

Breach Oak, Seddon

Profitable Dryland Legumes



Field Day

13 November 2013



This work is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](https://creativecommons.org/licenses/by-nc-nd/4.0/).



Persian clover in flower at Breach Oak

Contents

Contents	1
Basics for Dryland Lamb Producers.....	2
Principles for fast lamb production.....	2
How to get legume rich pastures	2
Alice’s Block at Mt Benger in North Canterbury	4
Nitrogen supply and water use efficiency by dryland pastures.....	7
Sub Clover Cultivars.....	8
Identifying Sub Cultivars.....	10
Improved top flowering annual clovers	13
Volunteer adventive annual clovers	16
Identifying your adventive annual clovers:.....	17
Managing sub clover after sowing to rapidly get a high producing, persistent clover dominant pasture	20
Practical Lucerne Grazing Management	23

COVER PHOTO: Warwick Lissaman in ‘Flecha’ tall fescue and balansa clover in spring 2012



That’s the easy bit....can we get the rest?

Basics for Dryland Lamb Producers

Principles for fast lamb production

- Ewes bearing twins and triplets need top quality feed in late pregnancy and throughout lactation
- Legume rich pastures or lucerne will give faster twin lamb live weight gain (LWG) than grass dominant pastures
- Sheep will select a diet of about 70% legume (lucerne or clover) and 30% grass when given a free choice
- Therefore, twin lamb LWG pre-weaning is directly proportional to the % clover dry matter (DM) on offer
- With over 50% clover on offer LWG of twins pre-weaning should be well over 300 g/hd/day
- This assumes bite size (= DM intake) is not limited by forcing ewes to eat a lot of lucerne stem or grazing pasture mass down to below 1200 kg/DM/ha.

How to get legume rich pastures

- Pasture legume content will not magically increase by continuing with the standard policy of annual superphosphate application and “good” grazing management if well adapted legumes are absent from the nitrogen deficient pasture.
- Choose an appropriate legume for your environment; lucerne if you can grow it, annual clovers such as sub if you have regular dry summers; perennial clovers such as white, red or Caucasian in summer moist or irrigated.
- Sow pastures with high legume rates (e.g. 10 kg/ha sub clover) and low grass rates (e.g. 2 kg/ha cocksfoot or 5 kg/ha ryegrass)

- Young pastures will be legume dominant, ideal for twins; as nitrogen (N) builds up with N fixation by legumes, grasses will become more vigorous and competitive
- Therefore appropriate management is vital to maintain legume content (e.g. manage sub clover for high seed production if sub drops below 20% on offer in early October)
- Avoid the use of N fertilisers if legume dominance is desired as N fed grass is very competitive for light, water, phosphorus (P), sulphur (S), potassium (K) and some trace elements.
- Pasture legumes fix N in proportion to their DM production; for every 1 t/ha of legume DM grown about 25 kg N/ha will be fixed
- So if a sub clover/ryegrass pasture produces 8 t DM/ha/year with 3 t/ha/yr clover and 5 t/ha of grass we can assume at least 75 kg N/ha was fixed
- Maintain soil pH at >5.6 for most clovers and >6.0 for lucerne, 'Antas' sub clover and strawberry clover



Plate 1 Clover canopy at 25 cm high in Alice's Block at Mt Bengier, North Canterbury on 20/5/2013.



Plate 2 Contrast of sown clover dominant pasture in Alice's Block at Mt Benger, North Canterbury with unimproved in background on 20 May 2013. The seed mix included 10 kg/ha sub clover + grasses and plantain

Alice's Block at Mt Benger in North Canterbury

Up until recently we were pessimistic about flying sub clover seed onto hill country but recent success in Alice's Block at Mt Benger has given cause for cautious optimism. We must also remember that sub clover was broadcast on a lot of hill country in the 1950's and '60's.

Alice's Block (25 ha) was fenced off from a larger 236 steep hill block in 2011. About 20 ha of this area was able to be cultivated. This bush/bog was disced with a 'dozer and a second discing with offsets. Area had good fertility but thick matagori, danthonia, browntop. There was a little striated clover and a presence of 'Mt Barker' sub clover. It had never been fertilised and carried <2 ewes/ha.

- Summer 2011/12: 1 t lime/ha applied and 3 kg/ha rape + 3 kg/ha 'Woogenellup' sub was flown on with 150 kg/ha of sulphur super 20. The 20 ha of disced cultivatable land was harrowed in the 1st week of Feb.
- 100 steers grazed rape/clover pasture for 6 weeks between June and mid July 2012.
- Not grazed in spring to allow 'Woogenellup' sub clover to set seed.
- Cattle grazed Jan 2013 then the block was lightly disced to cut up rape stalks.
- 1 Feb 2013: cocksfoot, ryegrass, plantain, white clover flown on with 5 kg/ha 'Antas' sub clover + 5 kg/ha 'Monti' sub clover.
- Grazed 500 ewe lambs (20 lambs/ha) over mating 1 May to 6 June.
- Set stocked with 100 twin bearing ewes on 29 July 2013. (4 ewes/ha)
- Tailed plus added 250 single bearing ewes 23 Sept until 6 Oct 2013 and then closed to allow clover to set seed.
- About 3 t DM/ha of legume dominant pasture was present on 1 Nov 2013. This indicated the 25 ha block could have carried double the stocking rate of twin bearing ewes in Aug/Sept (up to 8 ewes/ha).
- The sub clover establishment in the 20 ha disced area was outstanding (Plates 1 & 2) but what generated the most excitement was the sub clover establishment from broadcast seed onto the 5 ha uncultivated (no herbicide) steeper areas of the Block (Plates 3 & 4).
- Maybe only 3 or 4 out of every 100 sub clover seeds established from broadcasting seed on the steep hill but with correct management it may be the best way forward.



Plate 3 Sub clover establishment from February broadcasting of seed on hill (no herbicide or cultivation) on Alice's Block west face at Mt Benger, North Canterbury. Photo: 2/10/2013.



Plate 4 A mixture of sub clover cultivars on the uncultivated west face of Alice's Block at Mt Benger, North Canterbury, with danthonia and striated clover (right) on 2/10/2013.

Nitrogen supply and water use efficiency by dryland pastures

- Nitrogen drives grass productivity once other nutrients such as P, S, and K have been brought up to moderate levels and soil pH has been amended with lime
- Soil N supply can be gauged by the colour of grass dominant pastures (yellow-green through to dark green) and the prominence of urine patches
- Yellow-green N deficient grass in October, growing at 40 kg DM/ha/d uses water at the same rate (say 4 mm/d) as dark green urine patch grass growing at more than 100 kg DM/ha/day
- Therefore, N deficient grass in spring has a water use efficiency of 10 kg DM/mm water used BUT the grass in the dark green urine patch has an efficiency of over 25 kg DM/mm water used
- Healthy legumes can fix all their own N from the nitrogen gas in the air through the root nodules which contain rhizobium bacteria
- Legumes therefore have high water use efficiency of over 25 kg DM/mm water used, similar to grass in a urine patch
- Legume dominant pastures in summer dry areas will therefore use the limited soil water more efficiently than N deficient grass dominant dryland pastures
- Dryland pastoral farms, typically with N deficient grass dominant pastures and less than 10% clover use scarce water inefficiently and must do better by increasing total legume production or the farm could go broke

Sub Clover Cultivars

There are large differences between sub clover cultivars so it is important to select the best for each site. Mixtures of two contrasting sub clover cultivars are often recommended so that variations in soil depth, winter wetness and hill aspect can be covered. For example a wet tolerant cultivar such as 'Monti' may be sown with 'Woogenellup' on a hill block with wet gullies.

It is important to be able to identify the cultivars which thrive on different sites. Features which differ between cultivars are:-

- hairiness of runners (stems), petioles (leaf stems), and peduncles (flower stems);
- leaf markings,
- stipule colour(structure at base of petiole),
- flower colour,
- flowering time,
- seed colour.

Each subterranean clover cultivar belongs to one of three sub species, either

- *Trifolium subterraneum* sub spp *subterraneum* or
- *T. subterraneum* sub spp *yanninicum* or
- *T.subterraneum* sub spp *brachycalycinum*.

Most cultivars belong to the subspecies *subterraneum* (e.g. 'Campeda', 'Woogenellup', 'Denmark', 'Mount Barker', 'Rosabrook' and 'Leura'). These have black seeds and are adapted to well drained soils with pH (H₂O) down to about 5.4.

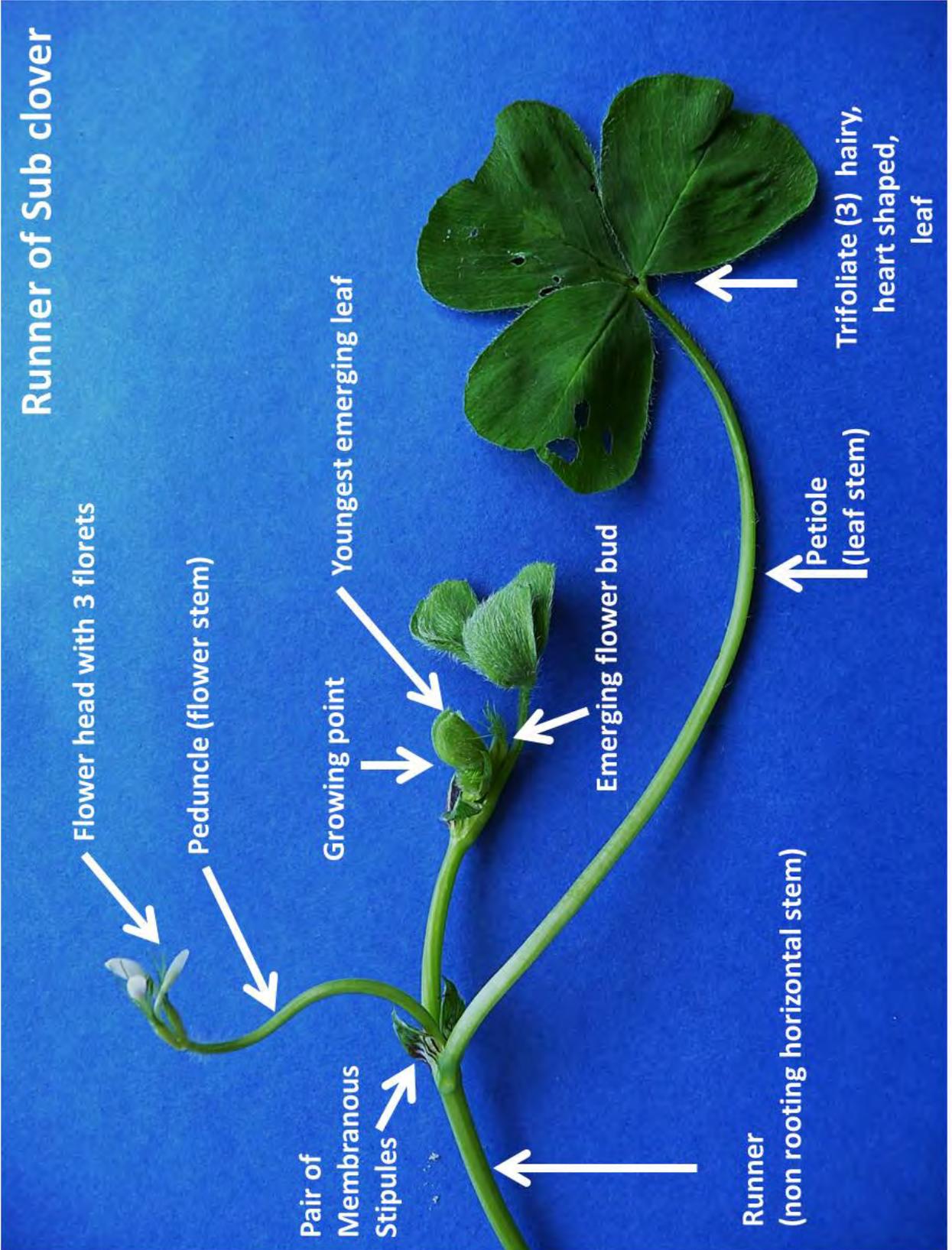


Plate 5 The morphology of a sub clover runner.

Identifying Sub Cultivars

'Campeda' flowers earlier than other cultivars available in NZ. It is therefore suited to lower rainfall (<600 mm) areas, shallow stony soils and north facing steep hill pastures. It has a hard seed rating of 3 which provides protection from 'false strikes'. It has hairless runners, red striped stipules and a faint orange band on its flower.

'Woogenellup' has hairless runners but may have hairy petioles and peduncles; stipule has red stripes; light leaf markings, large light green leaves with long petioles. It is very productive but has a reputation in Australia for false strikes because of its very low hardseededness rating of <1.

'Denmark' has hairless runners, petioles and peduncles; light leaf mark, small leaves. It persists well under intensive grazing and has a hardseededness rating of 1. This cultivar is later flowering than mid/late season flowering 'Woogenellup' and mid-season flowering cultivars 'Campeda' and 'Monti'.

'Rosabrook' flowers at the same time as 'Denmark' and is tolerant of red legged earth mite (RLEM). It has a more obvious leaf mark than 'Denmark' and slightly hairy runners. Stipules are green. The obvious red band on its flower means it could be confused with 'Mt Barker' but 'Rosabrook' is much less hairy than 'Mt Barker'

'Mt Barker' has very hairy runners and red stipules, brown flecks on leaves in winter and a red band on its flower tubes. 'Mt Barker' is very soft seeded and susceptible to false breaks with a hardseededness rating of <1. It has a similar late flowering time to 'Denmark'.

'Mt Barker' is the oldest sub cultivar in NZ. It will be surviving on many hill farms where it was oversown 50 to 60 years ago. By adopting grazing management aimed at encouraging sub clover, it may become more productive in some paddocks where its seed is present in sufficient quantities in the seedbank. However, the introduction of new, improved cultivars should lift dryland pasture productivity considerably.



Plate 6 A close up of 'Mt Barker' sub clover in late autumn/winter with a 10cm x 10 cm scale. Note that the brown leaf marks disappear in spring.

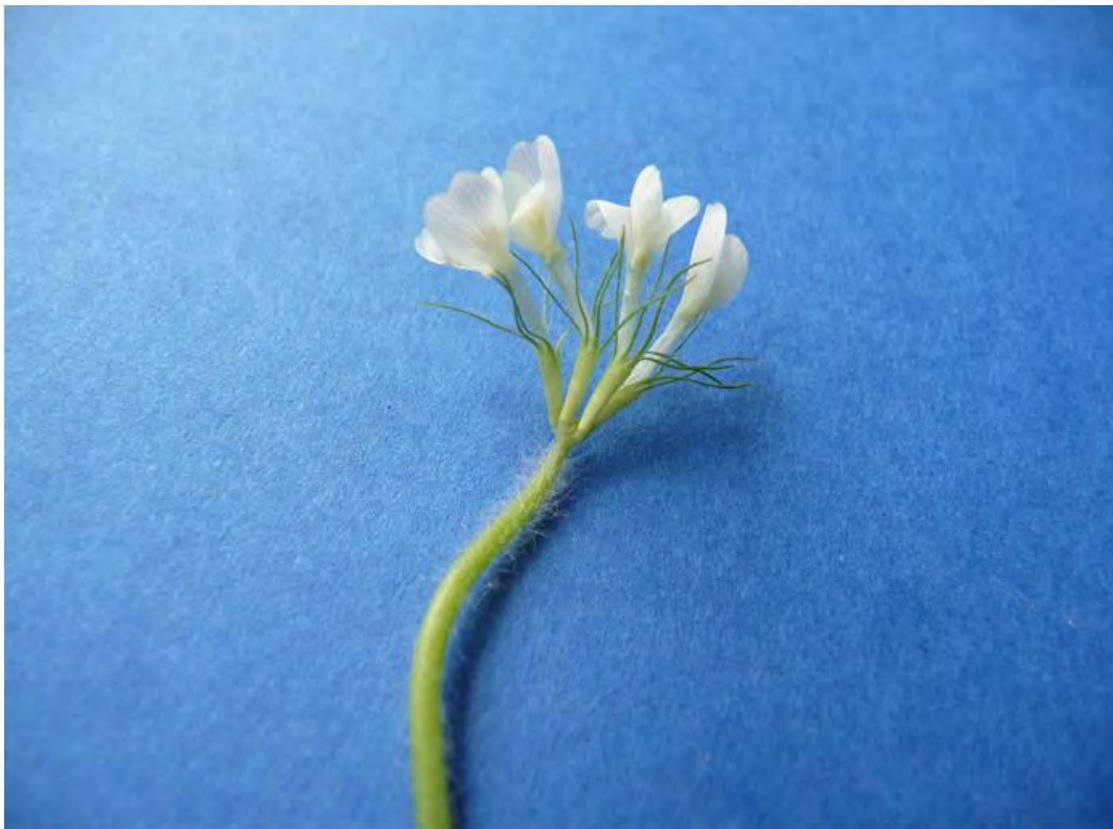
'**Leura**' is the latest flowering sub clover cultivar available in NZ. It is best suited to deeper soils in areas with >700 mm/yr rainfall or >800 mm/yr on NW facing hills, and higher rainfall stony soils where pastures regularly brown off in summer. 'Leura' runners are hairy and its stipules are green. 'Leura' has a hardseededness rating of 1.

'**Monti**' flowers about the same time as 'Campeda' and has hairless runners and petioles; a green stipule with red stripes; leaves may have some brown flecks in late autumn/winter; seeds are cream/white. 'Monti' is a newly

released cultivar which flowers earlier than 'Woogenellup' so is adapted to lower rainfall areas with its shorter active growth season. This cultivar has a hardseededness rating of 1. 'Monti' belongs to the *yannicum* sub-species of sub clover and cultivars derived from this sub species can tolerate periodic wet soil conditions better than other sub clover sub-species.

'Napier' is a later flowering *yannicum* sub clover adapted to higher rainfall areas with winter wet soils. 'Napier' has a hard seed raing of 3 and a similar flowering time to 'Denmark'.

'Antas' sub clover runners are weakly hairy or hairless; green stipules at petiole bases have red stripes. This cultivar has a strong leaf mark, very large leaves and long petioles. Its' seeds are black. Currently, there is limited experience with highly productive 'Antas' in NZ. It has a similar later flowering time to 'Denmark'. 'Antas' belongs to the *brachycalycinum* sub-species of sub clover and is best adapted to well limed soils or soils with a natural pH (H₂O) of >5.8. Its hardseedness rating is 2.



Flower of 'Monti' sub clover on 23 Oct 2013 at Lincoln University

Improved top flowering annual clovers

'Prima' gland clover is earlier flowering than 'Campeda' sub clover. It can produce a large quantity of feed in late winter/early spring. It is suitable for lower rainfall sites with a short growing season and requires bare ground during summer to soften its relatively hard seed. It has cold tolerance and may do well in inland areas.

Gland clover should not be sown with late flowering clovers. This is because it is difficult to apply optimum grazing management across the range of flowering dates within the mix. Consequently, it is difficult to optimise seed yields from all the clovers in the mixture.



Gland clover in flower

'Bolta' balansa clover tolerates wet soils. It flowers about the same time as 'Wooenellup' sub clover. There is more NZ research on balansa clover than on the other top flowering clover species. Like other top flowering species balansa is vulnerable to traditional set stocking in spring. It must therefore be rotationally grazed in spring to allow the plant to grow at maximum rates during its stem elongation phase. In the first spring after sowing it should be spelled to set seed before the longest flowering stems are 30 cm high. After 10 to 12 weeks the mature seed formed in the earliest flowers will shed and over 1 t/ha of mainly hard seed can drop onto the soil surface. This seed should last for 3-5 years but the balansa seedling populations after the autumn break will decline over time if the pasture isn't managed to allow some re-seeding to replenish the seed bank at 3 year intervals.

Balansa clover is hairless and develops distinctive leaf markings on about 10% of plants. Leaf margins have obviously serrated edges. Its flowers, borne on hollow stems, are similar to white clover but florets turn pink after bee pollination.



'Bolta' balansa in flower and leaves showing typical balansa leaf markings and serrated leaf margins

Arrowleaf clover cultivars have a wide range of flowering times. 'Cefalu' is early flowering at about the same time as 'Leura' sub clover and 'Arrotas' is the latest flowering about 6 weeks later. Arrowleaf clover is not tolerant of wet soils and its seed is very hard so seed softening may take several months. This

means that few seedlings will establish in the first autumn after the initial late spring/summer seed production. However, arrowleaf clover can be very productive, especially in warmer 700-1000 mm rainfall environments which have dry summers. Seed should be inoculated with group C rhizobia with the first sowings. Later flowering cultivars, such as 'Arrotas', grow rapidly in late spring/early summer which is ideal for weaned lamb feed.



The flower and the distinctly pointed (arrow shaped) leaflets of arrowleaf clover at Lincoln University

Persian clover like balansa is tolerant of wet soils. Cultivars have a wide range of flowering dates, similar to arrowleaf clovers. There are two sub species within the Persian clover species. One is described as a hay type with hollow stems and soft seeded. The other sub species is reputed to be better adapted to perennial pastures because it produces some hard seed. Up to now we have had no experience with Persian clover in grazed perennial pastures. In the meantime, it is a very impressive species when grown as a pure stand. It will yield over 10 t DM/ha of nutritious forage and fix over 250 kg N/ha.



Persian clover in flower

Volunteer adventive annual clovers

It is assumed the adventive annual clovers came to NZ many years ago as impurities in white and red clover imports. Suckling, cluster and haresfoot clovers have small seeds while striated clover has larger seeds about the same size as red clover.

To some extent these species can be regarded as indicators of the suitability of the environment for the introduction of more productive clover species. For instance, cluster clover is the main adventive species on the stony soils at Lincoln Universities Dryland Research, Farm Ashley Dene near Burnham in lowland Canterbury where sub clover is the most productive legume after lucerne. Striated clover dominance is also an indicator of the need for sub clover introductions. Suckling clover is widely adapted throughout NZ but not usually dominant so it is not a good indicator of what improved species to sow. Haresfoot clover is most likely to be the dominant adventive clover in the high country because of its later flowering and cold tolerance. It may indicate sites where sub clover may not persist.

These clovers fix nitrogen (N) in a similar manner to more productive legume species and the general “25 kg N/t legume DM produced” formula holds true. We assume that vigorous growth of an adventive clover indicates that strains of Rhizobia in the soil will be suitable for other annual clovers. No problems have been reported with sowing un-inoculated bare seed of sub or balansa clovers where good populations of vigorous adventive clover have been present. However, new sowings of arrowleaf clover should be inoculated with Group C inoculant.

Identifying your adventive annual clovers:

Suckling clover is an early flowering adventive clover. It has distinctive yellow flowers, thin red stems and the middle leaflet has a longer stem than the two side leaflets.



Suckling clover flower

Cluster clover is not common at higher altitudes. It is hairless and looks a bit like white clover but it has no stolons. Leaves are smaller than white clover and some leaflets will have a brown spot and some a light coloured central spot. Unfortunately, the leaf markings are variable and some forms will have no leaf markings for identification purposes. The small pink flower clusters form a ball in the leaf axils and there is no flower stem (peduncle).



Cluster clover flower and leaflets showing the pale dot present on some plants

Striated clover can become dominant in low fertility sites. It has fine hairs all over its plant parts. The leaves have no distinguishing marks and feel like velvet. Pink flowers develop into harsh feeling seedheads.



Hairy striated clover in flower

Haresfoot clover is another hairy legume. Haresfoot clover has a distinctive green-grey appearance due to its hairiness. Young plants form a prostrate rosette with rounded leaves but later in the season, as stem elongation occurs, the new leaves also elongate. Pink flowers and seedheads resemble a hare's foot.



Flowerhead of haresfoot adventive annual clover. Note hairy elongated green-grey leaves

Managing sub clover after sowing to rapidly get a high producing, persistent clover dominant pasture

The best way to rapidly build up a sub clover seed bank is through early spelling in the first spring after autumn drilling or broadcasting seed at 10 kg/ha. Newly sown sub clover/grass pasture should be grazed no lower than about 1200 DM/ha through late autumn and winter. It's OK to lamb on it but at a lower stocking rate than normal. The new paddock should be closed to reseed about a week after flowers become obvious. For mid/late flowering cultivars this will be in the first week of October in lower altitude Canterbury. Do not take a last few days grazing to 'clean up the green leaf' before spelling the paddock as that will result in runners being eaten and seed yield will be greatly reduced. There needs to be 6-8 weeks of soil moisture available to the sub plants to get maximum seed set. Check the seed burrs for fat ripe seeds.

During the spring spell from grazing, sub clover runners can grow a further 20 to 30 cm in length. This means that individual plants will have the potential to get to about 60 cm in diameter. These runners can colonize vacant space by pegging down seed burrs. Each burr will contain 3 or 4 large seeds each. Seeds are about ten times the weight of a white clover seed. Each sub clover plant will have about five runners each with six burrs containing mature seeds. So each spelled plant can produce over 100 seeds.

It is suggested that cattle will be best to clean up the standing hay sub clover/mature grass in December/early January. Once the paddock has been grazed hard by cattle keep on top of summer grass growth with sheep. Aim to create some bare ground during February so that the fluctuating soil surface temperatures will more rapidly soften hard seed to give a good strike of sub clover with the first significant autumn rains. If all goes well the pasture should then provide excellent ewe lactation feed in the second spring season.

On some hill country it may not be necessary to reseed the sub clover if there is sufficient sub present in the old pasture. Grazing management alone, perhaps helped by some judicious chemical topping, may achieve a sward which can regularly produce over 40 % clover in spring. Assess the suitability for this approach by measuring the frequency of sub clover presence in the pasture. Do this by **walking over it, do not ride**. If sub clover is under your boot more often than two thirds of your steps there may be enough present to bring it back to full potential through management only. This will require hard summer grazing,

briefly spell the paddock after autumn sub clover germination until seedlings have four or five leaves, control grass competition by keeping pasture mass to under 2 t DM/ha through winter, lamb on paddock but get off it a week after flowers are visible. Time the spelling of the pasture to your prediction of when there is 6-8 weeks of soil moisture remaining before the summer dry sets in. Graze the standing hay with cattle in summer. This pasture rejuvenation process may be successful without herbicides but strong grass competition may need to be challenged by more than 'hoof and tooth'.



Plate 7 Sub clover runners spreading through the danthonia dominant pasture on an uncultivated west face at Mt Benger on 2/10/2013.



Plate 8 Runner damage caused by overgrazing prior to close-up in early October. Flowers from recovery growth of these sub clover runners (photo taken 22/10/2013) may be too late to form seed burrs.



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 9 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.
- Plate 10 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!

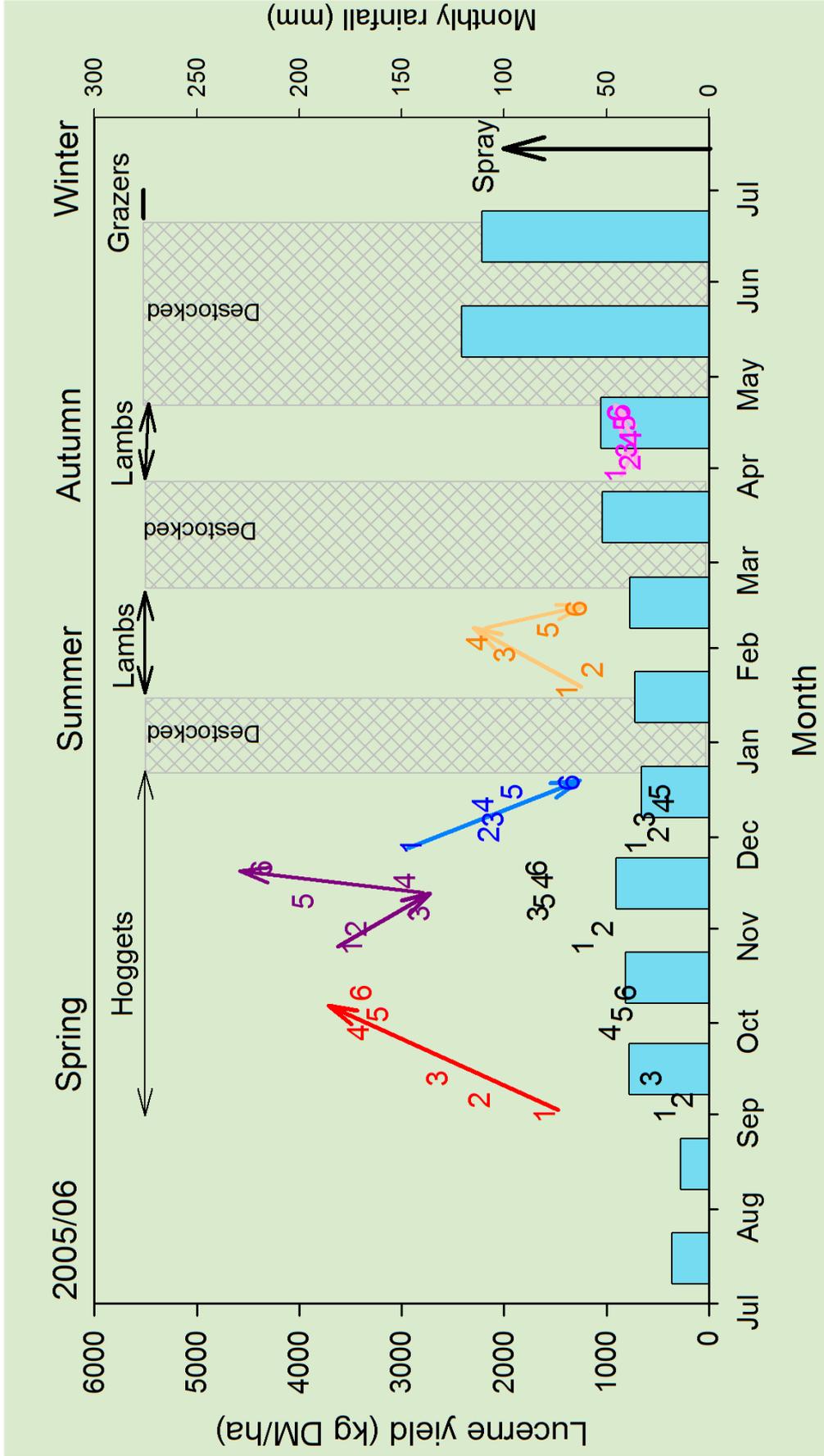


Plate 10 Yields in paddocks 1-6 as stock begin grazing the MaxClover experiment at Lincoln University in 2005. Values at the bottom of the 1st, 2nd, and 3rd grazing cycles are post grazing pasture (stem) mass (PGPM) when stock were moved to a new paddock.

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

- Plate 10 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.

- Plate 11 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.

- Plate 11 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.
- Plate 12 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.

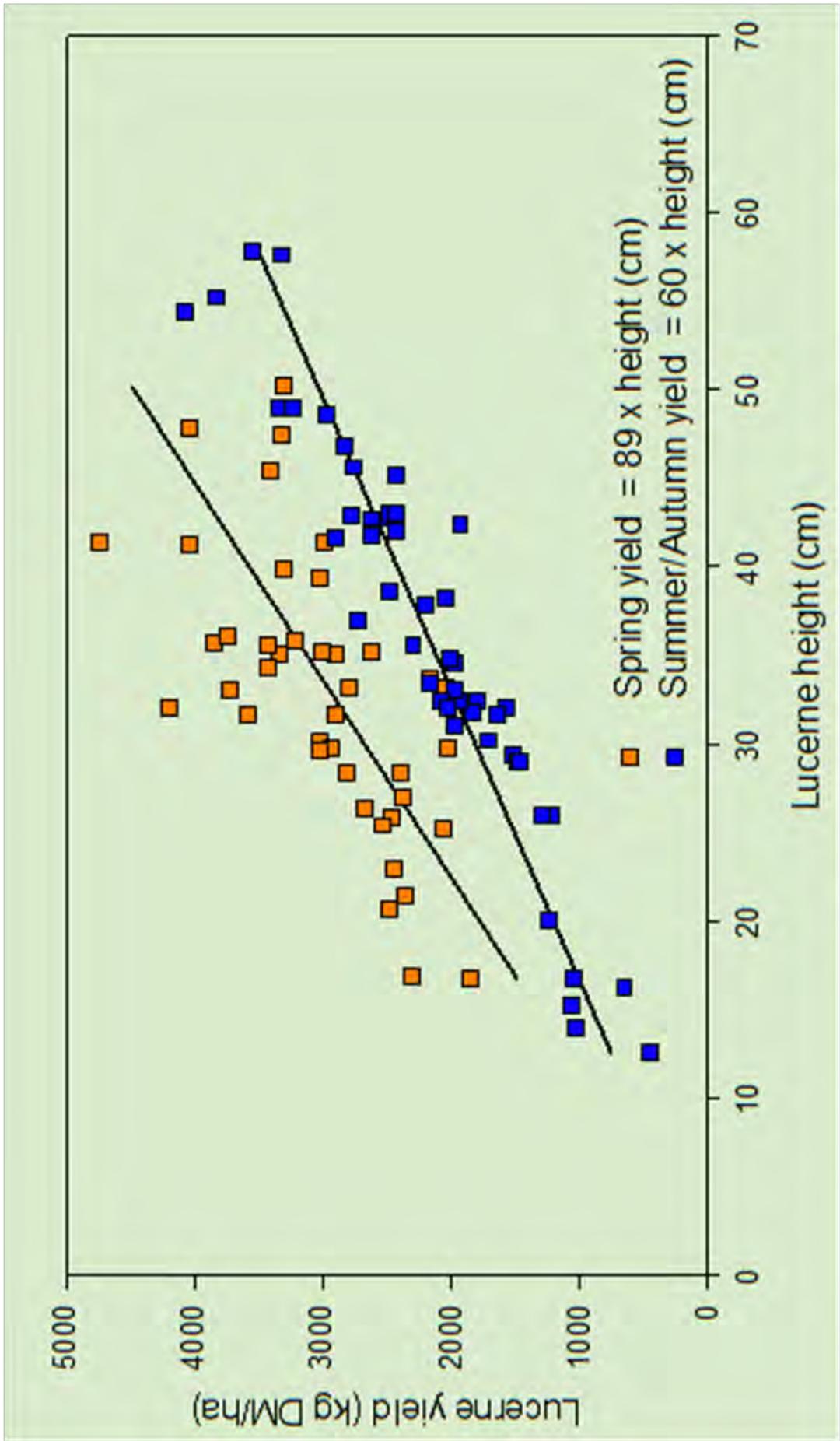


Plate 11 Lucerne dry matter yield estimated from height measurements in Spring (orange squares) and Summer/Autumn (blue squares) Changes in the multiplier used to predict dry matter from lucerne height over a year.

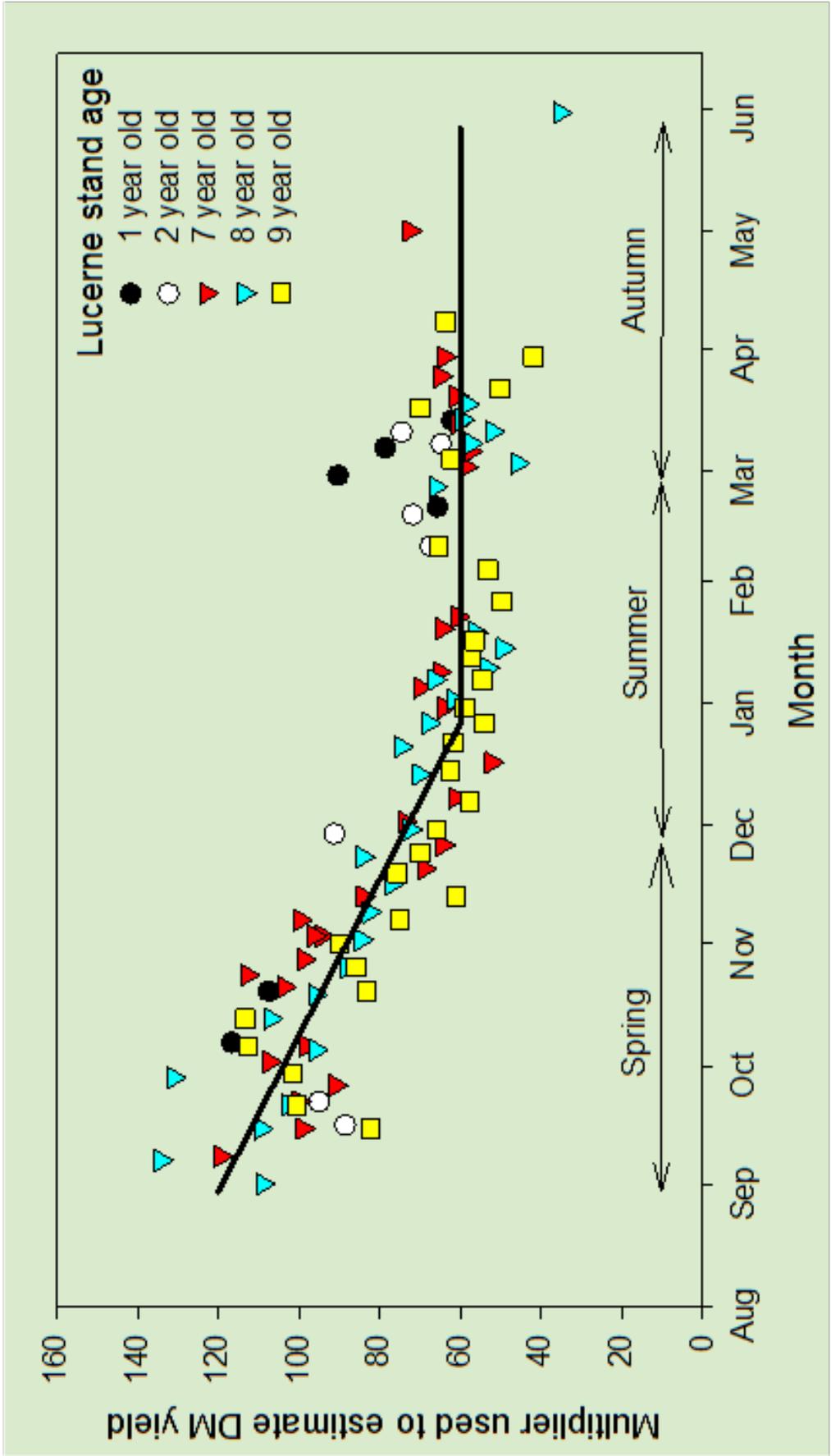


Plate 12 Changes in the multiplier used to predict dry matter from lucerne height over a year.



**Haresfoot clover at late flower stage at Sawdon Station, MacKenzie Country
(Jan 2012)**



Sub clover flowers and foliage (Oct 2012)



'Antas' sub clover leaf on 20/5/2013