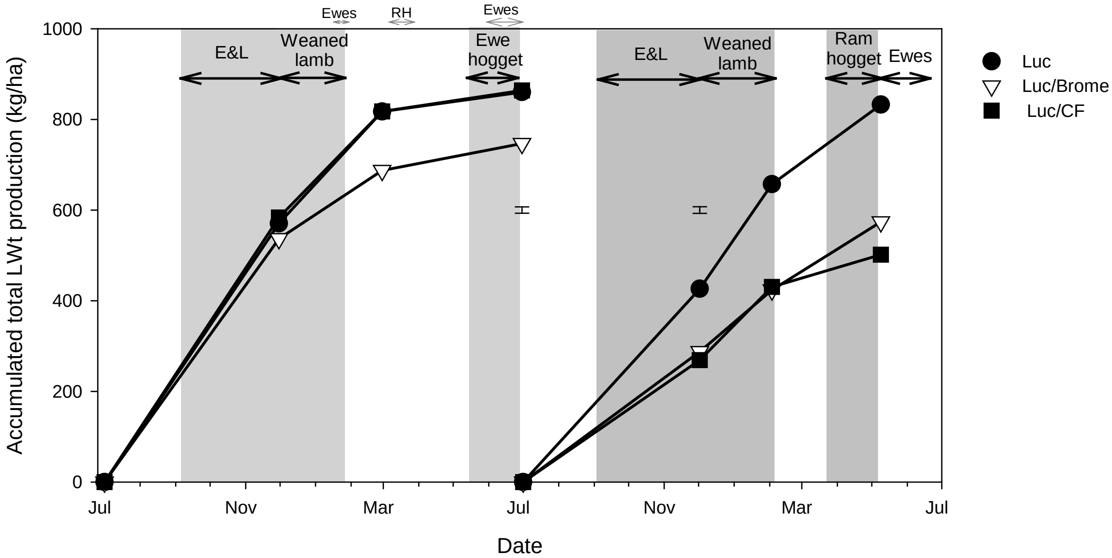
- Rotationally grazed by mobs of Coopworth ewes with twin lambs at foot in spring (weighed full). Grazing days and mean liveweight gain will create replicate LWt data for analysis.
- Put & Take system allows stocking rates to match feed supply and animal demand.
- Post-weaning the weaned lambs will be returned for grazing (weighed empty)
- After these lambs are sold hoggets may be brought on to simulate a store lamb production system if feed supply allows.
- Destocked in winter or when feed supply unable to meet animal demand.
- **Grazing began on 19 August 2014**

Water use

- TDR (0-0.2 m) and neutron probe access tubes (0.2-2.3 m) in all 18 plots.

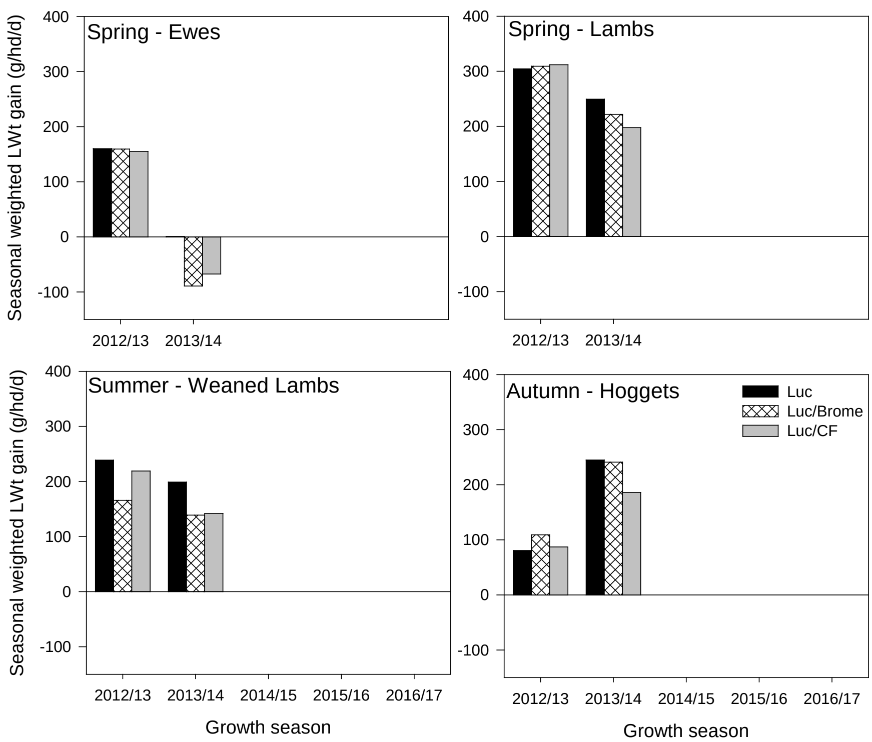
Prelim Results

Total LWt production 2012/13 and 2013/14



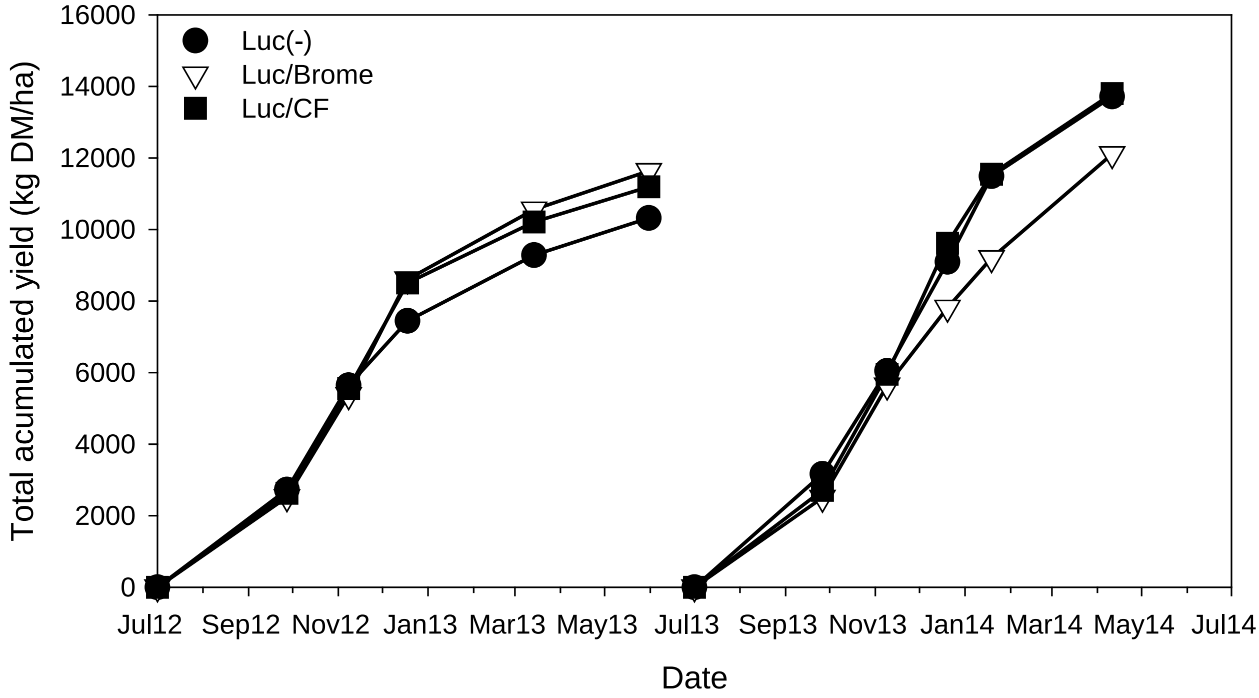
Spring:

- Spring 2012/13 LWt/ha was 6-9% more from Luc or Luc/CF than from Luc/Brome (537 kg LWt/ha).
- Spring 2013/14 LWt was 37% more (545 kg LWt/ha) from Luc than Luc/Brome or Luc/CF



Summer:

- Summer weaned lambs grew at 166 (Luc/brome) to 239 g/hd/d (Luc).
- 90 kg LWT/ha more produced from Luc or Luc/CF pastures than from Luc/Brome (150 kg LWt/ha)
- Stocking rates 14.8 to 16.5 weaned lambs/ha.


Luc(-)
Luc/Brome
Luc/CF
Total acumulated yield (kg DM/ha)
0
2000
4000
6000
8000
10000
12000
14000
16000
Jul12
Sep12
Nov12
Jan13
Mar13
May13
Jul13
Sep13
Nov13
Jan14
Mar14
May14
Jul14
Date

Cemetery Block – Legume/grass mixes

Alistair Black; Dick Lucas; Derrick Moot

B) Clover/grass mixes (Year 1)

C9A(N) + C9B(N)

- Established in paddocks C9A(N) and C9B(N) (total area 8.04 ha)
- Four pastures, replicated four times, were established in an RCB design between 26 Mar and 16 Apr 2013. Two replicates were sown on each date with the delay caused by rainfall.
- Paddocks are 0.5 ha in size.
- Soils are stony and have variable depth to gravels, typical of a floodplain. They are classified as Lowcliffe stony, Lowcliffe moderately deep, Ashley Dene Deep and Lismore stony soils.
- Grazed by hoggets in spring
- On 10 Oct Reps 2 and 4 were closed. Reps 1 and 3 were closed on 18 Oct 2013.

The first year was predominantly aimed at generating a seedbank for annual clover re-generation for the next 3-4 years. The first set of LWt production from ewes and lambs is scheduled for this spring.

2014/15

- Grazing for the 2014/15 season was initiated on 2/9/2014

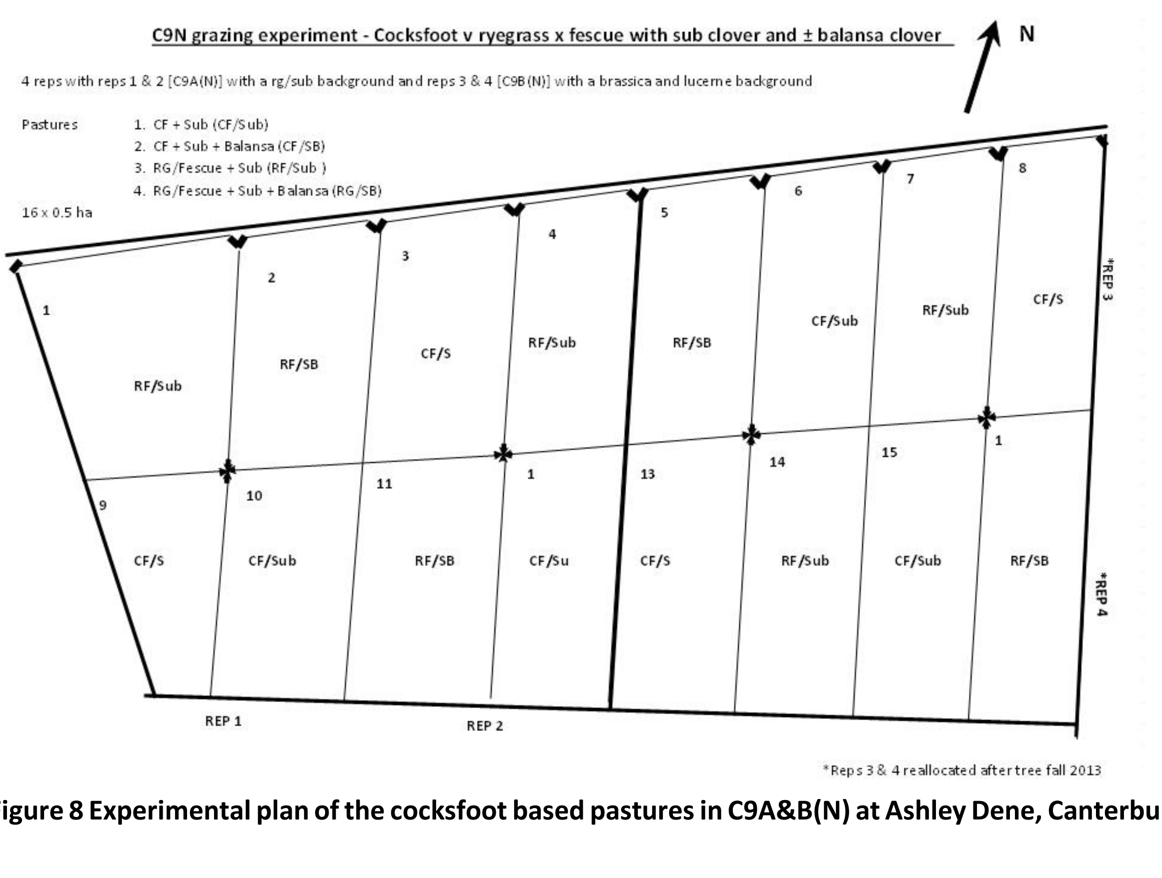


Figure 8 Experimental plan of the cocksfoot based pastures in C9A&B(N) at Ashley Dene, Canterbury.

Table 3 Sowing rates (kg/ha) of species and cultivars used in the dryland pastures established in C9N(A) and C9N(B) at Ashley Dene, Canterbury in autumn 2013. RGxTF is a perennial ryegrass x tall fescue hybrid and CF is cocksfoot. All pastures were established with basal white clover (Wc) and plantain.

	Sub clover		Wc	Plantain	Balansa	RG x TF hybrid	CF
Pasture	'Rosabrook'	'Denmark'	'Nomad'	'Tonic'	'Bolta'	'Ultra Enhanced'	'Greenly'
CF/Sub	5	5	0.5	0.5	0	0	2
CF/SB	5	5	0.5	0.5	4	0	2
RF/Sub	5	5	0.5	0.5	0	10	0
RF/SB	5	5	0.5	0.5	4	10	0

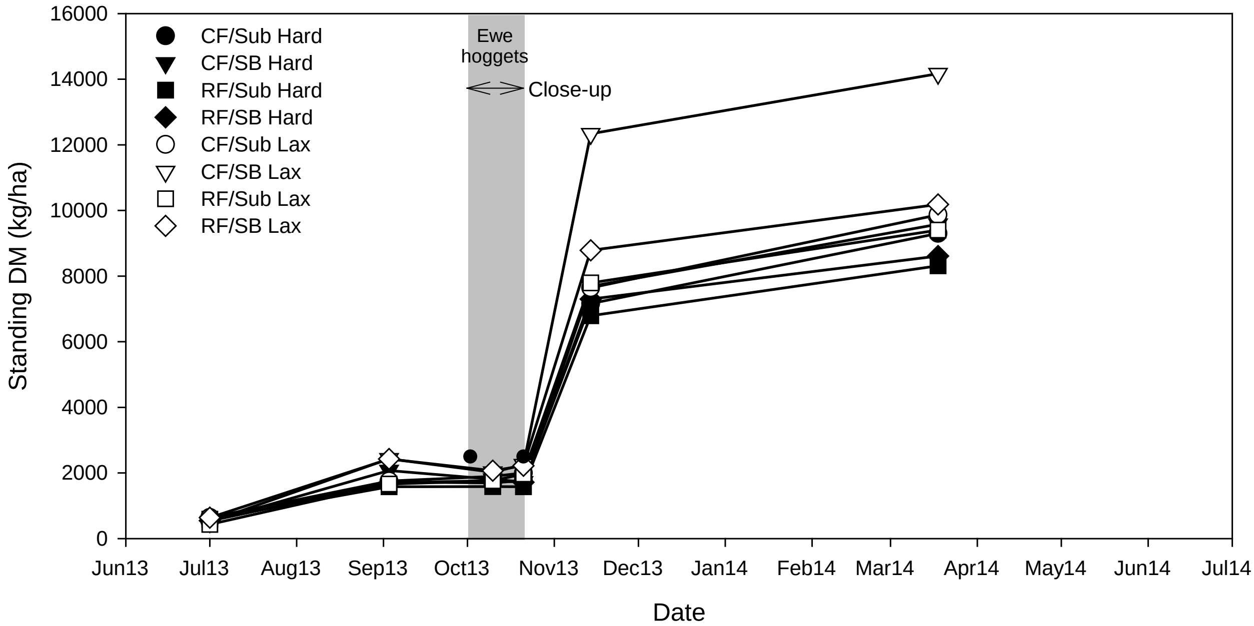


Figure 9 Accumulated DM yield (kg/ha) in the first year (2013/14) of cocksfoot or ryegrass/fescue hybrid pastures established with sub or sub and balansa clover. White clover and plantain were included in all pasture mixes.

Tall Fescue X Clover X Soil Fertility Grazing Trial

Dr Alistair Black
10 September 2014

- This trial measured the sheep and dry matter productivity of dryland tall fescue-clover pastures over three years (2011-12 to 2013-14) at Lincoln University.
- Treatments were all possible combinations (eight) of two cultivars of tall fescue (‘Advance’ and ‘Flecha’), two species of clover (white and sub) and two levels of soil fertility (Olsen P = 18 and 8 mg/L) in a randomised block design with four replicates and 0.04 ha plots.
- Fertility treatments were imposed in Dec 1996.
- Pastures were established in March 2008.
- Superphosphate was applied every 1-2 years to maintain soil fertility levels (rates depended on soil test results).
- Each plot was fenced to provide for a rotational grazing system across four plots within each treatment (5-7-day shifts, variable stocking rate).
- Coopworth ewe hoggets were stocked on each treatment (3-7 sheep per group) from August to December and from March to May each year.

Plot layout:
A = ‘Advance’ tall fescue S = sub clover H = high soil fertility
F = ‘Flecha’ tall fescue W = white clover L = low soil fertility

Block 1	1 FSL	2 ASL	3 AWH	4 FWH	5 AWL	6 ASH	7 FSH	8 FWL	
Block 2	9 ASH	10 FSH	11 AWL	12 FWL	13 FSL	14 FWH	15 AWH	16 ASL	
Block 3	17 FSH	18 ASH	19 FWL	20 AWL	21 FWH	22 ASL	23 FSL	24 AWH	
Block 4	25 ASL	26 FSL	27 AWH	28 FWH	29 ASH	30 AWL	31 FWL	32 FSH	Yards

Table 4 **Annual sheep liveweight gain (in g/day and kg/ha) of dryland tall fescue-clover pastures in response to tall fescue cultivar, clover species and soil fertility over three years (2011-12 to 2013-14) at Lincoln University.**

	Tall fescue (T)		Clover (C)		Soil fertility (F)			Level of significance			
	Adv	Fle	SC	WC	High	Low	SED	T	C	F	Int.
2011-12											
g/day	101	98	122	76	105	93	11.0	NS	*	NS	NS
kg/ha	648	668	878	437	719	596	79.9	NS	**	NS	NS
2012-13											
g/day	126	111	124	114	120	117	11.3	NS	NS	NS	NS
kg/ha	540	496	598	438	530	506	40.7	NS	*	NS	NS
2013-14											
g/day	87	91	95	83	92	86	18.4	NS	NS	NS	NS
kg/ha	571	651	683	539	648	574	121.0	NS	NS	NS	NS

* = P<0.05, ** = P<0.01, NS = not significantly different

Table 5 **Total annual dry matter yield (kg DM/ha) and botanical composition (% of annual total yield) of dryland tall fescue-clover pastures in response to tall fescue cultivar, clover species and soil fertility over three years (2011-12 to 2013-14) at Lincoln University.**

	Tall fescue (T)		Clover (C)		Soil fertility (F)			Level of significance			
	Adv	Fle	SC	WC	High	Low	SED	T	C	F	Int.
2011-12											
Total	13520	15370	16000	12890	15190	13710	442	***	***	**	T.C*
Tf	61	36	51	46	48	49	2.5	***	*	NS	NS
Cl	14	13	20	7	13	13	1.9	NS	***	NS	NS
Wd	25	51	29	47	39	38	2.0	***	***	NS	NS
2012-13											
Total	12940	13240	13800	12380	13550	12630	535	NS	*	NS	NS
Tf	58	31	51	39	44	46	3.0	***	***	NS	T.C.F*
Cl	13	13	14	12	14	12	2.4	NS	NS	NS	T.C.F*
Wd	29	55	35	49	41	42	2.8	***	***	NS	NS
2013-14											
Total	11490	11500	12030	10950	11650	11340	439	NS	*	NS	NS
Tf	51	40	48	43	46	46	3.0	**	NS	NS	T.F*
Cl	8	6	10	3	6	7	1.4	NS	***	NS	NS
Wd	41	54	42	54	48	47	2.5	***	***	NS	T.F*

* = P<0.05, ** = P<0.01, *** = P<0.001, NS = not significantly different

Figure 10 Seasonal dry matter production of dryland sub clover-tall fescue compared with white clover-tall fescue over three years (2011-12 to 2013-14) at Lincoln University.

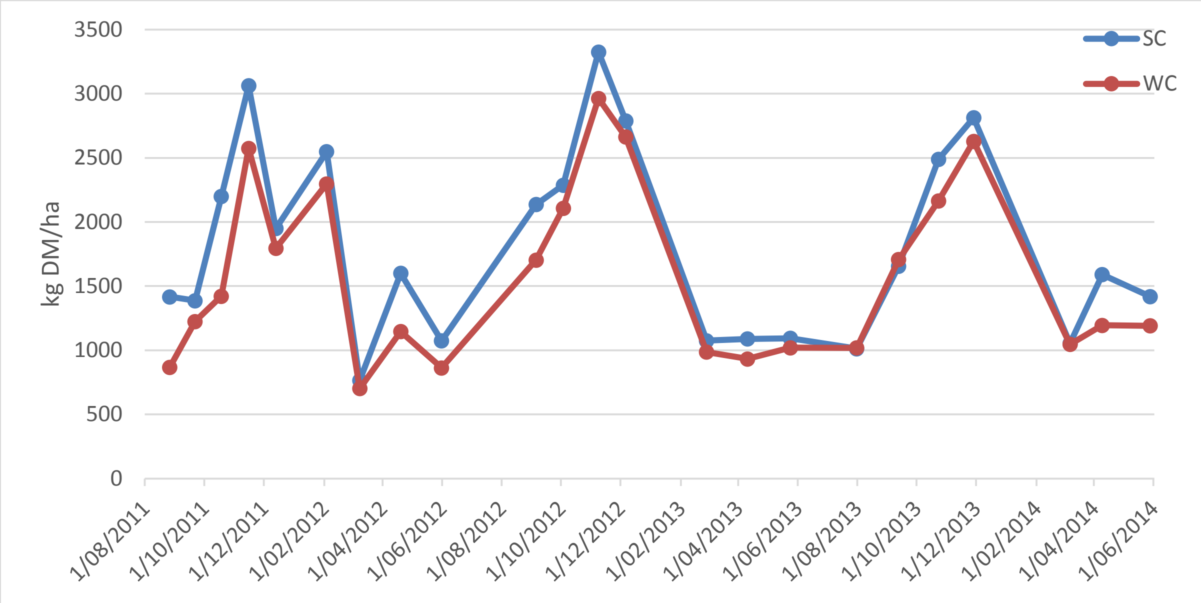
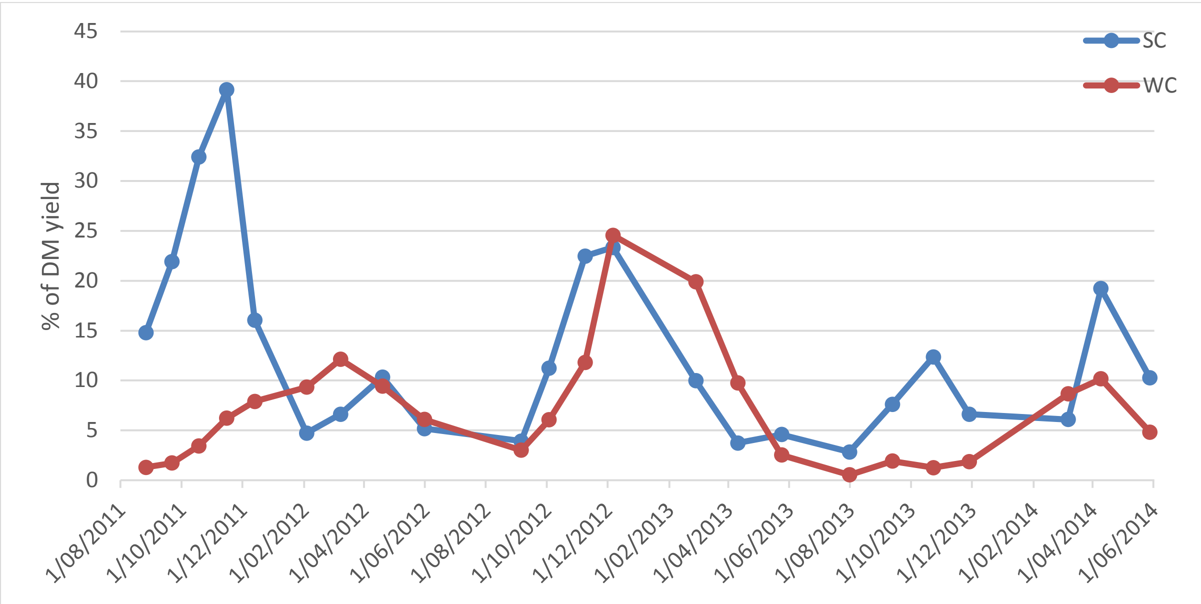


Figure 11 Seasonal clover content of dryland sub clover-tall fescue compared with white clover-tall fescue over three years (2011-12 to 2013-14) at Lincoln University.



Student projects on Pastoral 21

Natalie Stocker	BAgSci (Hons)	completed 2011
Alice Speedy	BAgSci (Hons)	completed 2012
Sarah Bennett	BAgSci (Hons)	completed 2012
Mart-Marie Roux	BAgSci (Hons)	completed 2012
Emma Coutts	BAgSci (Hons)	completed 2013
Richard Sim	PhD	completed 2014
Lisa Box	BAgSci (Hons)	completed 2014

Websites

Dryland pastures website: www.lincoln.ac.nz/dryland
Dryland pastures blog: http://www.lincoln.ac.nz/conversation/drylandpastures/