Lincoln University
Te Whare Wānaka o Aoraki
CHRISTCHURCH • NEW ZEALAND
New Zealand's specialist land-based university

beef + lamb new zealand

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.

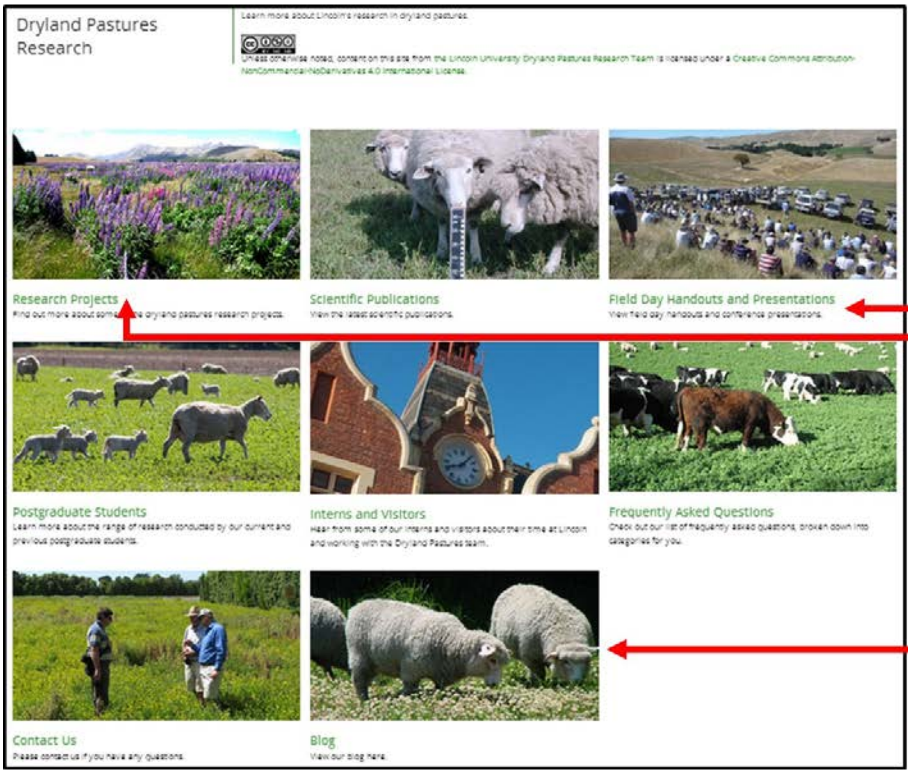
Pastoral 21

"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



New Website

Info on:

- Field Day presentations
- Current research projects

(inc access to Maxclover Photo Diary)

- FAQs
- Postgraduate study
- 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).

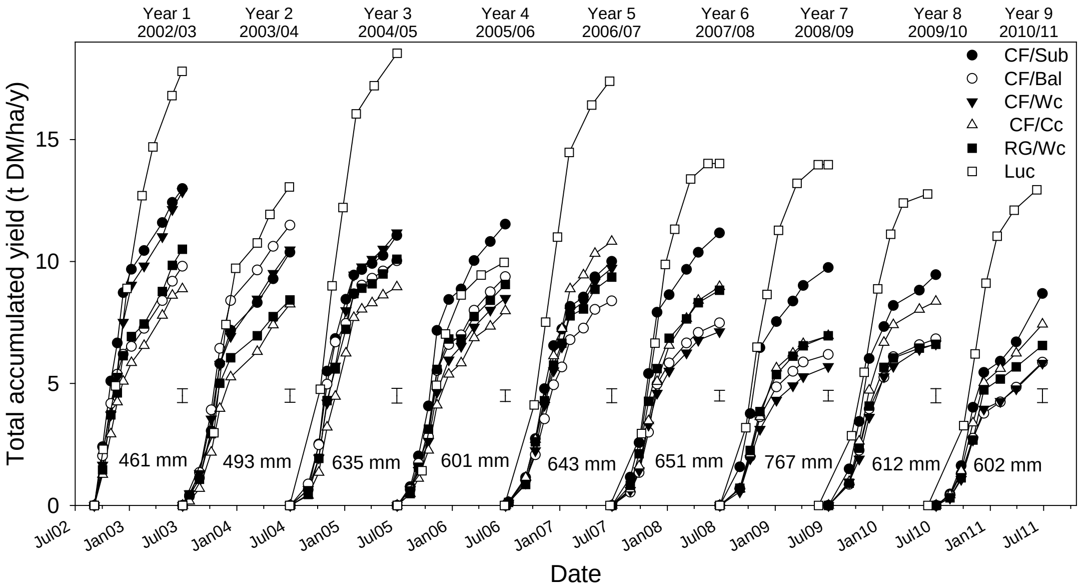


Figure 2 Total annual accumulated DM yields of six dryland grazed pastures at the 'MaxClover' grazing experiment at Lincoln University over nine years.

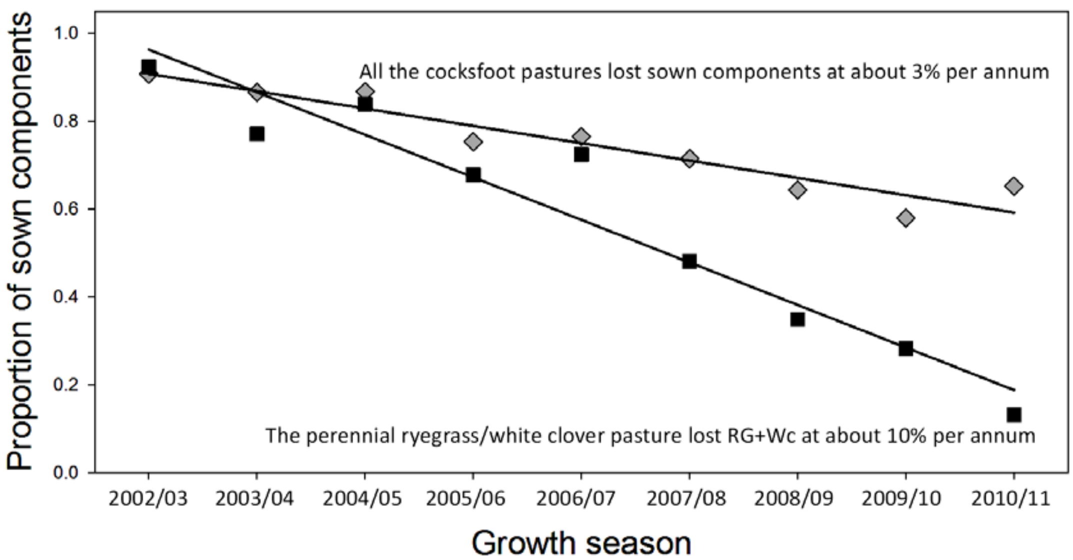


Figure 3 Rate of loss of the originally sown pasture components (grass+companion clover) from the five grass based dryland pastures at the 'MaxClover' grazing experiment at Lincoln University.

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 – completed spring 2014.

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

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).

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).

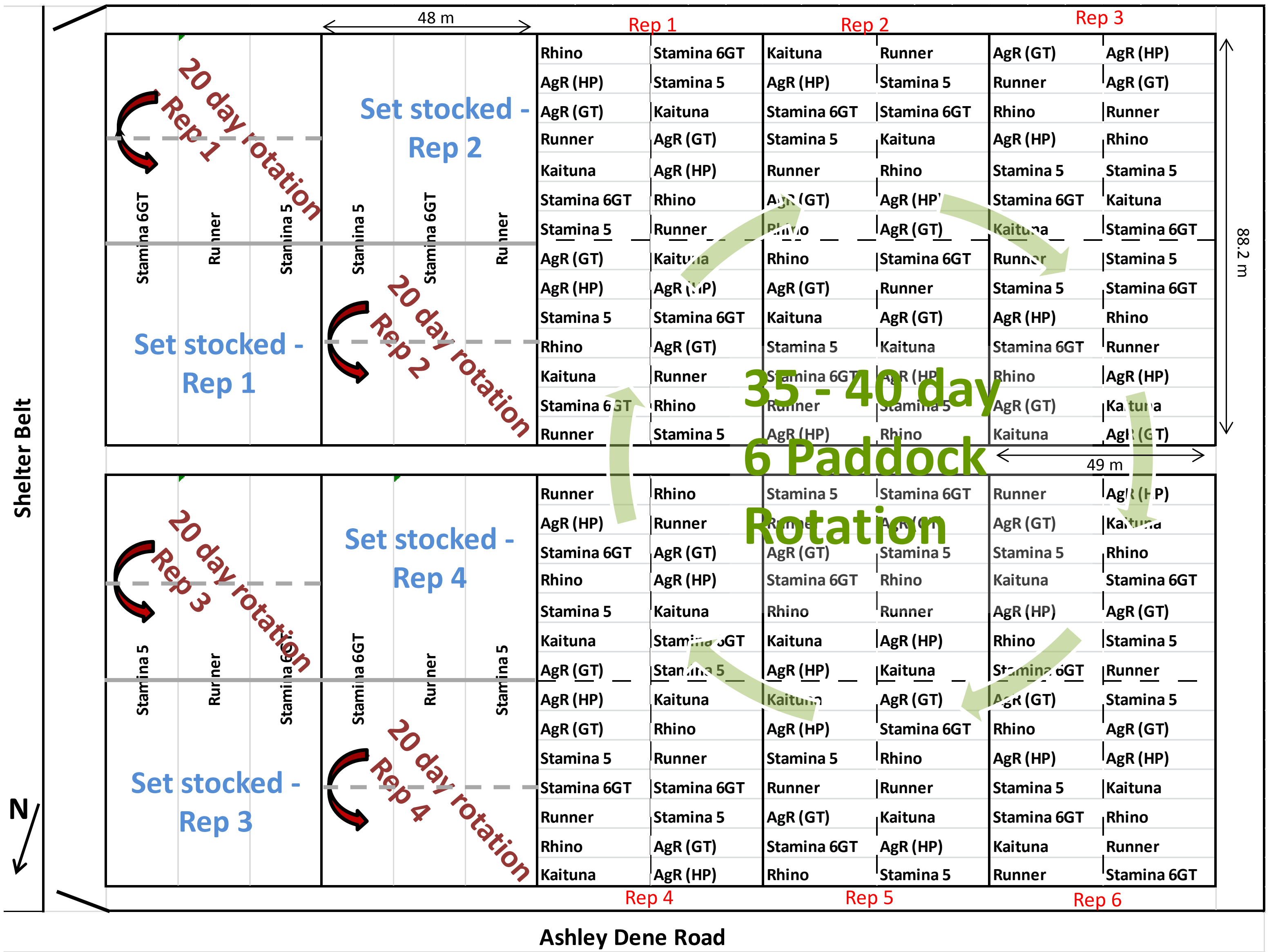
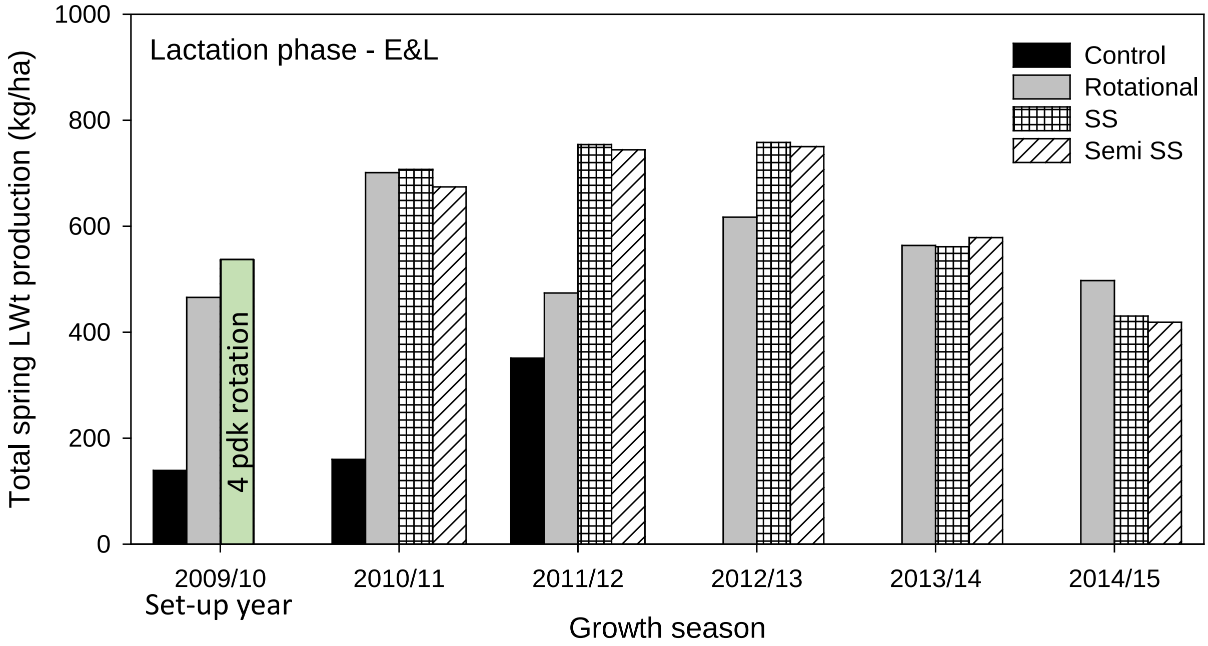


Figure 4 Experimental design for spring grazing management of lucerne farmlet experiment at H7, Ashley Dene, Canterbury.

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).

The experiment terminated at weaning on 24/11/2015 (Year 5) by which time 'Stamina 6GT' had produced 5.7 t DM/ha under rotational grazing. Seasonal rainfall (Jul-Nov) was about half the long-term average in the final season.

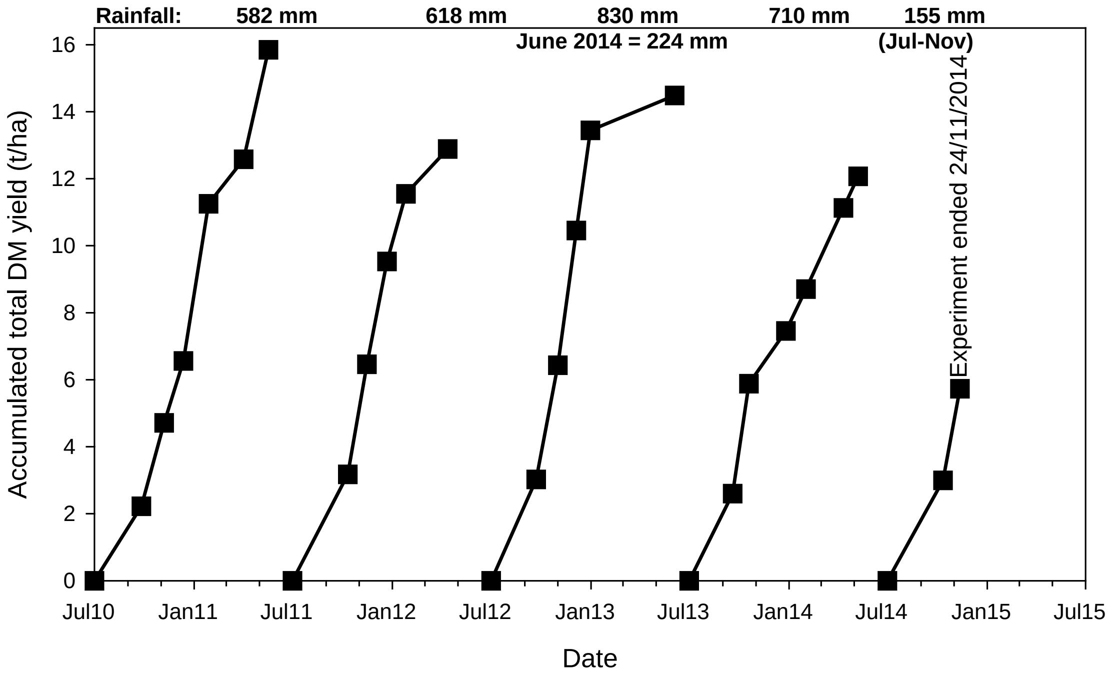


Figure 5 Accumulated dry matter yield of 'Stamina 6GT' lucerne (■) under a 6-paddock rotational grazing system at Ashley Dene, Canterbury.

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 ~15 cm tall and keep it there.
7. Stock at about **<u>half</u>** 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

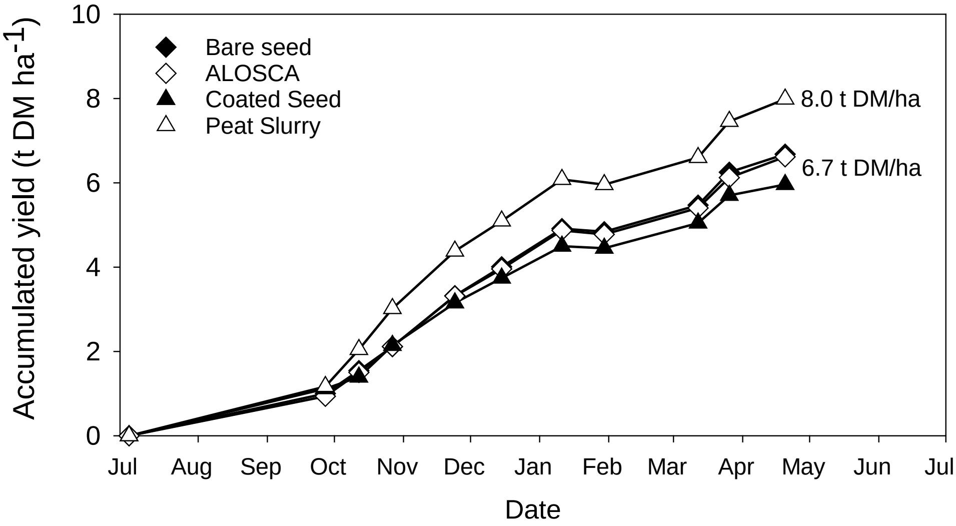


Figure 6 Effect of seed treatment on dry matter year in the 1st year after sowing

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:

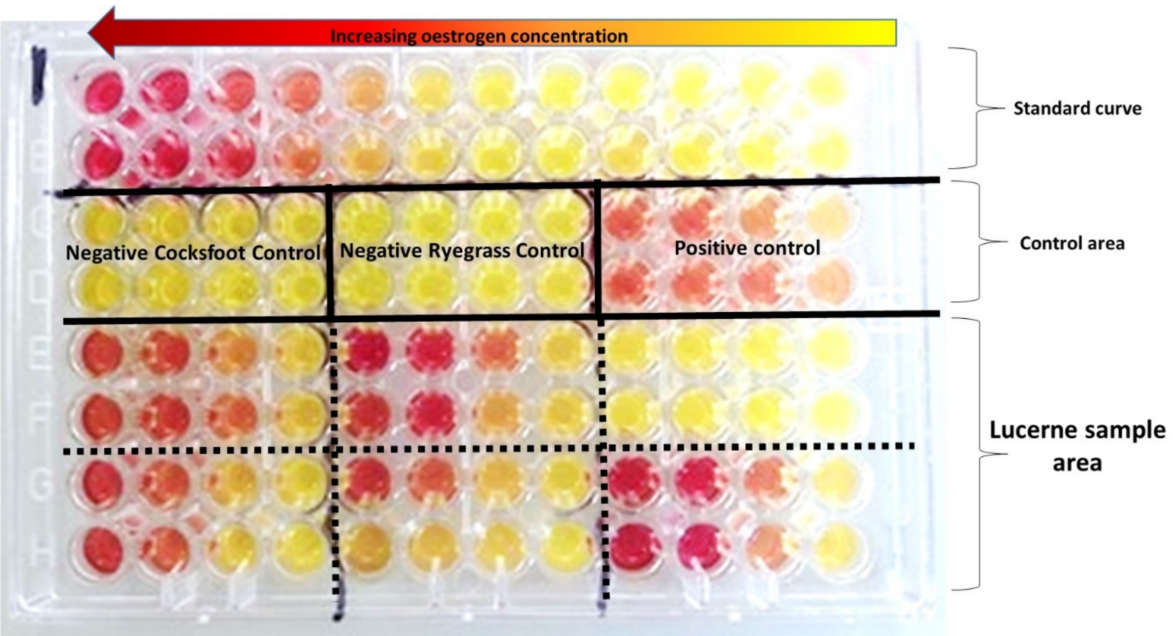
- high quality feed
- uses water efficiently
- long taproot

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

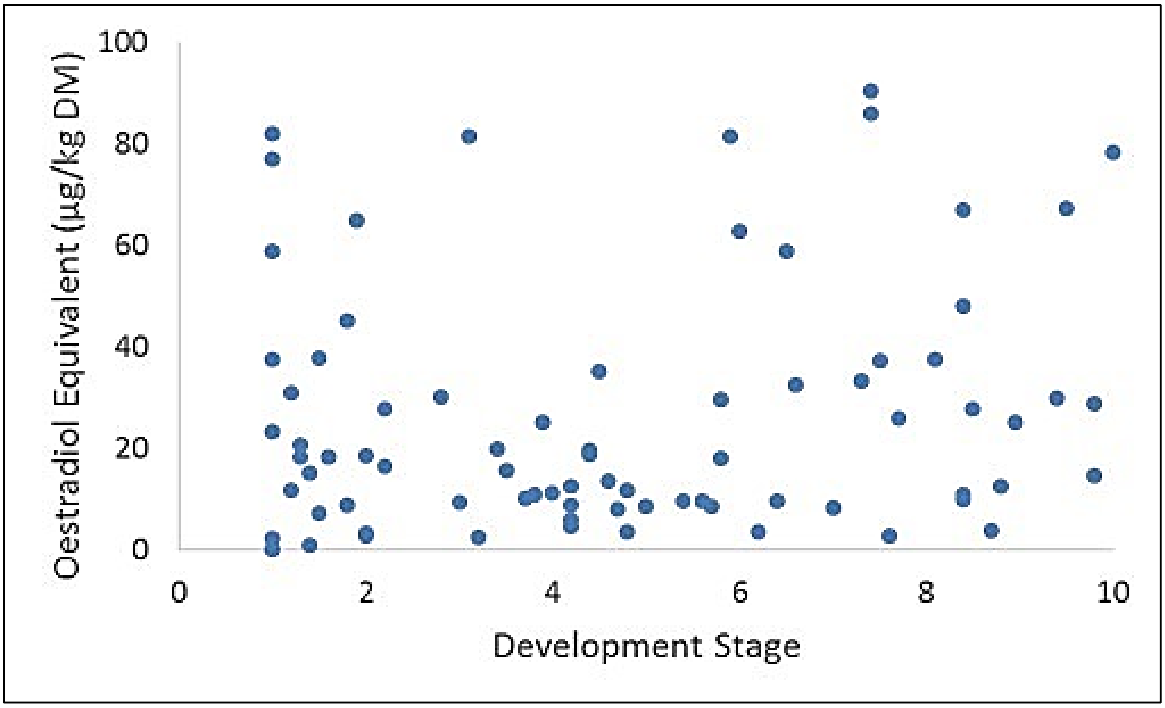
For this project I have a fast, cost-effective method of screening lucerne for its oestrogenicity. This method uses yeast modified with an oestrogen receptor. When an oestrogenic compound binds to the receptor the yeast produces a compound that causes a colour change from yellow to red, this takes about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



What factors are causing elevated coumestrol in lucerne:

- Fungal infection?
- Aphids?
- Flowering?

Initial Results



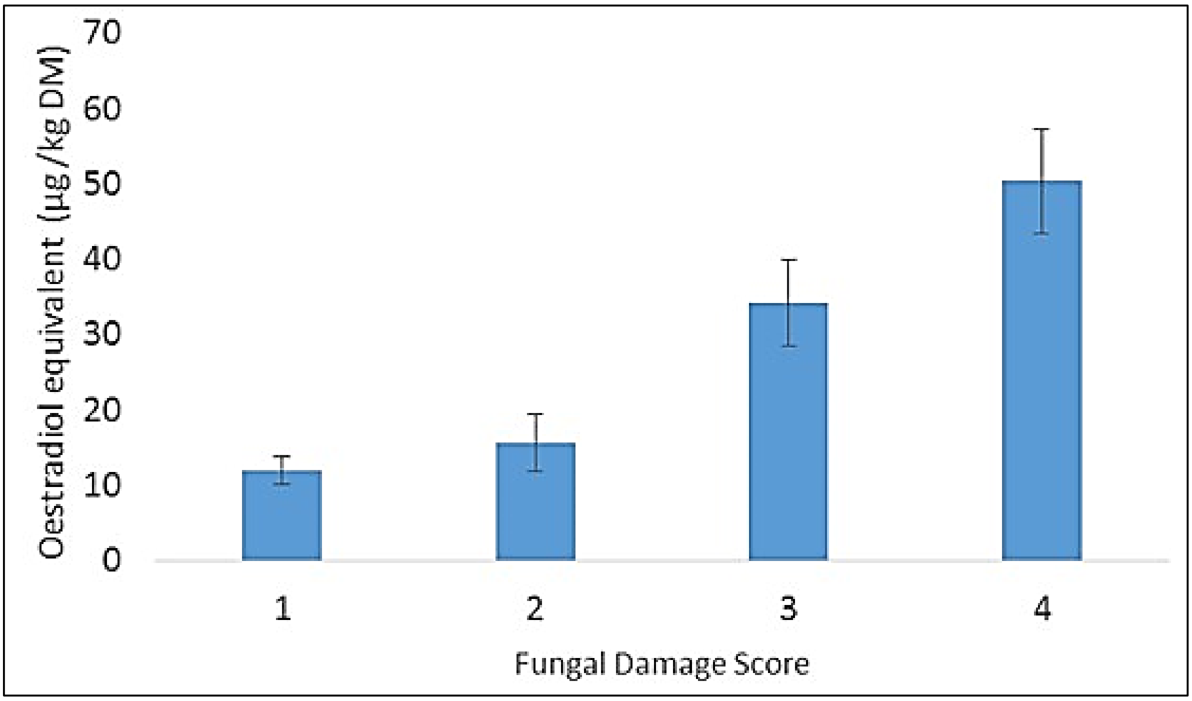
Stage 3

Stage 6

Stage 10

- Developmental Stage did not cause increased coumestrol levels.
- No coumestrol increase was measured during the drought last summer, therefore not increased by water stress.

- Fungal damage appears to be the cause:



Fungal Damage Score 1

Fingal Damage Score 4

Sheep Experiments

Ewe hogget udder development on lucerne (left) and ryegrass (right) at Creedmoor farm in Oamaru.

This autumn:

- 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.
- Comparing heavy and light ewes flushed on lucerne with heavy and light ewes on grass. This will allow us to determine whether improving pre-mating live weight by grazing on lucerne or avoiding lucerne containing coumestrol is more important for ovulation rate.

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.

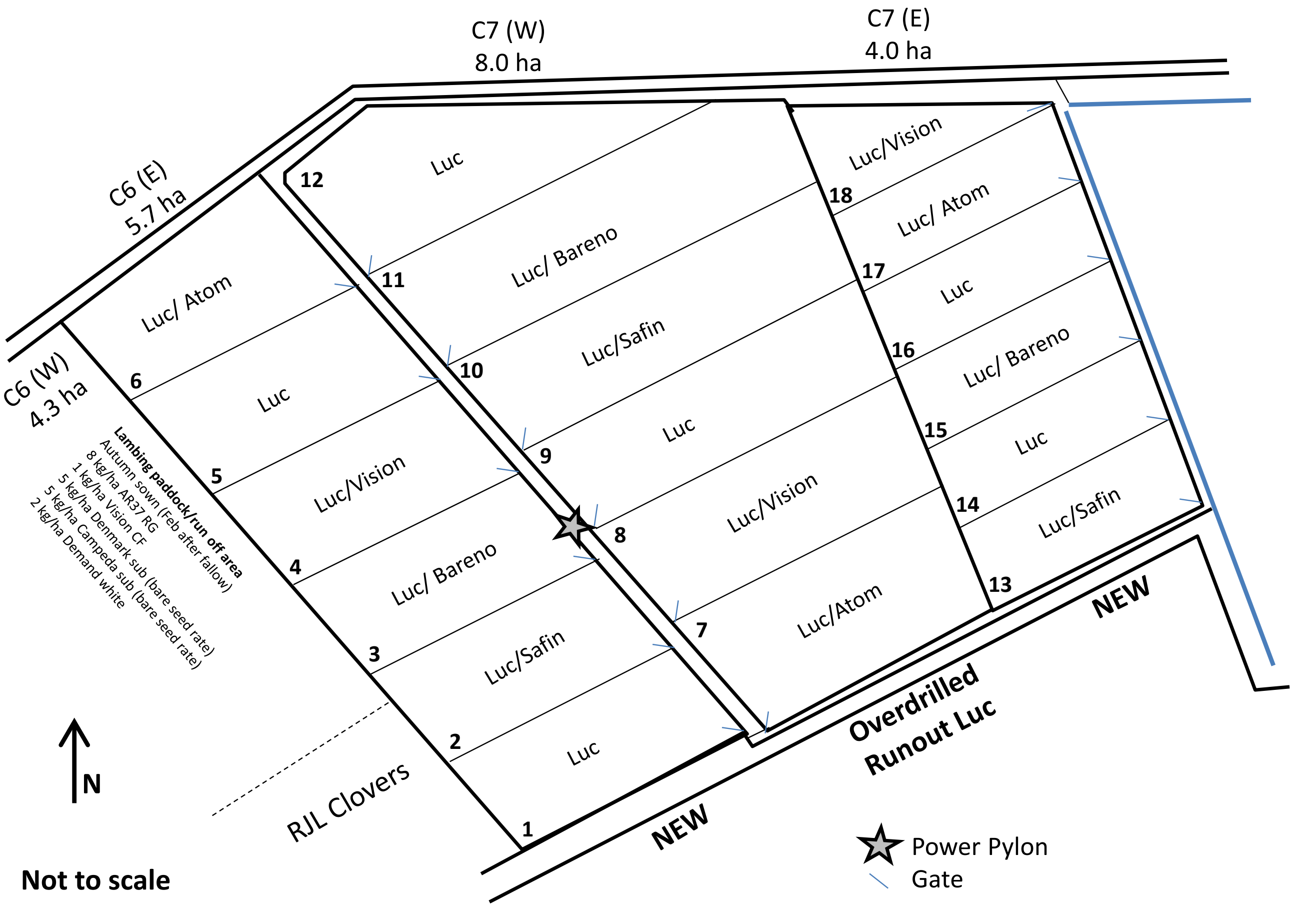


Figure 7 Experimental plan for the grazed lucerne/grass experiment in Cemetery Block at Ashley Dene, Canterbury.

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.

Table 3 Pasture treatments and sowing rates for MaxLucerne

Treatment	Lucerne cultivar	Rate (kg/ha)	Grass cultivar	Rate (kg/ha)
Lucerne	'Stamina'	8	-	-
Lucerne/brome	'Stamina'	8	'Atom' prairie grass 'Bareno' brome	9 10
Lucerne/cocksfoot	'Stamina'	8	'Safin' cocksfoot 'Vision' cocksfoot	3 3

Figure 8 MaxLucerne grazing experiment on 18 Sept 2015.

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.
- LWt production.
- 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 31 Aug 2015 for lucerne/grass mixes and on 17 Sept for lucerne monocultures.**
- **Pastures are stocked at 11 ewes/ha plus their lambs.**
- **Lucerne treatments have been split to quantify the effects of grain (barley) supplementation on lamb liveweight production during lactation.**

Water use

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

Prelim Results

Figure 9 shows total accumulated LWt production from dryland lucerne and lucerne/grass mixes.

Spring period summary:

- **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
- **Spring 2014/15**: Figure 10 shows ewes gained between 33 (Luc/CF) and 66 g/hd/day (Luc) while lambs at foot grew 250 (Luc/CF) to 334 g/hd/day (Luc) until pastures were destocked on 7 Nov. Destocking occurred prior to weaning on 20 Nov due to lack of feed resulting from earlier than average onset of water stress conditions.
- **Spring 2015/16 (In Progress – data to 12 October 2015) is shown below:**

LWt gain (g/hd/day)	Stock Class	
Pasture	Ewe	Lamb
Luc – grain supplementation	387	360
Luc – No grain supplements	396	366
Luc/Brome	43	281
Luc/CF	-99	223

Summer:

- Summer weaned lambs grew at 69 (Luc/brome 2014/15) to 239 g/hd/d (Luc 2012/13).
- In 2014/15: 90 kg LWT/ha more produced from Luc or Luc/CF pastures than from Luc/Brome (150 kg LWt/ha)
- In 2014/15: Stocking rates 14.8 to 16.5 weaned lambs/ha.

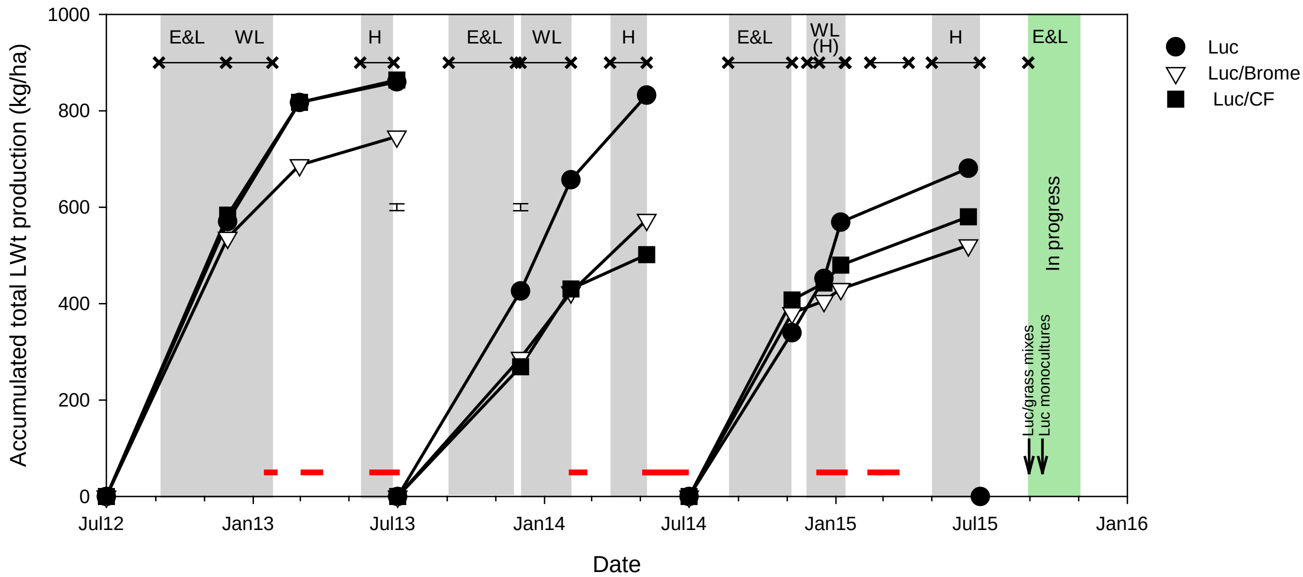


Figure 9 Total accumulated LWt production from sheep grazing dryland lucerne or lucerne/grass mixtures at Ashley Dene, Canterbury. Note: Grey areas indicate periods where production stock grazed and LWts contribute to measured LWt production. Red lines indicate periods of maintenance grazing for sward management where LWt was not measured.

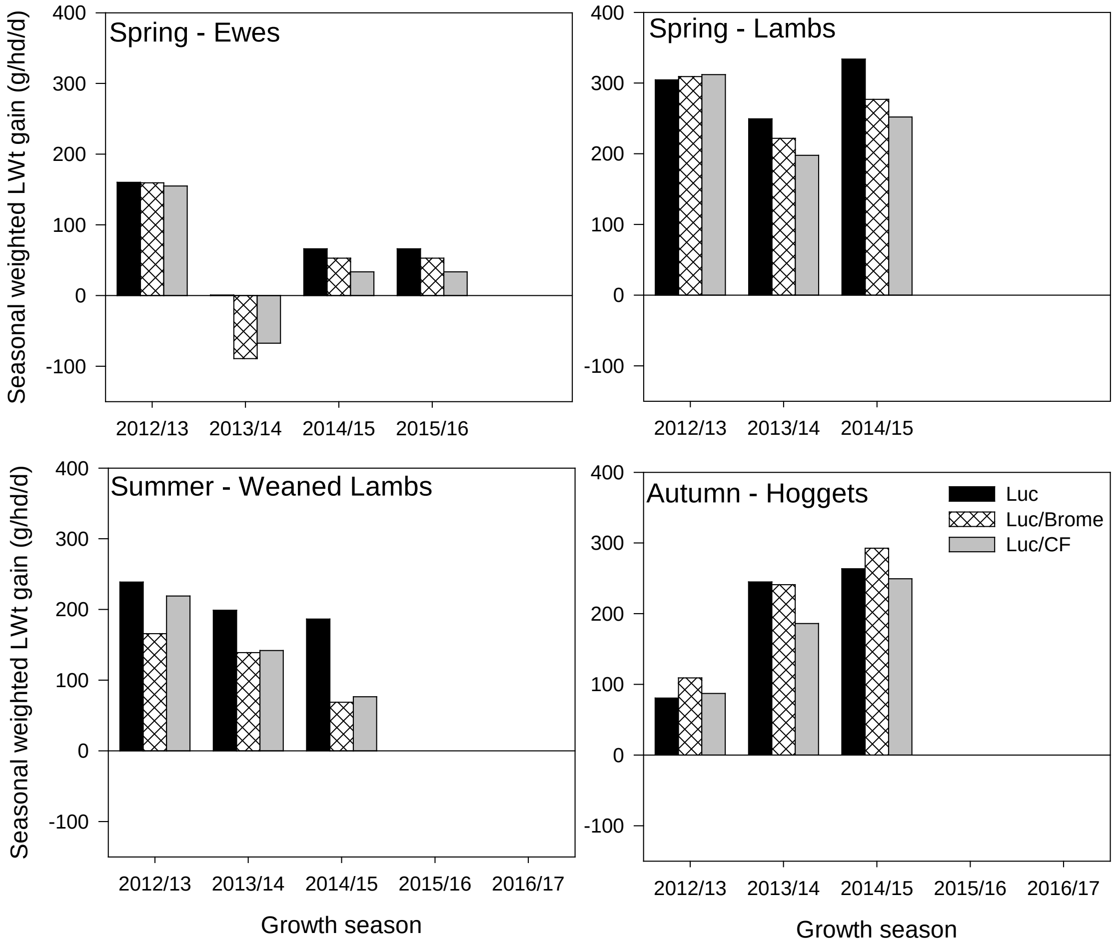


Figure 10 Mean daily growth rates of production livestock grazing lucerne of lucerne/grass mixtures in each entire season.

Accumulated DM Yield

- Yields were 10.3 (Luc) to 11.6 t DM/ha (Luc/Brome) in 2012/13 (Year 1). In 2013/14 (Year 2) the lowest yield (12.1 t/ha) was from the Luc/Brome pasture compared with 13.8 t/ha from the Luc monocultures and Luc/CF mixes.
- In 2014/15 (Year 3) grazing began on 19 Aug (Luc/CF); 26 Aug (Luc/Brome) and 18 Sept (Luc). All pastures were destocked on 7 Nov due to a lack of feed. Weaning occurred about 2 weeks later on 20 Nov. Spring lactation feed was about 5.5 t DM/ha from the lucerne/grass mixes and 6.0 t/ha from the lucerne monocultures.
- In 2014/15 annual yields from all three pastures were about 10.2 t DM/ha.

- In 2014/15 (Year 4) grazing began 2½ weeks earlier on the Luc/grass mixes (30/8/2015) than on the lucerne monocultures (17/9/2015).

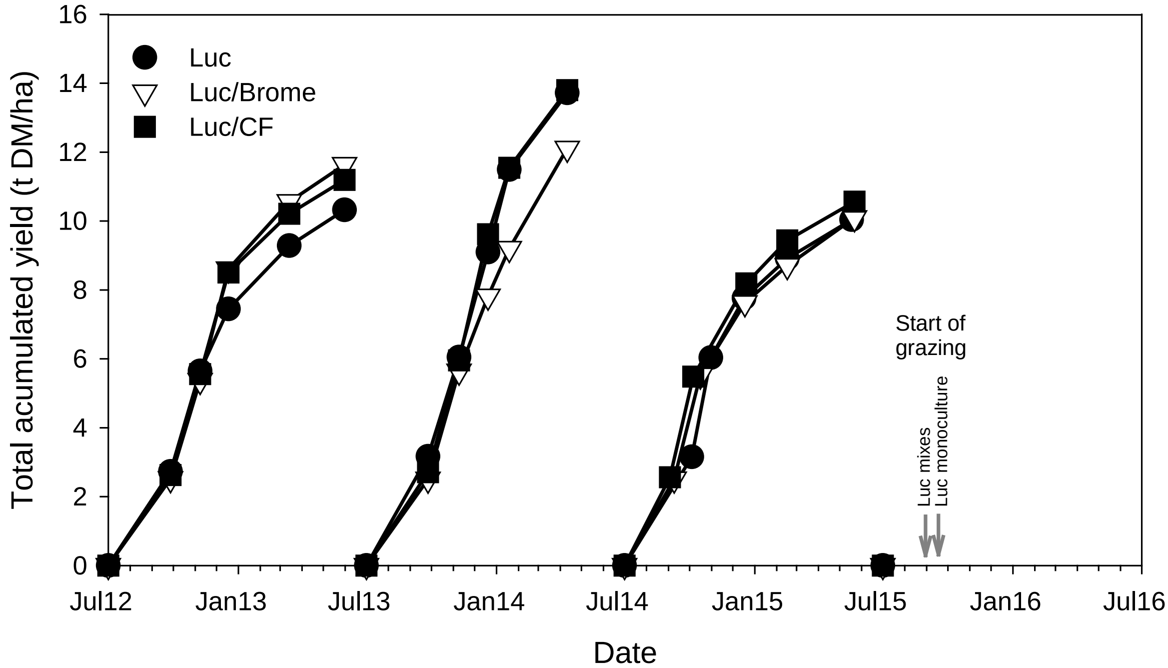


Figure 11 Accumulated DM yields from lucerne monocultures (Luc), Lucerne/brome and Lucerne/cocksfoot (Luc/CF) mixes at Ashley Dene Canterbury.

Grain supplementation for stock grazing lucerne monocultures

- Lucerne monocultures within the MaxLucerne experiment were split in half in 2013/14 and 2014/15.
- Stock on one half receive barley grain via an Advantage Feeder (NGF 800).
- Access was restricted in 2013/14 but not in 2014/15.
- Grain was available until weaned lambs were removed from the pastures in both years.
- The objective of this pilot study was to supplement barley grain to provide energy to process the nitrogen in the lucerne and determine if LWt production of stock can be enhanced in pre- and post-weaning phases (i.e. to increase the efficiency with which lucerne is used to produce LWt).

Year 1 (2013/14):

Liveweight production of lambs was unaffected by barley supplementation and a total of 782±11.5 kg LWt/ha was produced from 3/9/2014 to destocking on 3/2/2014.

Table 4 Liveweight gains (g/hd/d) of stock grazing a lucerne monoculture with (+Grain) or without (-Grain) access to barley grain supplements from 13/9/2013 to 3/2/2014 when pastures were destocked due to a lack of feed. Grazing was initiated on 3/9/2013 and stocking rates were increased as animals became available and both pastures were fully stocked by 18/9/2013.

Phase	LWt Rotation	Treatment	Ewes	Lambs
Lactation	1	+Grain	17	314
	(13/9 to 3/10)	-Grain	-103	305
		Significance	*	**ns**
	2	+Grain	77	238
	(4/10 to 13/11)	-Grain	107	242
		Significance	**ns**	**ns**
	3	+Grain	-124	175
	(14/11 to 2/12)	-Grain	-205	177
		Significance	*	**ns**
Post-weaning	4	+Grain	-	142
	(3/12 to 16/12)	-Grain	-	77
		Significance		**
	5	+Grain	-	130
	(17/12 to 6/1)	-Grain	-	94
		Significance		**ns**
	6	+Grain	-	320
	(7/1 to 3/2)	-Grain	-	352
		Significance		**ns**

Conclusions 2013/14:

- Barley grain supplementation generally had no effect on LWt production by lambs pre or post grazing.
- Ewe LWt was increased by 1.1± kg/hd, when barley grain was on offer prior to weaning and final weights were similar to start weights. In contrast, ewes in the –Grain treatment group lost 1.2± kg LWt/ha and weighed less than at the start of grazing. This resulted in a 10% higher ewe LWt at weaning from +Grain ewes (68.1±2.2 kg/hd) compared with –Grain ewes (61.8±1.4 kg/hd).
- Dry matter yields and the quantity of DM consumed were similar for both the + and –Grain flocks. This indicated barley supplementation was the most likely cause of improved ewe performance. An alternative explanation would be improved ewe condition reflected reduced demand on the dam by the +Grain progeny although this is unlikely given the lambs did not show increased LWt, nor was more DM consumed relative to the –Grain group.
- The lack of difference in DM yield data indicated that similar LWt production from the lambs was not a function of increased DM intake by the –Grain treatment group.
- Lamb LWt gain/hd varied by sex with ram lambs growing about 13% faster than ewe lambs. The main difference in lambs reaching target weight in this pilot study was a result of the variation in the proportions of ewe and ram lambs in the + and- Grain treatment groups. Initial ratios were about 50:50 in the +Grain group and 60:40 in the –Grain group.
- Cost benefit analysis is needed to determine if the cost of barley supplementation is justifiable to maintain ewe condition during lactation.

Year 2 (2014/15):

Liveweight production of lambs was unaffected by barley supplementation and a total of 385 kg LWt/ha was produced from 18/9/2014 to destocking on 7/1/2014.

Table 5 Liveweight gains (g/hd/d) of ewes and lambs grazing a lucerne monoculture with (+Grain) or without (-Grain) access to barley grain supplements from 18/9/2014 to 7/1/2015 when pastures were destocked due to a lack of feed. Grazing was initiated on 18/9/2014 and stocking rates were increased as animals became available and both pastures were fully stocked by 30/9/2014.

Phase	LWt Rotation	Treatment	Ewes	Lambs
Lactation	1	+Grain	220	359
	(18/9 to 21/10)	-Grain	268	352
		Significance	**ns**	**ns**
	2	+Grain	-356	340
	(22/10-7/11)	-Grain	-331	297
		Significance	**ns**	**
Lactation average	1 & 2 (18/9 to 7/11)	+Grain	-	353
		-Grain	-	334
		Significance		**ns**
Post-weaning	3	+Grain	-	154
	(26/11-7/1)	-Grain	-	187
		Significance		**ns**

Conclusions 2014/15:

- Barley grain supplementation had minimal effect on lamb or ewe liveweight production during lactation or after weaning.
- Dry matter yields (pre- and post-grazing) and dry matter consumption were similar for both the +Grain and –Grain treatments.
- The lack of difference in dry matter yield between grain treatments indicated that similar liveweight production from lambs and ewes was not as a result of increased dry matter intake by the –Grain stock.

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.
- Paddocks are ~0.5 ha in size, except Paddocks 1 (0.6 ha) and 9 (0.3 ha).
- Soils are stony and have variable depth to gravels, typical of a floodplain. They are classified as Lismore stony soils over most of the site.
- Grazed by hoggets in spring of 2013 and by ewes with lambs in spring 2014.
- 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 grazing in spring occurred in 2014/15 (Yr 2).

2015/16 (Yr 3)

- Grazing for the 2014/15 season was initiated on 20 Aug 2015 for the ryegrass based pastures (spelled over winter as ryegrass had to be oversown in autumn of Yr 2 as originally sown RG had failed to survive drought).
- For the cocksfoot based pastures grazing was initiated on 10 Sept 2015 (21 days later) because there was less feed available. This was a consequence of winter grazing (June/July 2015) to open the canopy for youg sub clover seedlings which were being supressed by vigous cocksfoot growth.
- Net result was early grazing in ryegrass plots reflected 126 days regrowth (April-August) compared with the cocksfoot where grazing was initiated on 10 Sept on approx. 68 days of regrowth.

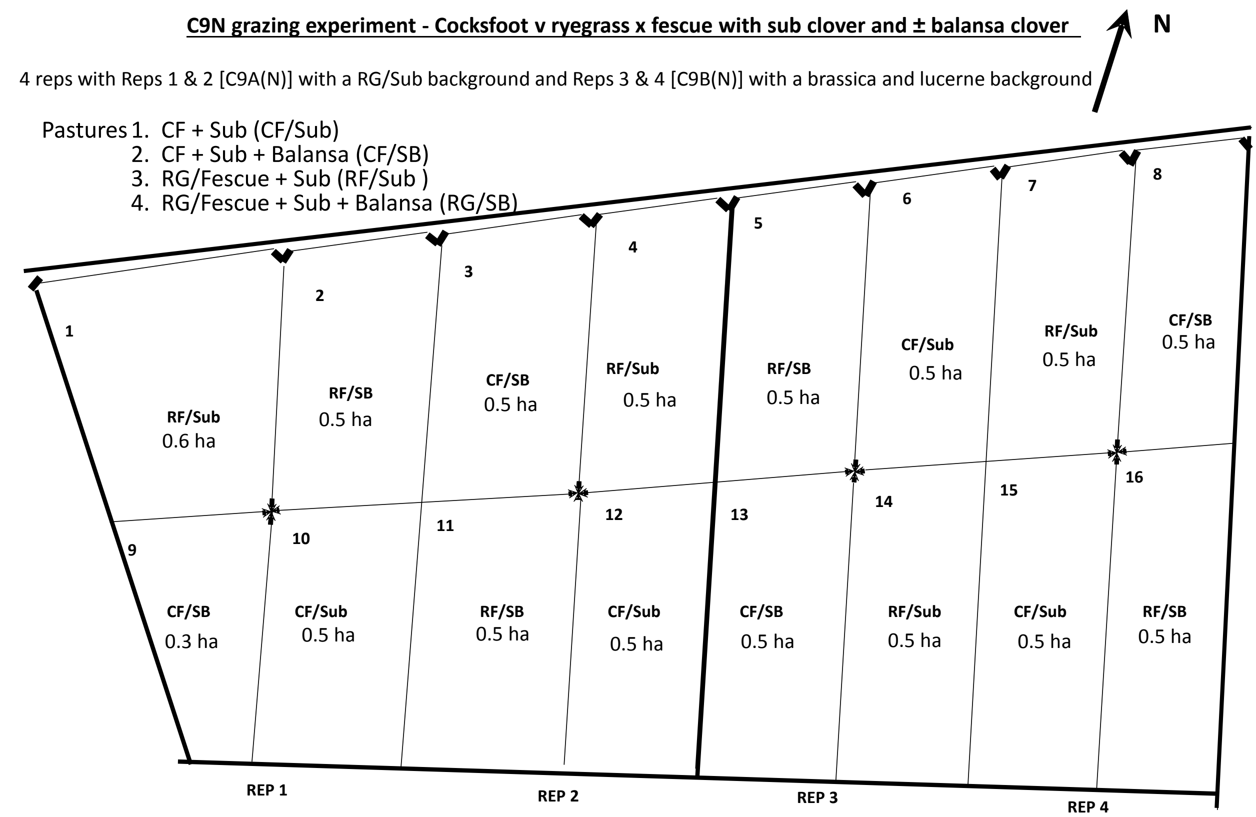


Figure 12 Experimental plan of the annual clover based pastures in C9A&B(N) at Ashley Dene, Canterbury.

Table 6 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. RGxMF is a perennial ryegrass x meadow fescue hybrid + a novel endophyte and CF is cocksfoot. All pastures were established with basal sub clover, white clover (Wc) and plantain.

	Sub clover		Wc	Plantain	Balansa	RG x TF hybrid ‘Ultra Enhanced’	CF
Pasture	‘Rosabrook’	‘Denmark’	‘Nomad’	‘Tonic’	‘Bolta’		‘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

* ~20kg/ha (target) SFR31-033 AR1 perennial ryegrass broadcast on 16 April 2015 due to failure of RF to survive.

The sub clover mixture aims to compare the standard, late flowering ‘Denmark’ with the recently released more erect, late flowering, red-legged earth mite tolerant ‘Rosabrook’.

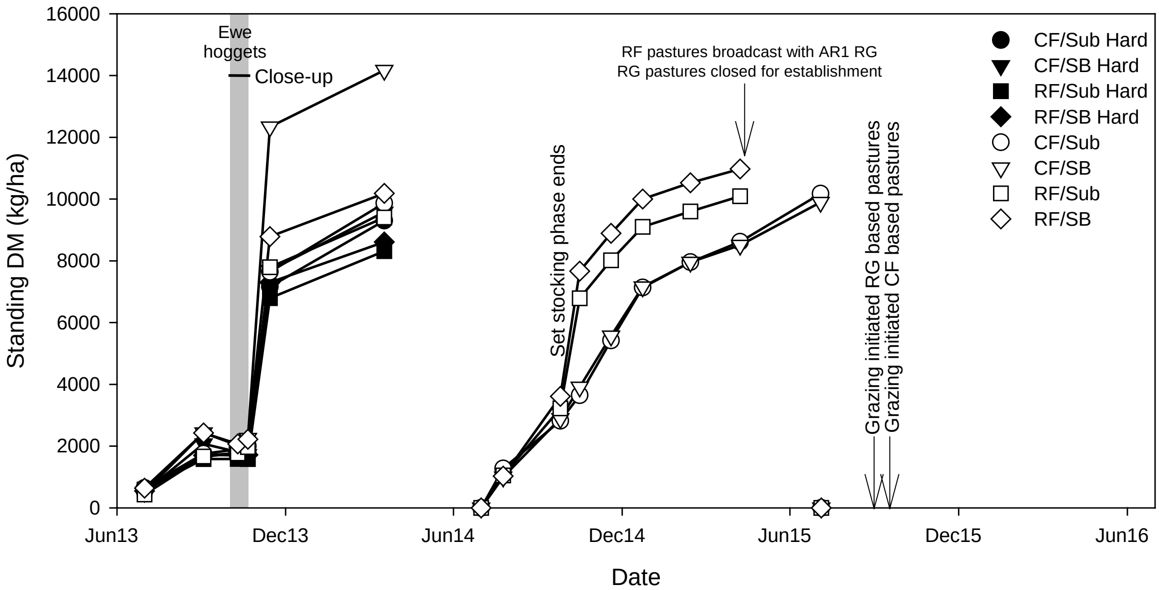


Figure 13 Accumulated DM yield (kg/ha) in 2013/14 (Yr 1) and 2015/15 (Yr 2) of cocksfoot (CF) or ryegrass/fescue hybrid (RF) pastures established with sub (Sub) or sub and balansa (SB) clovers. White clover and plantain were included in all pasture mixes. For 2014/15 spring data is from cage cuts under set stocking. RF pastures were broadcast with approx. 20 kg/ha of AR1 perennial ryegrass in April 2015 and closed to allow establishment.

Spring 2014/15: Lactation phase summary

Total LWt production during the lactation phase was 545±43.6 kg/ha of which 428±29.9 was from lambs at foot. Stocking rates were similar on all pastures at 11.9±0.3 ewes/ha plus 21.6±1.2 lambs/ha. This resulted in a similar amount of grazing days achieved on all four pastures. Average LWt gains per head were 173 g/hd/day for ewes and 345 g/hd/day for lambs at foot during the 83 day period between 2/9/2014 and weaning on 24/11/2014.

Total stocking rates in all pastures were reduced prior to weaning (22 Oct 2014) as water stress compromised DM production (Figure 13).

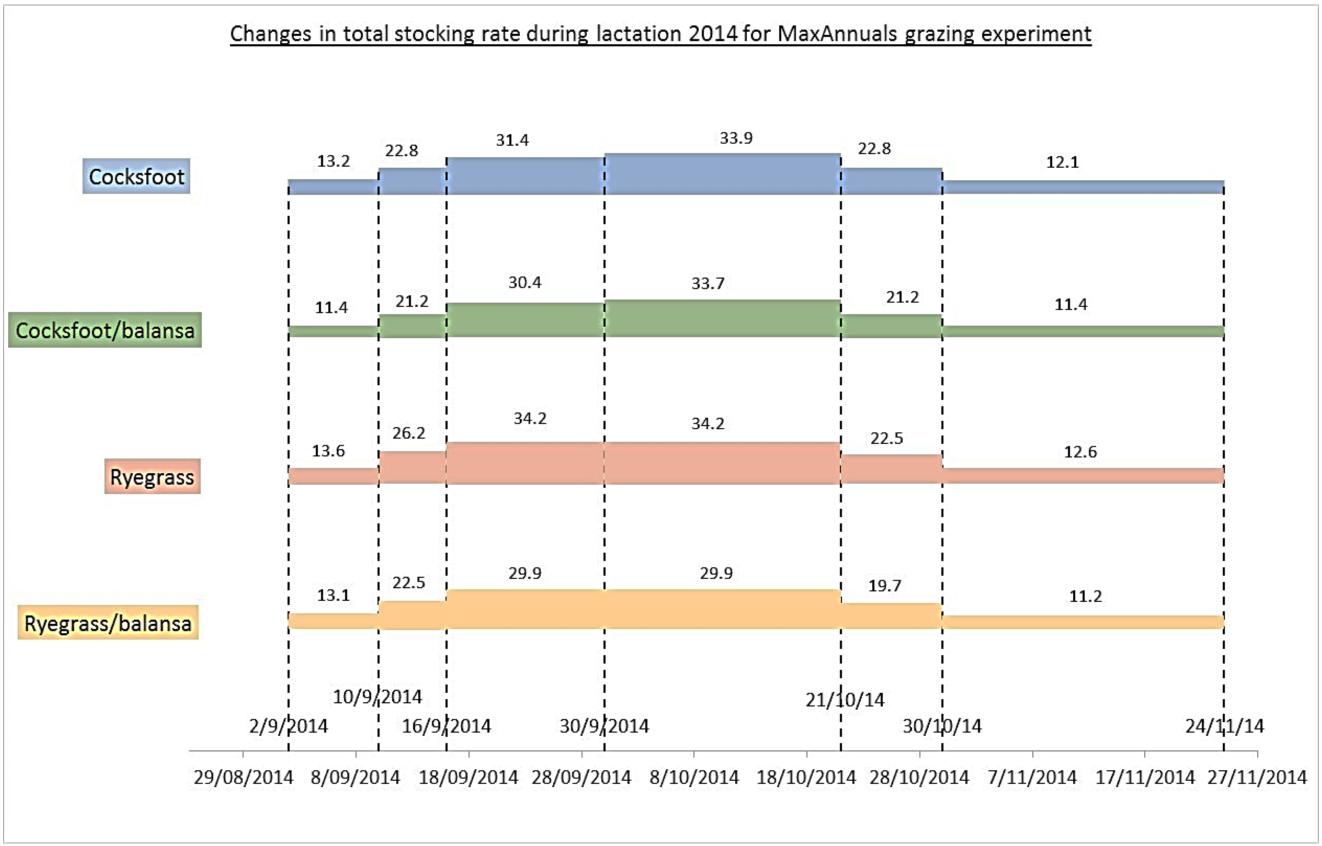


Figure 14 Changes in total stocking rate (ewes plus lambs at foot/ha) during the lactation phase on the grass/clover pastures in 2014/15.

Table 7 Stocking rate, grazing days (GD), mean daily Liveweight (LWt) gain per head, and total LWt produced/ha from ewes with twin lambs at foot set stocked on cocksfoot (CF) or hybrid ryegrass (HRG) pastures established with sub clover with or without balansa clover between 2/9/2014 and weaning on 24/11/2014.

	CF/Sub	CF/Sub/Bal	HRG/Sub	HRG/Sub/Bal
Ewe GD/ha	658	673	690	653
Lamb GD/ha	1202	1277	1299	1200
Ewe LWt gain/hd	121	158	201	212
Lamb LWt gain/hd	340	328	356	354
Ewe LWt/ha	80	109	140	140
Lamb LWt/ha	408	418	464	423
Total Lactation LWt/ha	487	527	603	563

Summer/Autumn 2014/15:

Only maintenance grazing events occurred after weaning (nil LWt gain) until June 2015 when ram hoggets rotationally grazed CF based pastures. An additional 63 kg LWt/ha was produced at this time.

Spring 2015/16: Lactation phase (to 23 Oct 2015 only)

Mean daily LWt gain (g/hd/day) so far this season are shown below:

	Class	
Pasture	**Ewe**	**Lamb**
CF/Sub	57	328
CF/SB	26	329
RG/Sub	134	314
RG/SB	95	321

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beef + lamb new zealand

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: https://blogs.lincoln.ac.nz/dryland/

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Practical Lucerne Grazing Management

Professor Derrick Moot and Malcolm Smith
Email: Derrick.Moot@lincoln.ac.nz

1. Getting started: (Paddock 1)

One of the most difficult things to understand when grazing lucerne is what stocking rate to use and when to start grazing. At Lincoln University we have been faced with this dilemma over many years and we don't always get it right. This guide summarises our experiences to date;

- Start spring grazing of lucerne when it is about 15-20 cm tall – the first paddock grazed and sprayed in the autumn clean-up round is likely to be the first one ready for grazing in spring.
- Put ewes with lambs at foot onto lucerne as early as your management allows i.e. lamb onto older stands with some fibre available or start drifting stock on when lambs are no more than 2 weeks of age. The younger the lambs are on lucerne the better!
- Stock at 10-14 ewes plus lambs (180%+) per hectare in one mob to commence grazing in the first paddock (Paddock 1) of a six paddock rotation. e.g. if you have 30 hectares of lucerne that is 300-420 ewes and lambs all being put on the first 5 ha when it is 15-20 cm tall in spring or about 1500 kg DM/ha. (And then you can wonder where all your stock have gone as they come off lambing blocks letting those areas recover).

- The exact number of animals to put on is location and spring dependent and will take a year or two to work out for yourself. For us it is 12-14 ewes plus twins per hectare for 10-12 weeks.
- Paddock 1 needs to be consumed in 3-4 days. There will be little post grazing pasture mass (PGPM) because all of the herbage on offer is leafy rocket fuel (all herbage ME=12+ and protein 26%+).
- Animals grazing lush lucerne are most prone to health issues as guts adjust – but it is really important to start grazing lambs on lucerne as young as possible. Ensure fibre and salt are available. Ewes that have previously been on lucerne are likely to take to it with little adjustment.
- If you find you are losing lambs or ewes (usually the best ones) check your vaccination programme is up to date and consider 10 in 1 vaccine. Fast growing animals are more prone to clostridia disease from rapid bacterial growth in the rumen that causes sudden death. This is often mis-reported as bloat because they blow quickly after death.

Plate 1. Hoggets grazing lucerne in spring 2007 at the MaxClover Grazing Experiment at Lincoln University, Canterbury, New Zealand.

2. First rotation (Paddocks 2-5).

Having started ewes and lambs on lucerne the next issue is when to move them onto Paddocks 2-6. This is a combination of observation and experience and not always easy to get right the first year you start grazing. Some tips;

- The lucerne continues to grow in front of you as you are grazing a paddock- so you are building a wedge or bank of feed ahead of you – managing this is the key to maintaining lucerne quality to maximize animal growth in this vital spring period.
- As you open the gate to Paddock 2 the ewes will usually walk (not run) because they know they are getting good quality feed and won't have to hunt for the tasty legume amongst grass. But make sure there is fibre and salt on offer.
- Paddock 2 will be taller and contain more dry matter than when you started in Paddock 1.
- Figure 1 is an example of one years grazing management from our six paddock rotation for the 'MaxClover' experiment at Lincoln. Grazing of hoggets started in Paddock 1 in early September 2005. The dry matter increased from 1500 kg DM/ha to 2200 kg DM/ha before entry to Paddock 2.
- Paddock 3 was about 2600 kg DM/ha upon entry. The PGPM is shown as less than 500 kg DM/ha for these first three paddocks.
- Paddocks 4-6 were all around 3300 kg DM/ha upon entry and the PGPMs were closer to 1000 kg DM/ha.
- To get an idea of how much to leave behind after grazing test the herbage as animals go in. Either squeeze or bend a stem until you can find where the woody part begins - this is low quality (ME=8, Protein = 12%) that is maintenance feed at best so not recommended for fast growing stock!

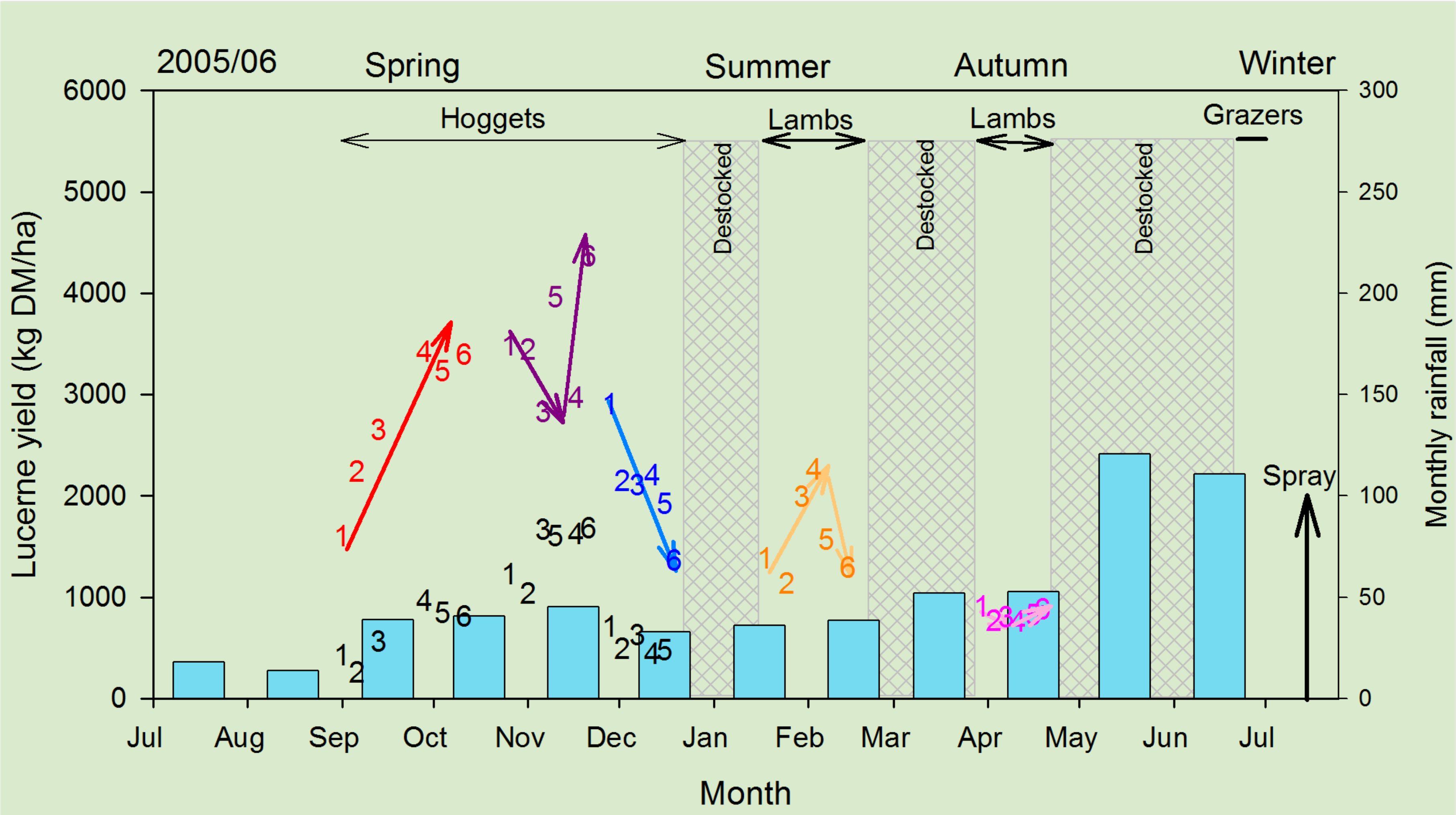

Figure 1. Yields in paddocks 1-6 as stock begin grazing the MaxClover experiment at Lincoln University in 2005. Values at the bottom of the 1st, 2nd, and 3rd grazing cycles are post grazing pasture (stem) mass (PGPM) when stock were moved to a new paddock.

3. When to go back to Paddock 1?

When you enter Paddock 4 you should look to see if recovery in Paddock 1 is 10-15 cm tall. How this grows over the next two weeks dictates paddock rotation. If regrowth is rapid you may not want to graze Paddock 6 but drop it out of the rotation for hay or silage or increase the mob size to cope. As a guide, the time of return to Paddock 1 after leaving should be between 30 and 42 days (or you will have grown too much stem).

- Ideally Paddock 1 will have about 3300 kg DM/ha upon entry the second time (Figure 1 shows this was similar to Rotation 1 in Paddocks 4, 5 and 6). In our example, Paddocks 1 – 5 were all grazed at reasonable yields for the second rotation but Paddock 6 was starting to become too heavy/stemmy.
- The PGPM for Paddocks 1-6 shows about 2000 kg DM/ha was grazed or about 70% utilization. Herbage analyses indicate this level of DM utilization will see over 80% of the total ME and CP consumed. There is no point in making growing animals eat the lower quality residual.
- The amount of regrowth in the second cycle will depend on in season rainfall. In our 2005/06 example the monthly average rainfall was around the long term mean of 50 mm. This was sufficient to keep lucerne growing in Paddock 1 for a third rotation with another 3000 kg DM upon entry.
- For Paddocks 2-6 this level of in season rainfall is inadequate and meant growth was reduced. Paddock 6 only 1200 kg DM/ha was available for grazing in late December.
- Conveniently our experimental plots were destocked from late December until mid January – beach time for dryland farmers!

- The average summer rainfall until May was inadequate for much regrowth so only a single summer rotation was possible with lambs before a clean-up graze in April followed by destocking and a winter weed spray in mid July.

4. Annual Production Summary

- Figure 1 shows the timing of production from each paddock varied across the season. However, when the total dry matter yields were accumulated each grew 10-11 t DM/ha.
- For spring, Paddock 1 produced 7.8 t DM/ha (1.5+ 3.4+2.9) across the first three rotations compared with 8.8 t DM/ha (3.4+4.2+1.2) for Paddock 6. If we converted these to herbage quality the difference would be smaller with the higher yield from Paddock 6 resulting from more stem production, particularly in the second rotation.
- The annual rainfall for this season was 600 mm which is similar to our long term average. Of note, the 230 mm of rainfall in May and June did not result in any significant autumn lucerne growth. At this time the moisture would be accumulated in the soil for use the following spring.
- Ideally the stock on these experimental plots would have been ewes and lambs. However, the small size meant hoggets and weaned lambs are more appropriate.

5. Estimating Dry Matter Yields

One of the key questions when determining stocking rate is assessing current herbage yields. Over the life of the 'MaxClover' experiment and other Lincoln University experiments we have examined the relationship between yield and height and can show a distinct seasonal relationship.

- Figure 2 shows that in spring the lucerne yield can be estimated by multiplying the height (cm) by 90 to get an estimate of yield (kg DM/ha). For example, when a paddock is ready for grazing at about 35 cm height it contains about 3200 kg DM/ha.
- Figure 2 also shows that for summer and autumn the relationship is lower with the multiplier being 60. Thus, that same 35 cm height equates to 2100 kg DM/ha.
- Figure 3 gives a picture of the multiplier on a calendar basis. The overall pattern of a higher multiplier in spring than summer held for stands of many different ages. At Lincoln the highest multiplier of 100 is appropriate in the main growth period of September and October but it then declines to be about 60 from December on.

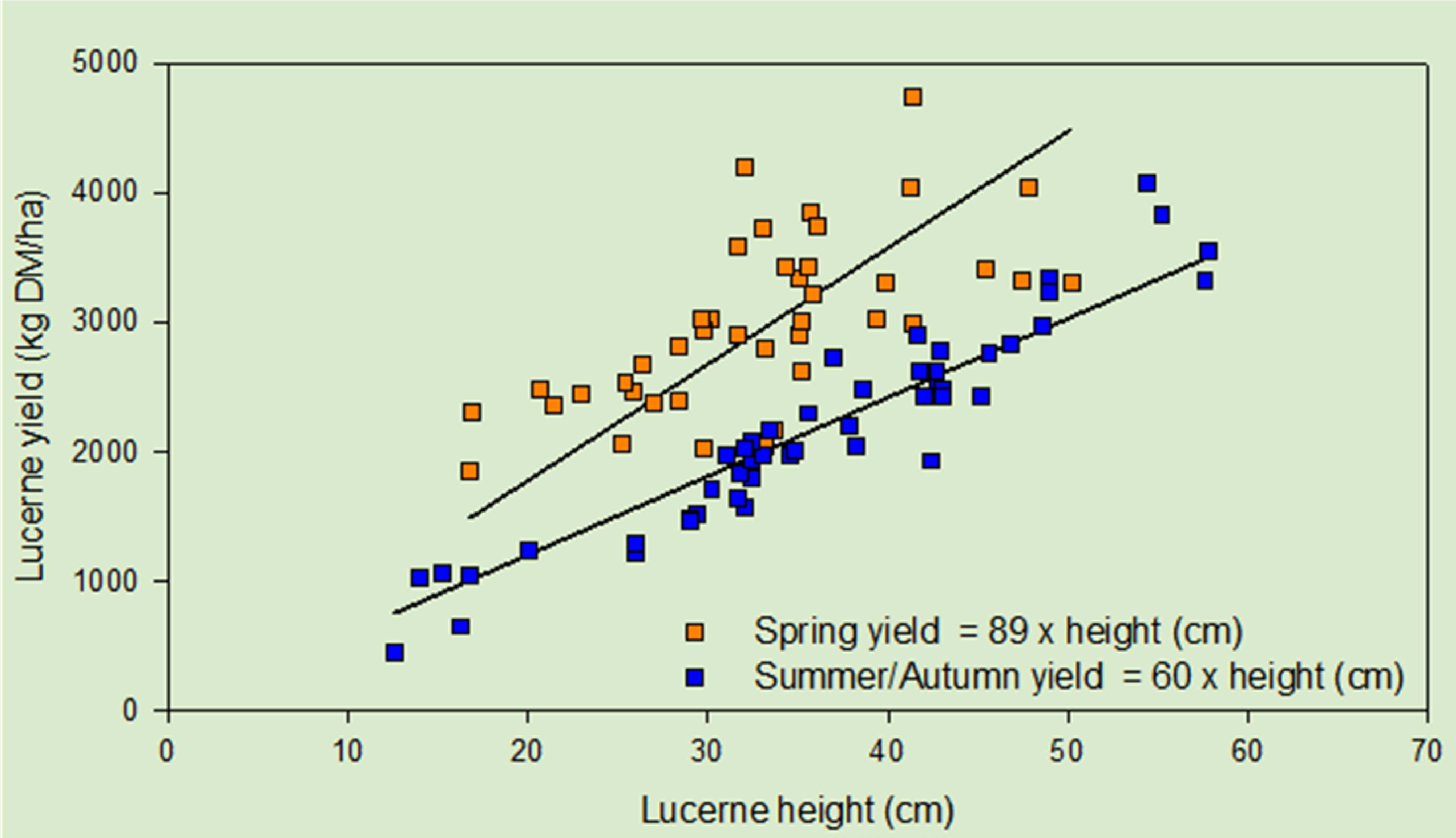

Figure 2. Lucerne dry matter yield estimated from height measurements in Spring (orange squares) and Summer/Autumn (blue squares) Changes in the multiplier used to predict dry mater from lucerne height over a year.

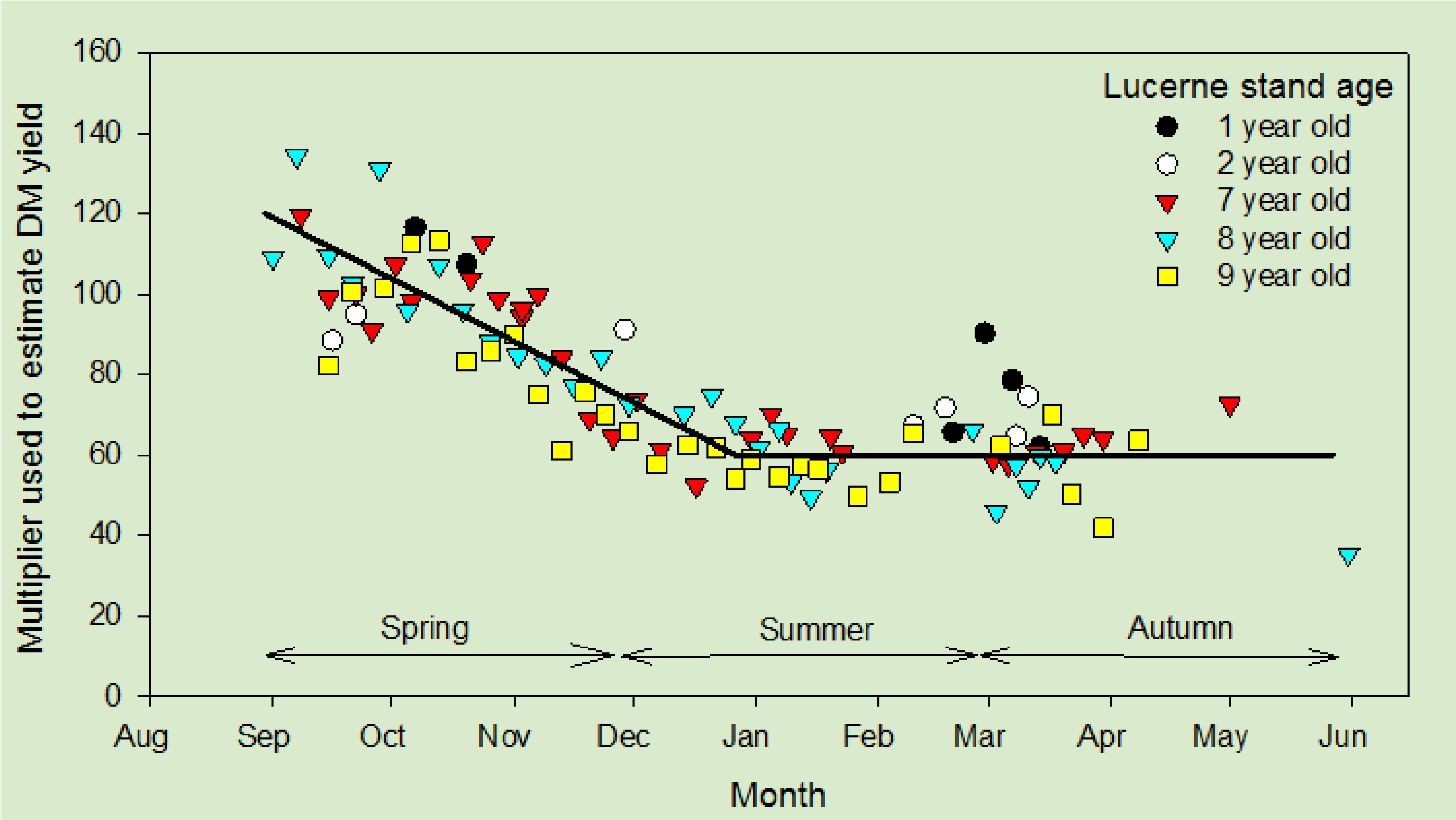

Figure 3. Changes in the multiplier used to predict dry mater from lucerne height over a year.

NOTES:

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