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Summary of latest live weight gain data from the legume grazing trials at Lincoln University and strategies for sub clover management

Produced by the

Dryland Pastures Research Team

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Dryland Pastures Research Team

Mission statement

"To provide research results that assist dryland pastoral farmers to develop resilient farm systems that are financially, economically, environmentally and socially sustainable."

DPR solutions for dryland pastures: Which legume drives your system?

- High quality forages that maximize water use efficiency (kg DM/mm/ha) and water extraction (Lucerne).
- Pasture species that fix nitrogen and grow early in spring when soil moisture is available (Annual clovers).
- Grazing management systems that maximize spring live-weight gain (LWG/ha) but enable the high quality forages to survive and thrive.
- Persistent grass species that respond to moisture during summer dry periods (Cocksfoot).
- Appropriate research information to allow farmers to develop management systems that maximize the benefits of dryland pasture species (Field days)!

Website & Social Media

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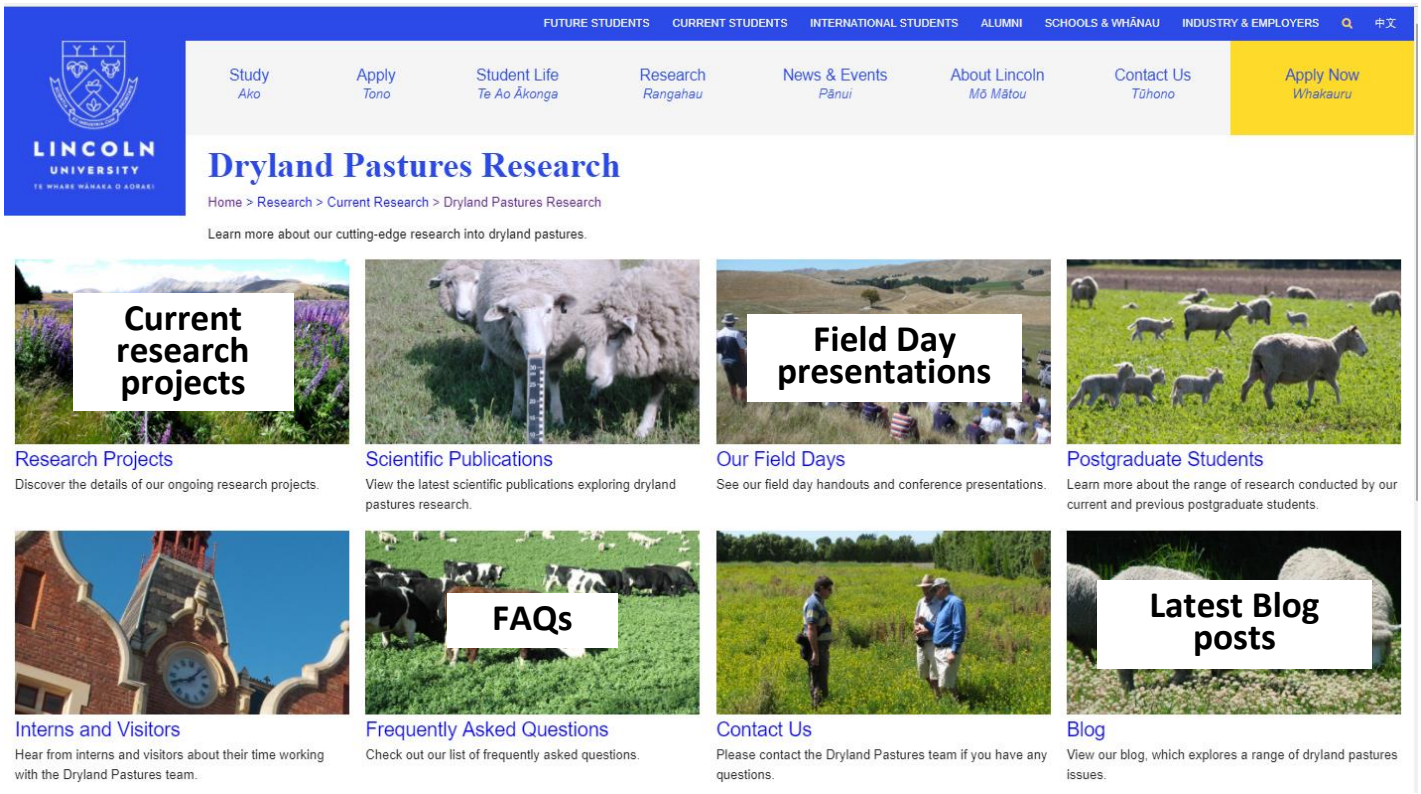

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Ashley Dene – MaxAnnuals

Dr Alistair Black, Mr Dick Lucas and Prof Derrick Moot

The Problem: Shortage of feed available in early spring for set-stocking and before lucerne is ready to be grazed.

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 between 26 Mar and 16 Apr 2013 (Figure 1). Two replicates 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 2013 and ewes with lambs in spring from 2014-2017.
- On 10 Oct Reps 2 and 4 were closed. Reps 1 and 3 were closed on 18 Oct 2013.

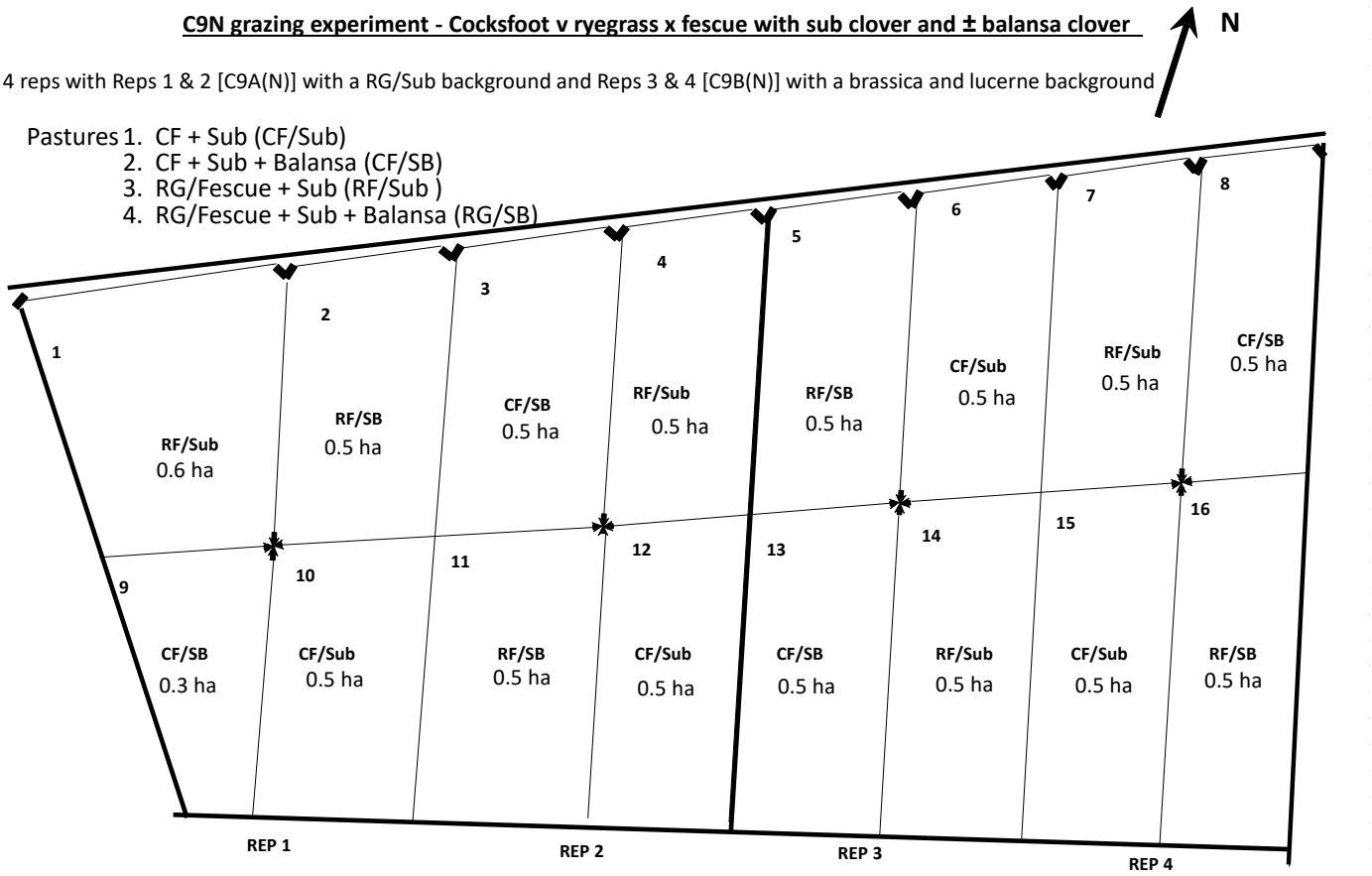


Figure 1: Experimental plan of the MaxAnnuals clover based pastures in C9A&B(N) at Ashley Dene, Canterbury.

Table 1: 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/S+B	5	5	0.5	0.5	4	0	2
RF*/Sub	5	5	0.5	0.5	0	10	0
RF*/S+B	5	5	0.5	0.5	4	10	0

* ~20 kg/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'.

RESULTS

Rainfall - 2013-2017

Monthly rainfalls at Ashley Dene, from July 2013 to December 2017, are shown in Figure 2.

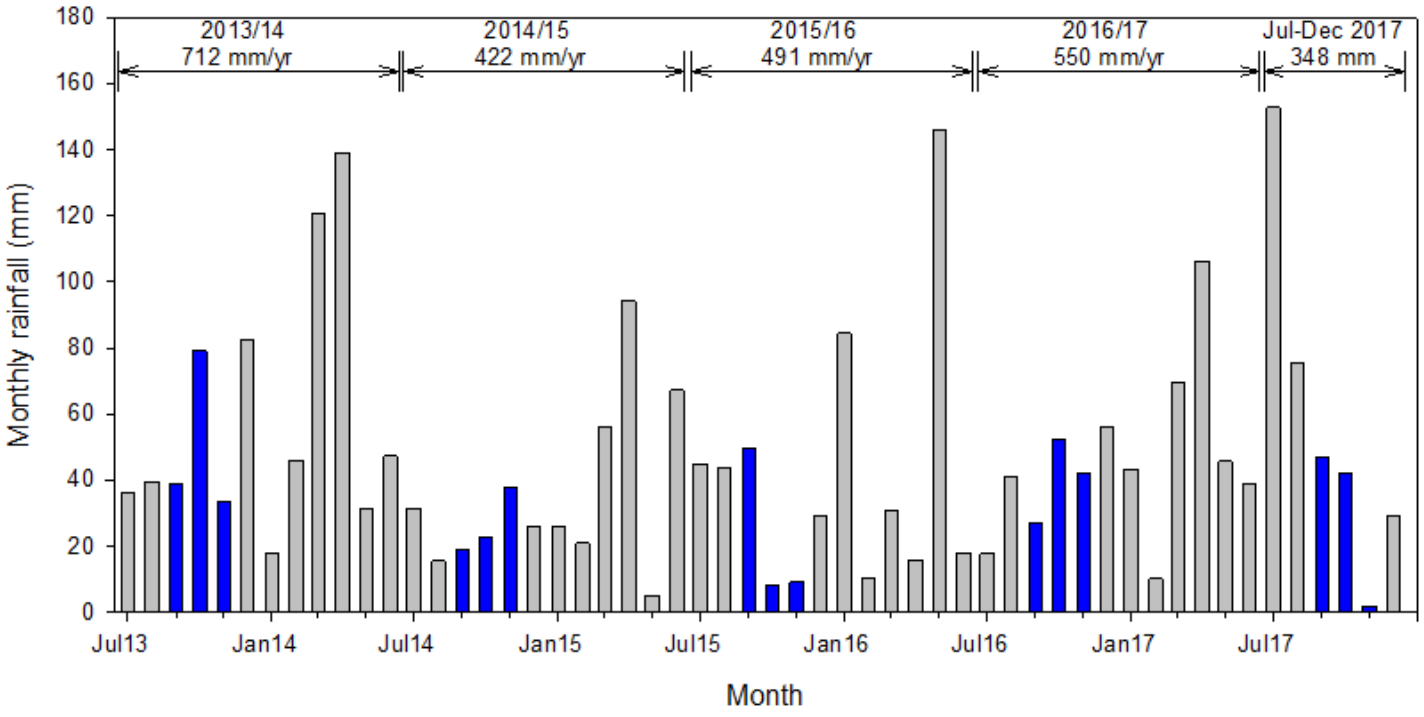


Figure 2: Ashley Dene monthly rainfall from July 2013 to December 2017. The blue bars are spring: September to November. Annual July to June rainfalls are noted at the top.

MaxAnnuals results (years 1-5)

Pre-weaning lamb LWt production (kg/ha)

The total pre-weaning spring lamb LWt production is shown in Table 2. The pastures were grazed by hoggets in 2013/14 so no lamb data available.

Table 2: MaxAnnuals total pre-weaning spring lamb LWt production (kg/ha).

Pasture	2013/14	2014/15	2015/16	2016/17	2017/18
CF/Sub	-	297	163	160	246
CF/S+B	-	290	177	172	252
RG/Sub	-	329	191	165	273
RG/S+B	-	306	224	160	275
Mean	**-**	**306 a**	**189 c**	**164 c**	**261 b**

There were no differences among pastures but production did differ between years reflecting differences in quality and quantity of feed available in the lactation phase.

Total pre-weaning spring lamb LWt production in 2017/18 was 60% higher than in 2016/17 (Table 2). A comparison of the pasture clover content and yield for these two years is shown in Table 3. In 2016/17 the average pasture clover content was 7% and the yield was 0.28 t DM/ha. In 2017/18 the average pasture clover content increased to 45% and the yield was 2.4 t DM/ha.

Table 3: Average total clover % and total clover yield in spring for the last two years of the MaxAnnuals experiment at Ashley Dene, Canterbury. Data are based on composition from the first two cage cuts for the season.

		Total clover %	Total Clover yield (t DM/ha)
2016/17	CF/Sub	4.2	0.14
	CF/S+B	8.3	0.29
	RG/Sub	4.8	0.22
	RG/S+B	10.6	0.48
2017/18	CF/Sub	42.5	2.18
	CF/S+B	43.3	2.17
	RG/Sub	48.1	2.95
	RG/S+B	46.0	2.49

Note: in the last two years little ryegrass remained and plantain was the major non clover component contributing to total yield.

Seasonal Weighted LWt gains (g/hd/d)

To account for differences in the duration of individual LWt periods a weighted seasonal LWG was calculated for each stock class grazing the pastures. Data for the ewes and lambs in spring are presented in Figure 3.

♣ Spring LWG of twin lambs at foot was reasonably consistent from the initiation of grazing to either weaning or destocking across the four annual clover based pastures and averaged 327 g/hd/d for twins between 2014/15 and 2017/18.

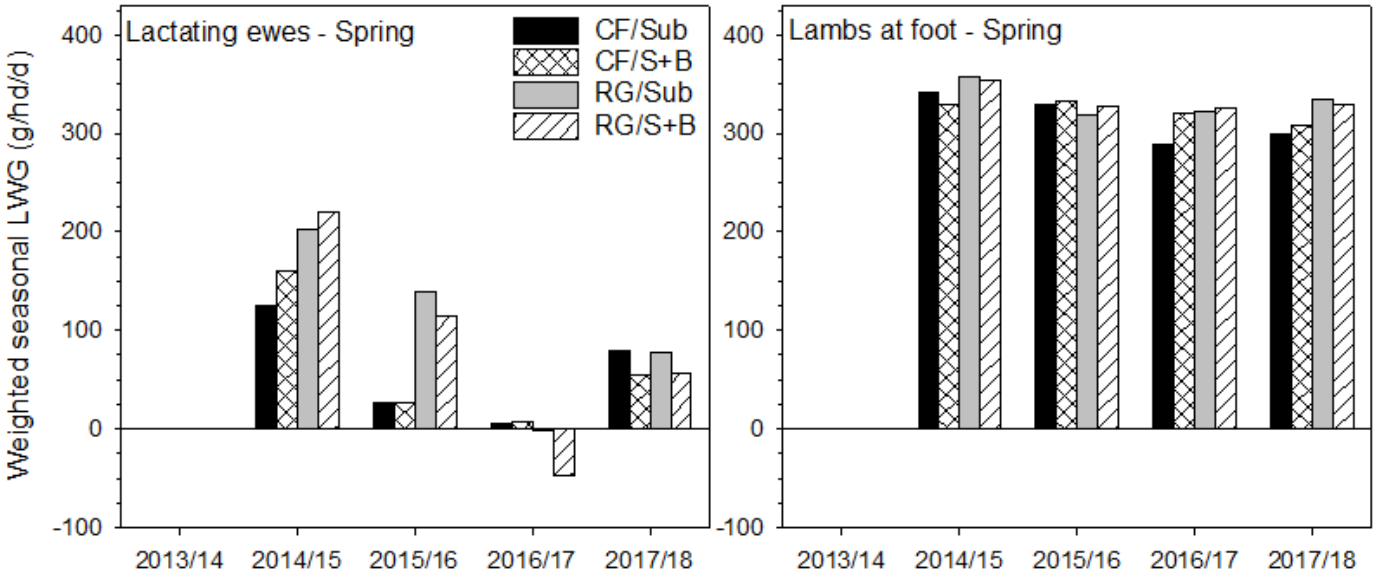
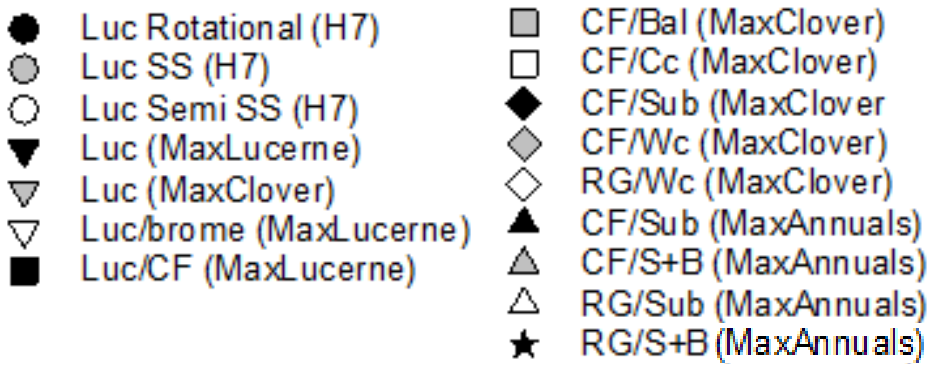


Figure 3: Seasonal weighted LWt gain (or loss) of lactating ewes and twin lambs at foot grazing one of four dryland pasture treatments at Ashley Dene, Canterbury over four growth seasons (Note: hoggets grazed in the first year).

For twin lambs to grow 300 g/hd/d or more, the ewes also need to be gaining weight – at least 60 g/hd/d as indicated by the dotted green lines on Figure 4. This requires quantity and quality of feed which can be achieved with a number of lucerne and legume + grass combinations (Figure 4).

Legend for Figure 4:



Codes: Luc = lucerne, SS = set stocked, CF = Cocksfoot, Bal = Balansa clover, Cc = Caucasian clover, Sub = Subterranean clover, Wc = white clover, RG = ryegrass, S+B = Subterranean + Balansa clovers.

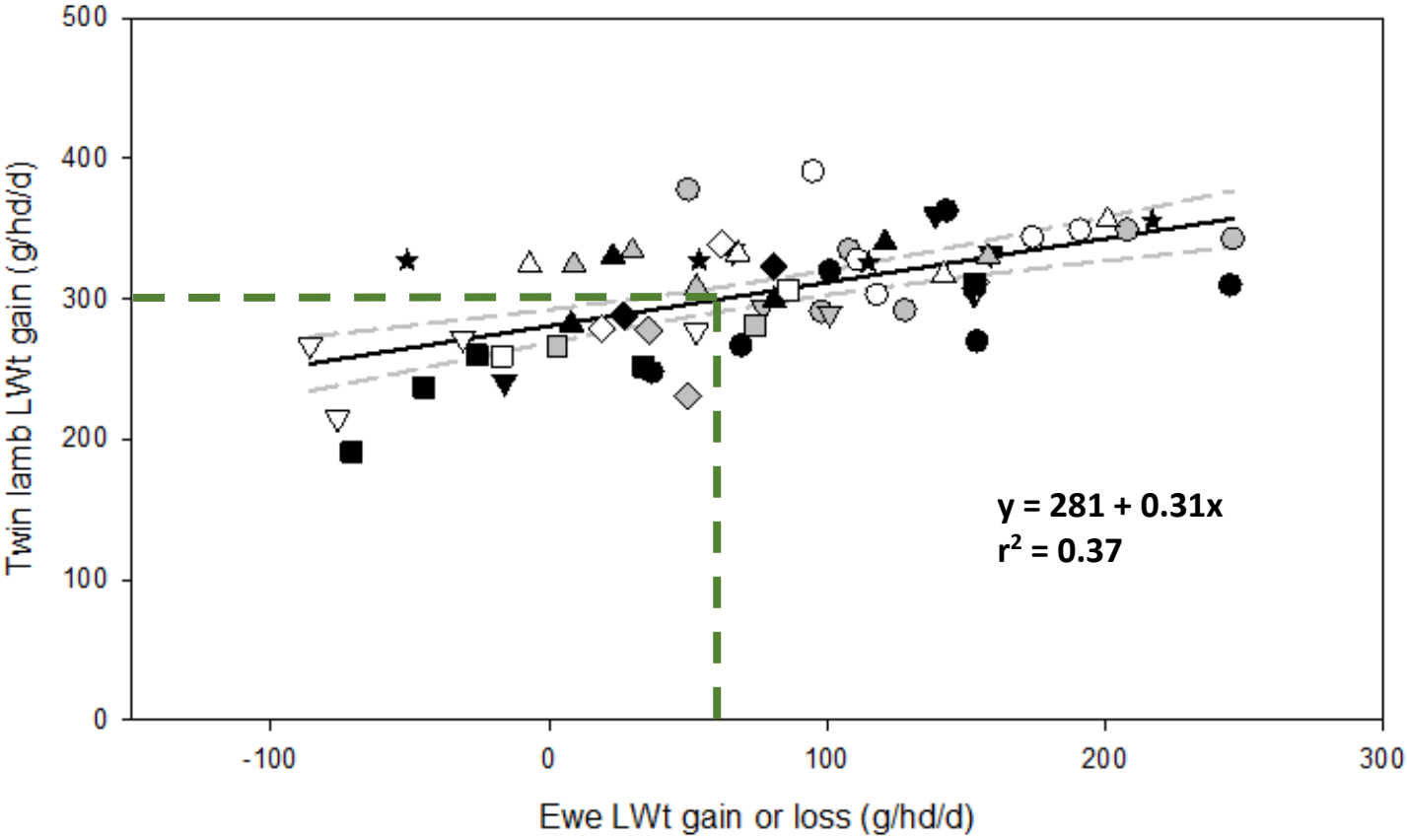


Figure 4: Collated data graph showing relationship between twin lamb LWt gain (g/hd/d) and ewe LWt gain (g/hd/d) during the lactation phase. Data was sourced from four dryland experiments (H7, MaxLucerne, MaxAnnuals and MaxClover) and represents a total of 16 different pasture or grazing treatments.

Pasture dry matter production

Annual yield differed between pasture treatments in Years 1 to 4 (Figure 5). Total DM yields of the CF based pastures were superior to those of the RG based pastures. In 2013/14 (Year 1) CF pastures produced 12000 kg DM/ha which was 18% more ($P<0.05$) than the 10100 kg DM/ha from the RG/Sub pasture. Total DM yields were high in Year 1 because of the early close up for reseeding and the above average annual rainfall (Figure 2). 2014/15 was the first of a series of El Nino years with below average rainfall. Total yield from CF based pastures was 12200 kg DM/ha which was 15% greater ($P<0.001$) than the 10600 kg DM/ha produced by the RG based pastures. Ryegrass pastures were oversown with perennial RG seed in April 2015 and closed to allow seedlings to establish. The lack of difference in corresponding LWt production occurred because the majority of the yield differences occurred in the summer period, and this was associated with a series of 'maintenance' grazing events when LWt production was not determined. In Year 3 (2015/16) yields ranged from 5080 ($P<0.05$) in the RG/Sub pastures to 6700 kg DM/ha from the CF/S+B pasture. Between Jul 2016 and Feb 2017 CF based pastures yielded 6740 kg DM/ha which was 33% more ($P<0.05$) than the 5060 kg DM/ha produced by the RG/Sub pasture.

For the spring of 2017/18, pastures accumulated 6762 kg DM/ha prior to destocking in November and no effect of pasture type was observed.

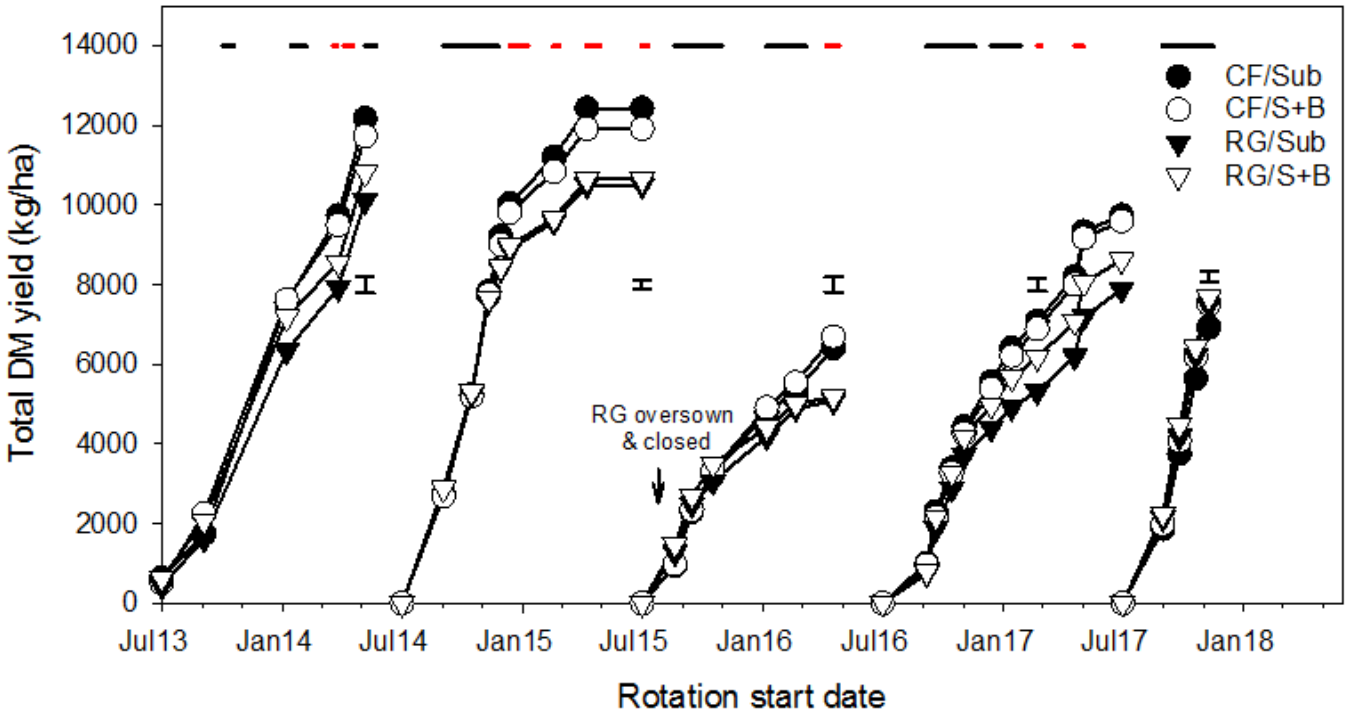


Figure 5: Accumulated total DM production (kg DM/ha) of cocksfoot (F) or perennial ryegrass (RG) based pastures established with either subterranean clover (Sub) or subterranean and balansa clovers (S+B). Black horizontal lines indicate "production" grazing events. Red horizontal lines are "maintenance" grazing events. In Year 1 hoggets grazed to set up the seed bank. In subsequent years ewes with twin lambs at foot grazed in spring.

The Solution: spring pasture systems producing high quality feed that enable lamb growth rates of 300+ g/hd/d are lucerne, on the best and deepest cultivatable soils, or annual clovers in drier areas including uncultivatable hill country.

NOTES:

Managing resident sub clover and introducing new sub clover

Dick Lucas and Derrick Moot

Is resident sub clover present?

- The best time to assess sub clover presence is by walking across your paddocks in September/October.
- If you step on a sub clover plant/patch every second step, about every 2 metres, then that is acceptable.
- Given the opportunity, the sub clover runners will extend the patch up to 60 cm in diameter in a season with spelling.

Plate 1: 'Mt Barker' sub clover in late autumn/winter with a 10 x 10 cm scale. Note significant pigmentation of the leaves and prostrate rosette growth form in the cool season. Once runners start elongating in spring new leaves have no brown pigmentation.

There are a number of ways to manage and improve the sub clover content of existing pastures. Calendars for the following are described:

1. Acceptable resident sub clover - manage to increase sub content
2. Low or no resident sub clover - plan to oversow the following autumn
3. Drilling sub clover into existing pasture

1. Acceptable resident sub clover - manage to increase sub content

Use the following timeline to manage grazing to increase sub clover content:

When	Task/Comment
September	**Paddock walk to identify sub clover populations** Greater than 1 sub clover plant/patch every 2 m Normal stocking rates, keep grazing above 1200 kg DM/ha
Mid-September onwards	**Identify when sub clover flowers are obvious** This will depend on the sub clover cultivar (check the sub clover guide. NB: sub clover flowers are small (see Plate 2. Spell the paddock for four to five weeks or longer if possible (e.g. up to 8 weeks)
After spelling	**Graze with cattle after spelling** This will limit amount of grass seed produced. Sheep target sub clover runners and eat the seeds.
Summer grazing	**Graze with stock as required depending on rainfall** Reduce pasture mass to 700 kg DM/ha by the end of February
End of February until significant autumn rain (over 200 mm)	**Remove any tag** Keep grazing pasture down to 700 kg DM/ha. Opening up the pasture will aid sub clover seed germination.
Autumn	**Monitor rainfall and watch for sub clover germination** Sub clover germination triggered by a rainfall > 20 mm. **Spell to allow sub clover establishment** Spell the paddock to allow established sub clover plants to reach 3-4 trifoliate leaf stage. The graze preferably with cattle to remove grass.
Winter	**Graze as required** Keep pasture above 1200 kg DM/ha. If possible spell lambing paddocks to build clover rich pasture for lambing. A sub clover rich pasture is great feed for lactating ewes

♣ Manage at least one paddock/block each year on a sub clover friendly manner.

Plate 2: Sub clover flowers are small - about 10 mm long and 3-4 mm wide. Mt Barker (left) has red-banded flowers which helps with cultivar identification in the spring. Antas flowers (right) have no bands. Photos: David Hollander.

Plate 3: Earlier growth stages of the Mt Barker sub clover cultivar: cotyledons (top left), unifoliate or spade leaf (bottom left), five trifoliate leaves (right). Photos: David Hollander.

- The ultimate aim of long-term grazing management is to have 80% ground cover of sub clover in the spring pasture. This means there is 40-50% clover DM on offer.
- Spelling pastures to 'rejuvenate' sub clover populations is not required every year but is recommended that each paddock is managed to favour sub clover about once every five years – do paddock walks to monitor sub clover contents from year to year.

2. Low or no resident sub clover – plan to oversow the next autumn

Use the following timeline to improve sub clover content on uncultivatable hills by oversowing seed in autumn:

When	Task/Comment
September	**Paddock walk to identify sub clover populations** Less than 1 sub clover plant/patch every 2 m **Plan to oversow with sub clover next autumn:** ♣ Investigate sub clover cultivar options[1] ♣ Soil test – check recent results or get soils tested Check pH is > 5.6, Olsen P is 15-19, and Sulphate-S > 8. ♣ Order sub clover seed – need 10 kg/ha
September to January	**Graze as normal** If some resident sub clover is present aim to keep pasture above 1200 kg DM/ha
February to mid-March	**Remove any tag** Chew the pasture down hard to 700 -1000 kg DM/ha. Opening up the pasture will aid resident and oversown sub clover seed germination
Mid-March	**Oversow with sub clover seed & apply fertiliser if required** **Monitor rainfall and watch for sub clover germination** Sub clover germination triggered by a rainfall > 20 mm. **Spell to allow sub clover establishment** Spell the paddock to allow sub clover seedlings to reach 3-4 trifoliate leaf stage
Winter/spring	**Graze lightly in the first year preferably with cattle** Keep pasture at about 2000 kg DM/ha to control grass so clover is not shaded Lamb on pasture
Mid-September onwards	**Identify when sub clover flowers are obvious – usually early October** Spell the paddock for at least six weeks then graze with cattle to get on top of the tall pasture. Ongoing management as previously outlined for acceptable sub clover content

[1] Look at sub clover cultivar options in the Sub clover guide or DPR blog posts.

Oversowing costs at Koromiko

Hugh Dampier-Crossley

The following are the costs to oversow the uncultivatable hill country at Koromiko:

Item	Cost per hectare
Fertiliser: Sulphur Super 20 (incl. Transport)	$90
Sub clover seed (10 kg)	$100
Helicopter to apply fertiliser and seed	$25
Total:	**$215**

This is very cheap development considering the cost of the tractor and drill alone to direct drill our cultivatable country is around $130-$145/ha, with the cost of spray, helicopter, fertiliser and seed on top of that.

3. Drilling sub clover into existing pasture

At a Koromiko Field Day in May 2015, at the end of a very dry autumn, it was suggested that the North Canterbury farmers present should consider direct drilling sub clover into bare, dead and dying pastures as soon as possible. The aim being to grab the opportunity to inject some superior sub clover cultivars into depleted pasture where competition from resident grasses was likely to be minimal.

The following photos show the excellent result achieved by Chris Crossley who put the over-drilling suggestion into action on his farm 'Cranford' in Rotherham. The mix of sub clovers including Antas re-established naturally in autumn 2016 and again in 2017.

Plate 4: Strip sown sub clover on part of paddock at 'Cranford', Rotherham (13/9/17, Photo: Dick Lucas).

Use the following timeline to improve resident sub clover content by drilling sub clover into rolling hill country:

When	Task/Comment
September	**Plan to drill selected paddock(s) with sub clover next autumn:** ♣ Investigate sub clover cultivar options[2] ♣ Soil test – check recent results or get soils tested Check that pH is > 5.6, Olsen P is 15-19, and Sulphate-S > 8. ♣ Order sub clover seed – need 10 kg/ha
September to January	**Graze as normal or Herbicide if green in Oct-Nov** Graze or consider herbicide pre-drilling if green
End of February to mid-March	**Remove any tag** Chew the pasture down hard to 700 -1000 kg DM/ha Opening up the pasture will aid sub clover seed germination and establishment
February (if soil is moist) to mid-March	**Drill in sub clover seed and apply fertiliser if required** **Monitor rainfall and watch for sub clover germination** Sub clover germination triggered by a rainfall > 20 mm. **Spell to allow sub clover establishment** Spell the paddock to allow established sub clover plants to reach 3-4 trifoliate leaf stage
Winter/spring	**Graze lightly in the first year** Can lamb on the new paddock. Keep pasture above 2000 kg DM/ha and consider using lower stocking rates than normal
Mid-September onwards	**Identify when sub clover flowers are obvious** Spell the paddock for at least six weeks to maximise seed set. Ongoing management as previously outlined for acceptable sub clover content
December	**After spelling for seed set, graze with cattle**

[2] Look at sub clover cultivar options in the Sub clover guide or DPR blog posts.

‘Sub 4 Spring’ – some take-home messages for clover enthusiasts

1. Modest regular applications of superphosphate will not magically increase clover content of summer dry pastures without specific grazing management to favour annual clover species.

2. Ensure clovers have optimum nutrient supplies by getting soil and leaf analyses done so the right type and amount of fertiliser is spread. The paddock will then produce over 500 kg/ha seed if it is spelled for about eight weeks after sub clover has been flowering for two weeks.

3. Twin lambs will grow at over 300 g/head/day if 40% of pasture dry matter on offer is clover.

4. Note that if you can see clover foliage covering about 80% of the visible leaf canopy it probably amounts to only 40 % of the actual dry matter on offer.

5. Spring is the money making time, exploit the lactation potential of ewes and cows by optimal feeding.

6. Aim to manage for increased clover on at least 10% of permanent pasture each year. Record paddock clover contents each spring to guide decisions on which paddock needs improvement.

7. It is difficult to optimally manage more than one clover species in a pasture. It may therefore be best in higher rainfall areas to manage for white clover on south faces and sub clover on sunny faces.

8. Allow annual clovers to fulfil their growth potential by rotationally grazing after a flock finishes lambing.

9. It takes about 10 weeks for a sub clover flower to form four mature hard seeds in a burr. So if it gets dry two weeks after a flower is fertilised it is unlikely produce viable seed.

10. Select sub clover cultivars to match the time when the soil dries out and pasture ceases to grow. If the summer dry usually starts in the first week of November your Mr Barker and Tallarook sub clovers may be flowering too late. Consider an earlier flowering cultivar. Future proof your farm against climate warming!

Dryland Pastures Research supporters

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The Sub 4 Spring research projects were also supported by Field Research Centre staff and post grad students at Lincoln University, and the farmers who hosted the experiments on their properties.

Sub clover 'Antas' at Mt Benger. Photo: Dick Lucas.