Seasonal priorities for successful grazing management of lucerne

Professor Derrick Moot, Lincoln University and Fraser and Doug Avery, Bonavaree Farm

Fraser Avery. Photo by Dave Williams, The Marlborough Express

Doug Avery

Management adapts to dry at Bonavaree; an overview

The decision to increase the proportion of lucerne on the Avery family's Bonavaree farm at Grassmere was born out of frustration tinged with desperation. Six continuous years of below average rainfall in the 1990's had seriously affected the financial, environmental and emotional sustainability of the farm.

Lucerne had always been grown but mostly for conserving as hay and to produce seed crops. A late autumn clean-up graze after seed harvesting provided some direct feeding but there was little stand management planning or regular rotational grazing. Coupled with this was the realisation that lucerne was thriving, in contrast to the continual disappointment of ryegrass and white clover which were failing to perform as the feed base for the number and type of stock being carried on farm. As a consequence, overgrazing of the rolling hill country was leading to serious degradation of the soil resource so vital for sustainable farming.

Overgrazing of hill country in the Starborough Flaxbourne district, and the same site four years later.

The need to change was reinforced by Doug's attendance at a field day in North Canterbury in 1998. Here, starting with how lucerne grows and survives, Professor Derrick Moot explained how the plant could be direct-fed to increase the production of all classes of livestock while maintaining stand production and persistence. The messages struck a chord with Doug who gained new insights into lucerne growth and development and the subsequent importance of seasonal management to get the most out of this plant. He returned home to implement these new ideas at Bonavaree.

Recent Lincoln University research was presented at the field day that enabled greater flexibility in the way lucerne grazing could be managed in the spring. This gave Doug the confidence to try a new system, which has been refined over the last 10 years and is still evolving to deal with new challenges as they emerge. For Bonavaree, the results have been remarkable.

This chapter outlines the main points for seasonal grazing of lucerne with an explanation of how the theory has been adopted and adapted by the Averys.

Lucerne growth and development

Growth of a plant refers to dry matter (DM) production as the result of light interception and photosynthesis. Development is the 'age' or maturity of the regrowth crop within a cycle. This includes the interval between leaves appearing on the stem and when crops flower. Lucerne growth and development are strongly linked, and altered by environmental signals across seasons. Understanding how these signals affect what is happening to the plant in different seasons allows plant and animal requirements to be addressed throughout a production cycle.

New lucerne shoots develop from crown buds.

Lucerne leaves grow from the top of each stem. After cutting or grazing, regrowth occurs from new basal buds on the crown of the plant. This crown sits above-ground so the new shoots are susceptible to grazing, explaining why rotational grazing is required. In contrast, grass species produce their leaves from below-ground growing points, therefore rotational grazing or set stocking are appropriate.

Seasonal growth and development

The pattern of lucerne growth and development within each regrowth cycle shows seasonal variation. Specifically, shoot growth rates increase with increased temperature, but are higher in spring than in autumn at the same temperature (Figure 1). This is because in spring, roots and crowns lose weight as stored reserves are remobilised to initiate new growth in much the same way a poplar or willow tree sprouts new shoots in spring. In contrast, autumn shoot growth is reduced because the plants replenish these reserves for overwintering and spring regrowth.

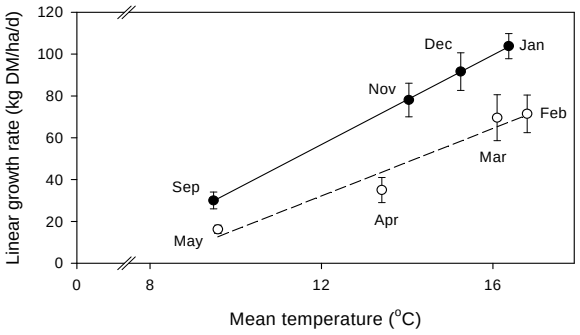

Figure 1: Growth rates of irrigated lucerne in relation to mean temperature at Lincoln University, Canterbury. Data points are the mean of five years and bars represent one standard error.

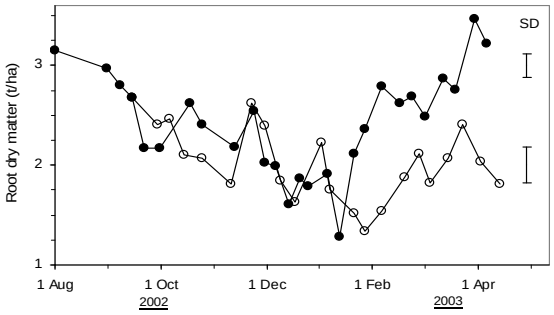

Figure 2: Root dry matter of irrigated 'Kaituna' lucerne crops defoliated at 28-day (○) or 42-day (●) intervals at Lincoln University, Canterbury, New Zealand.

The change in root dry weight for two three-year-old 'Kaituna' lucerne stands grown at Lincoln University in 2002-2003, are shown in Figure 2. For crops grazed either every 42 days or every 28 days, there was a steady loss of root weight in spring and summer and replenishment of root reserves throughout February and March. In the crop grazed every 42 days, total root dry matter returned to a similar level to that measured at the beginning of the previous spring. This both increased stand persistence and ensured rapid early spring growth the following season. The impact of 28 versus 42 days grazing can be seen in the photo (right).

Leaf appearance is also delayed in autumn and winter. In contrast, the number of days required before the crop flowers is lowest in the long days of mid summer. In the remainder of this chapter, we outline how knowledge of these seasonal crop responses can assist seasonally based management objectives to maximise both animal and plant production.

The effects of 28 versus 42 days grazing on root and shoot yield.

Winter (June-July)

Objectives for winter management should be related to weed control and ensuring that crop regrowth is as early and vigorous as possible, the following spring. Ideally, a 'clean-up' graze of any residual autumn herbage in late June/early July removes any over-wintering aphids. Within the next 10 days, appropriate contact and residual activity herbicides are applied before spelling until spring grazing.

The order in which paddocks are grazed during this clean-up period is likely to be the order in which they will be ready for grazing in spring. If herbicide application or final grazing is delayed in winter, the timing of first spring grazing will consequently be delayed. For example, on Bonavaree the aim is to spray all paddocks that are showing weeds (mainly barley grass and shepherds purse) going into late autumn. These paddocks are identified as weed seedlings germinate after autumn rain. Effectively, most are sprayed annually, involving a hard graze in late autumn to mid winter then being left for 3-4 days before 2 l/ha of paraquat and 900 g/ha of atrazine are applied. The amount of lucerne on this farm means that the first paddocks are grazed in early May while the last one may not get its final graze until late July. These late grazed paddocks provide some carryover cover into the spring.

Any management that removes the growing point (top) of lucerne during the late-winter/early-spring period will reduce its yield potential, with important and ongoing consequences for spring growth. Thus, once paddocks are grazed in May/June they are left to develop new shoots then are the first paddocks to be grazed in spring.

Lucerne is never set-stocked at Bonavaree, because the continual removal of newly developing shoots would mean a need for continuous development of new basal shoots. This would rapidly deplete root-reserves, prevent a canopy of leaves from expanding to out-compete spring weeds and reduce yield because not all light available for photosynthesis is intercepted.

Spring (August-November)

Maximising liveweight gain of production stock in spring to get them off the property at saleable weights is vital to meeting financial goals and minimising the number of stock carried through a dry summer.

Early in spring, immediately after lambing, there is a pinch period before lucerne can be grazed. This may be overcome by the use of short rotation ryegrasses and/or cereal greenfeeds.

At Bonavaree, the lambing date is July 23. This feed gap has usually been filled with 'Omaka' barley, Italian ryegrass and other cereals. The key to ensuring these crops are established and producing sufficient quality feed is February establishment, after a summer fallow. The importance of conserving late spring and any summer rainfall cannot be overemphasised. The security of knowing that the barley will strike and sit waiting for autumn rain reduces pressure on other feed sources in early spring.

Early autumn rain stimulates the greenfeed which then provides early feed for flushing or grazing before winter. In drier autumns, if there is a late strike or following rain, crops are left mainly for the ewes in the early spring.

A paddock is planted in barley, in February 2008 (left) and a bag of the Omaka barley, sown at Bonavaree.

When there is autumn growth, barley is managed with cattle then shut up around July 10, to ensure sufficient feed for ewes to lamb onto. The aim is to have all twinning ewes on cereal greenfeeds coming up to lambing. On occasion, sleepy sickness has occurred on the greenfeeds in cold spring conditions. To minimise this, the last lucerne paddocks to be cleaned up in winter may be held over and lambed on for a maximum of three to four days. This provides a high protein and energy diet, particularly to multiple-bearing ewes.

During early spring, lucerne crop growth accelerates as temperature rises. However, flowering is delayed by short day length, meaning grazing should be based on crop growth rather than the previous lucerne mantra of "wait for 10% flowering or when the basal buds have developed".

For dryland systems, where lucerne makes up a high (>20%) proportion of farm cover, early spring grazing is required. In these circumstances, grazing must commence in some lucerne paddocks before they reach their maximum DM yield. To minimise the impact on stand persistence, it is preferable to begin by grazing older stands, targeted for renewal. On Bonavaree, these “transition” paddocks have often had grass sown into them, providing an opportunity to introduce lucerne to the diet before stock move onto pure stands.

Waiting until herbage is 20-25cm high provides a compromise between maximising DM yield and meeting increasing animal demand requirements. Ideally, ewes with lambs at foot should be rotationally grazed on these stands at a stocking-rate that enables all herbage to be removed within 7-10 days. The first paddock grazed will have five to six weeks to re-grow to about 3000kg DM/ha (35-45cm) before it is grazed again. A third grazing may not be achieved because the crop has run out of water.

On Bonavaree, ewes and lambs go onto lucerne around the third week of August, when lambs are just beginning to eat and the lucerne paddocks sprayed first in the autumn are about 20cm in height. The first paddocks used are the transition paddocks that contain some grass or allow access to grass on the hills. Sheep graze paddocks on breaks that last no longer than seven days and do not return to that paddock for at least 30-35 days. Ewes are stocked at about 12 ewes+twin lambs per hectare for the spring. For many lambs, the only feed they eat on the farm is lucerne.

To maximise animal liveweight gain (LWG), finishing stock need to be grazed solely on lucerne, for six to eight weeks at an allowance of 2.5-4.0 kilograms of dry matter per head, per day (kg DM/hd/d). Stock first selectively graze the highest quality top leaves and stem, followed by the less palatable lower stem which may be left as the residual or grazed by dry stock.

On Bonavaree, yearling bulls or steers follow ewes and lambs to harvest less palatable lower stems. In practice, the use of break-feeding on flatter paddocks means these are cleaned out after about three days by ewes and lambs which are then moved on to the next break. In larger hill paddocks, ewes and lambs may graze for up to seven days. To follow up, bulls and steers are then run on the paddocks for two to three days, cleaning up remaining stem and rougher grass on hillsides.

Lambs (left) and bulls graze lucerne at Bonavaree.

Animal health issues

In the first years of increasing the direct grazing of lucerne on Bonavaree, some animal health issues developed, particularly when the lucerne was lush in early spring. In one year up to 50 ewes were lost to bloat and some lambs to red gut. The decision to direct-feed lucerne was seriously questioned. Today there are minimal losses (<10 per year).

Stock at Bonavaree have constant access to multi-mineral salt blocks (lucerne stores sodium in the roots and is thus deficient in foliage), to reduce cases of bloat. Stock never go onto lucerne hungry. When lucerne is really lush, after rain, or during early spring, lucerne hay is fed every second day ensuring that red gut is no longer a problem. In addition, bloat capsules are used when bulls or steers are grazing fresh lucerne but not usually for clean-up grazing after ewes and lambs.

Summer (December-February)

The objective in summer is to utilise lucerne to maximise animal liveweight gain of priority stock, when possible. In the absence of water stress, lucerne growth and development are rapid and respond to high temperatures and long sunny days. The number of crop regrowth cycles during this time is solely related to the availability of moisture via rainfall or irrigation. For example, at Lincoln University five to six regrowth rotations gave a total yield of over 17 tonnes of dry matter per hectare (t DM/ha) in dryland crops on a deep Wakanui silt loam soil with 350mm of plant available water content (PAWC). In contrast, at the University's dryland farm, Ashley Dene, on a very stony Lismore soil (PAWC = 150 mm) lucerne yielded about 7t DM/ha from three regrowth crops and most of this was in spring.

Recent results suggest the comparative advantage of lucerne over grass-based pastures is greatest in wetter than average summers due to the plant's ability to rapidly respond to rainfall and produce high quality feed, any time in the growing season.

The quality of lucerne as a feed source depends on the proportion of leaf and stem in the stand. Regardless of yield, lucerne crops contain about 1.5t DM/ha of leaf with metabolisable energy (ME) of 12 and protein content of 27%. This protein level is higher than required by animals, so can be balanced with some poorer quality stem. At DM yields above 2000 kg/ha, the proportion of poorer quality (ME = 8.5, crude protein = 15%) stem increases.

Valley floor planting of lucerne at Bonavaree.

On Bonavaree, lucerne is deliberately planted in valleys to take advantage of deeper soils and catch any summer rainfall that may run off parched hard hillsides. The response of lucerne to summer rain was evident in 2007, when 80mm of rain on December 18 saw lucerne spring back into life while grasses grew seedheads. The available lucerne was used to finish hogget lambs to heavy weights and put weight onto yearling steers and two tooths. However, the farm system is set with an expectation that summers will be dry. The target is for all lambs to be off the property by the end of November, although currently 80% are finished before January 1.

In mid summer when stands have become drought stressed, they can either be hard-grazed to avoid loss of currently available production before leaves drop or left to build some reserves for regrowth. Even a drought-stressed crop will slowly accumulate nodes on basal buds after defoliation, enabling a rapid response to any rainfall.

Stock should not be left on lucerne stands after summer grazing, as ideally plants should be left to flower and recharge root reserves in mid summer (Jan-Feb). In practice, this is not often possible in dryland situations when the feed has either been eaten or the crop prematurely runs out of water.

Autumn (March-May)

In autumn, the objective changes from stock performance to managing the stand for persistence and production the following year. Decreasing temperatures and day length reduce both growth and development. In practice, this is often the time when the crop is able to reach 50% flowering and recharge root reserves.

For dryland crops, a lack of rainfall may rule out this ideal autumn management. Delaying grazing of any autumn regrowth after significant rainfall will help the plant recover reserves. This management technique has the added advantage of allowing the lucerne canopy to develop at a time when winter annual weeds are also germinating. The expanding lucerne canopy uses the rainfall at the expense of the initially shallower rooted weed seedlings.

Thus, ideal management for lucerne (and all pastures) after the rainfall that ends a prolonged summer-dry period, is to spell the crop to maximise growth for the remainder of the season. Lucerne growth usually ends with a period of successive hard frosts in late autumn, which damage the vulnerable growing point at the top of the plant.

Lucerne is sometimes used for flushing but concerns around poor ovulation rates have limited this practice.

Lucerne foliage that is experiencing attack from aphids or leaf diseases should be avoided at this time.

At Bonavaree, autumn is the time when flowering is ensured on all lucerne stands (100% of stems with an open flower).

Mating on lucerne is now mainstream at Bonavaree, resulting in excellent scanning weights. In recent years two-tooths have been mated on lucerne, resulting in a 35% increase in lambs born. Regrowth is carried through and grazed ahead of spraying in late autumn.

The overriding aim is to directly graze as much lucerne as possible. The crop is conserved as hay or baleage only when a true surplus develops. The Averys' preference is to buy in trading stock to eat the surplus, when summer and autumn rain permit. Any hay may then be fed out in spring, to provide roughage when stock are being grazed on pure lucerne stands.

Corriedales are mated on lucerne, at Bonavaree.

Stand renewal

Reasons for lucerne stand decline vary, but the decision to renew a stand is usually based on a declining plant population and ingress of tap-rooted weeds such as dandelions. Pest and disease damage may also play a part. Most modern lucerne cultivars have a wider tolerance of aphids, weevils, fungi and viruses than those used 30 years ago. However, white fringed weevil has been an irritation at Bonavaree in recent years. The root-feeding weevil larvae thrive on legumes and a monoculture of lucerne provides ideal feeding conditions.

To mitigate the impact, lucerne stands were not sprayed in 2007 and the unappealing weeds that remained may have reduced weevil populations. Equally, the practice of drilling grass into declining stands will suppress this pest. Following this with a two year crop of barley will break the weevil's life cycle.

To renew lucerne, barley is sprayed out in late spring (September 15) with glyphosate at 4l/ha then the new stand direct-drilled on October 15. All stands on Bonavaree are direct-drilled at 8kg/ha of bare inoculated seed with 250kg/ha of Cropmaster 15 fertiliser, then left until mid December - when about 50% of stems have an open flower - before the first grazing. After this, renewed stands join the grazing rotation with no more special management.

Surplus lucerne is cut for hay, at Bonavaree.

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