3.6 Seasonal grazing management

Having successfully established a lucerne stand it can be used for grazing or conserving as hay, baleage or silage. This section outlines the management required for production and persistence of a lucerne stand. The principals described and underlying physiological basis are similar regardless of location. Understanding the different plant processes that affect lucerne growth and development are the keys to stand longevity and feed quality. This section outlines the seasonal grazing management recommended for direct grazing Lucerne to maximize animal live-weight gains without compromising lucerne stand performance.

Shoot growth rates increase with temperature, but rates are higher in spring than in autumn at the same temperature (Moot *et al*., 2003). In spring, roots lose weight as stored sugars and nitrogen are used to stimulate early season growth but in autumn shoot growth is reduced as roots are recharged with nitrogen and carbohydrates (Teixeira *et al*., 2009). Understanding this change in plant priorities allows flexible grazing management to be used on a seasonal basis. A second consideration is the time of flowering. This has previously been used as a guide for grazing management but research indicates there is no need to wait for flowering before commencing grazing in spring (Moot *et al*., 2003). This increased flexibility has assisted dryland farmers to use lucerne for ewes and lambs from about 3 weeks after lambing (Avery *et al*., 2008). This section outlines how these simple mechanisms can be used to develop seasonally based management objectives to maximise both animal and plant performance.

3.6.1 Winter (June–August)

Objectives for winter management of lucerne should be weed control and ensuring that crop regrowth is as early and vigorous as possible in spring. Ideally, a 'clean-up' graze of any residual autumn herbage in late June/early July can be used to remove any overwintering aphids. This graze should be followed 7–10 days later by appropriate contact and residual activity herbicides. Lucerne crops should then be left until spring defoliation.

Lucerne should not be grazed in winter. This is because the potential for rapid stem elongation, and consequently early spring regrowth is generated over the entire winter period whenever the air temperature is above 5 °C (Moot *et al*., 2003). When stands are less than 400 kg DM/ha, the impact of any grazing can be enormous. The small amount of available grazing removes the plants growing point, preventing rapid stem elongation and consequently leaf area expansion. This results in a delay in spring growth and reduced yield potential.

Set stocking should also be avoided at all times. Set-stocking of lucerne crops results in the continual removal of newly developing shoots, stresses the plants and allows weed invasion. In grasses the growing point that produces new leaves is below ground so grass based pastures can be set-stocked. In contrast, the elevated growing point for lucerne is removed by grazing livestock and this needs to regenerate after each grazing. Consequently, lucerne should never be set stocked.

3.6.2 Spring (September–November)

In spring, the aim is to maximise live weight gain of stock. Flowering is delayed by the short photoperiod so grazing or cutting should be based on crop height and yield rather than waiting for flowering or basal bud development. For dryland systems, where lucerne makes up a high (>30%) proportion of the farm cover, early spring grazing is inevitable. In these circumstances, grazing must commence in some paddocks before they reach their maximum DM yield. To ensure this early grazing has minimal impact on stand persistence, it is preferable to begin grazing older stands that are targeted for renewal. Waiting until herbage is 0.20-0.25 m high provides a compromise between the need for early grazing to meet animal demands and capturing the rapid spring growth. The aim is for ewes and lambs to be introduced to the lucerne when lambs are 2-3 weeks of age and starting to eat herbage themselves. These ewes with lambs at foot should be rotationally grazed on stands at a stocking-rate that enables all herbage to be removed within 4-7 days (Moot *et al*., 2003). For example, over an area of 30 hectares about 300 ewes with twin lambs can be rotationally grazed on six 5.0 hectare breaks. The resting period before they return should be about 35 days at this time of year. During the first spring rotation, the lush high quality of lucerne can increase the risk of animal health issues such as red gut (Section 3.7) and strategies to minimise this potential are needed.

An advantage of lucerne growth in spring is that it uses water more efficiently than grasses (Moot *et al*., 2008). Therefore, for dryland farmers that have a limited amount of soil moisture, lucerne will grow more dry matter per millimetre of water used and has deeper roots with access to more water than grass based pastures. For example, Figure 2 shows lucerne produced ~6.2 t DM/ha from 250 mm of water used in spring when grown on a Templeton silt loam soil at Lincoln. The comparable ryegrass pasture grew produced less than half this yield from 220 mm of water used.

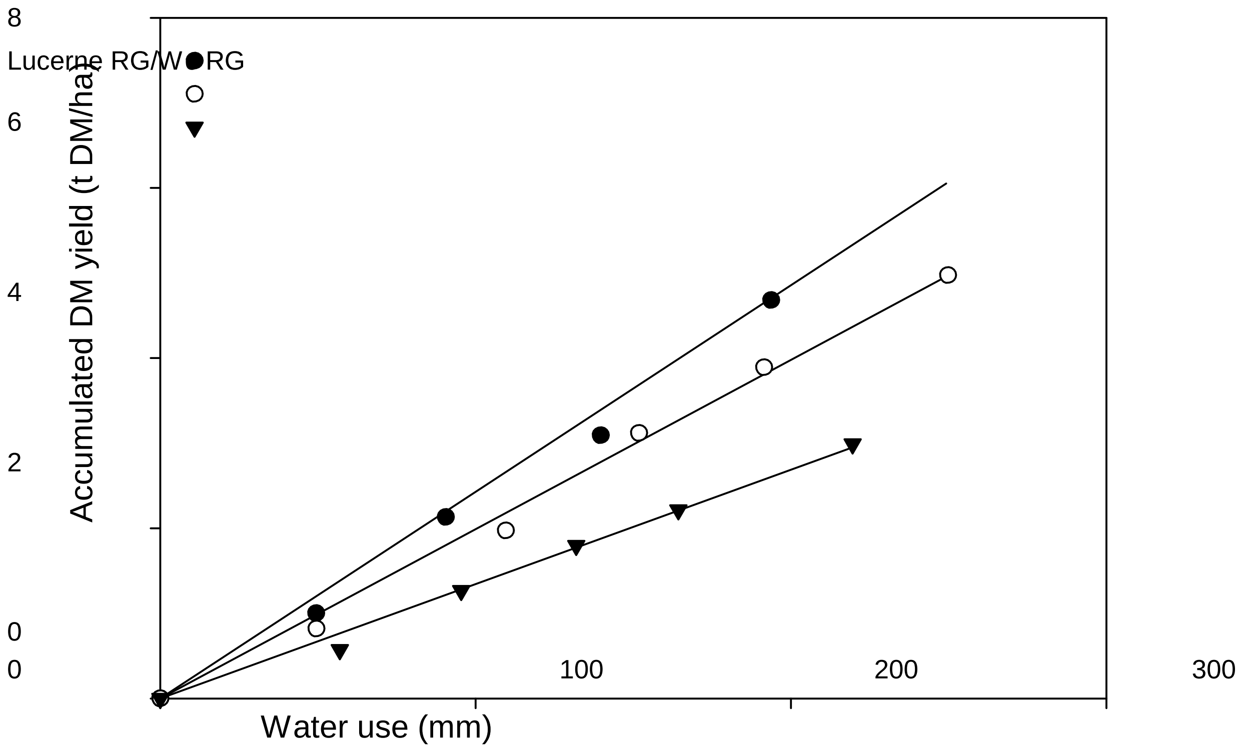

Figure 2 Spring water use efficiency (kg DM/ha/mm) of lucerne (24 kg DM/ha/mm), perennial ryegrass/white clover (RG/Wc, 20 kg DM/ha/mm) and perennial ryegrass (RG, 13 kg DM/ha/mm) pastures grown on a Templeton silt loam soil at Lincoln, Canterbury between 29/9-9/12/1993 (Moot *et al*., 2008).

3.6.3 Summer (December–February)

From the commencement of grazing until the lucerne stops growing or sometime in February, the objective is to maximise animal live weight gain of priority stock. In the absence of water stress, lucerne growth is rapid and crops may be grazed 2 or 3 times in rotation. If crops have become drought stressed, with an expectation of continued dry weather, any accumulated herbage can be hard-grazed to avoid the loss of current production through leaves dropping (senescing).

To maximise animal live weight gain, farmers should aim to graze priority stock solely on lucerne for 6 to 8 weeks at an allowance of 2.5–4.0 kg DM/hd/d (Moot *et al*., 2003; Avery *et al*., 2008). Stock graze the highest quality top leaves and stem first, followed by the less palatable lower stem which may be left. Continue to rotationally graze for no more than 7–10 days. Residual stem can then be grazed by dry or low priority stock, mown or left standing. Optimum grazing management during this time allows 35±4 days regrowth from when stock leave a paddock until when they re-enter.

Where lucerne can be irrigated, the optimum frequency and timing of water application is dependent on how much water the soil can hold. Irrigation also encourages weed seed germination so after defoliation, when demand for water is low, delay irrigation until new leaves grow and are ready to expand and out-compete germinating weeds.

3.6.4 Autumn (March–May)

In autumn, priorities change from stock performance to managing the stand for persistence and production in the following year. During autumn the ratio of shoot to root production decreases (Moot *et al*., 2003). To maximise this, the crop should be allowed to reach 50% flowering in early-autumn (February–March). For dryland crops, a lack of rainfall may not allow this ideal management during autumn. Delaying the grazing of any autumn regrowth after significant rainfall will assist the plant in recovering below ground reserves. Thus, the 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 in a period of successive hard frosts in late autumn, which damage the vulnerable growing point at the top of the plant. The last clean-up of residual herbage should occur before the end of June in most areas of New Zealand, even if frosts have not stopped growth, before the cycle recommences for the following year.

3.7 Animal Health Risks

When direct grazing lucerne some animal health issues can develop. These are most likely when the lucerne is lush in early spring. At this time the rapid passage of lucerne through the rumen can cause ‘red gut’. Fibre sources such as palatable weeds, straw, patches of grass and/or lignified portions of lucerne stems reduce this risk. Also, on high quality legumes bloat can be a problem, particularly with cattle. To minimize the opportunity for losses, stock should have access to salt or mineral blocks (lucerne stores sodium in the roots and is thus deficient in the foliage; Douglas, 1986). Also, hungry stock should never be put onto lucerne to prevent them from gorging on high quality feed which can cause bloating. When lucerne is lush, after rain, or during early spring, feed hay or give livestock access to adjacent grass or weedy areas for roughage. Bloat capsules and oils are useful when bulls or steers are grazing fresh lucerne but are not usually needed for the clean-up grazing after ewes and lambs. Lucerne can be used for flushing provided the foliage is free of aphids and leaf diseases. On some dryland farms two-tooths and ewes are routinely mated on wilted lucerne (Avery *et al*., 2008). This practice started initially because no other feed was available for flushing in dry years.

3.8 Dairy / Beef grazing

Most of the literature related to grazing management reflects experiences from grazing ewes and lambs, beef cattle and deer. There are fewer examples of direct feeding of lucerne by dairy cows in New Zealand. However, this is common practice in some South American countries. For example, in Argentina, Basigalup and Ustarroz (2007) report 4.7 M hectares of lucerne is grown and, in the Pampa region, over 90% of the lucerne grown is used for direct feeding to dairy and beef cattle. Compared with confined feeding, the lower operational costs, higher utilization *in situ* and healthier animal products for animal consumption were highlighted as advantages for direct feeding. Danelón *et al*. (2002) state that lucerne is the most popular forage for dairy cows in Argentina. Crops are strip grazed at about 69% efficiency but this may be improved by mechanical mowing and wilting prior to grazing. The addition of corn silage supplementation before grazing lucerne may also be used to reduce the incidence of bloat (Bretschneider *et al*., 2007). These well developed feeding systems offer research areas for exploration to assist New Zealand dairy farmers to further utilize lucerne in the diet. Because lucerne is high in nitrogen a large scale adoption of direct feeding may reduce the reliance on nitrogen fertiliser but pose issues for nutrient capture. These are explored in the following sections.

3.9 Nitrogen (N) fixation, forage quality, nitrogen losses

Being a legume, lucerne fixes its own nitrogen and this reduces the requirement for nitrogen fertilizers. The amount of nitrogen fixed will depend on the amount of herbage grown.

3.9.1 Nitrogen (N) fixation

At Lincoln, accumulated N yield (kg N/ha/yr) of irrigated lucerne was 860 kg N/ha averaged across 21.4 t DM/ha which equates to 25 kg N/t DM (Hoglund *et al*. 1974). In dryland conditions a yield of 14 t DM/ha contained 470 kg N/ha or 30 kg N/t DM accumulated (Tonmukaykul *et al*., 2009). This figure is similar to several others reports for legumes in general (Peoples and Baldock, 2001) and shows the benefits of having nitrogen fixing plants within a pasture system. The fixed nitrogen could potentially be released into the soil once a lucerne crop is ploughed up. Following a lucerne crop with a cereal grain crop or greenfeed allows the nitrogen to be used and reduces inorganic N requirements for the following crop.

3.9.2 Forage quality

Lucerne is a high quality forage that can be used to produce fast growth rates of many classes of livestock. Nutritive value of lucerne alters throughout regrowth and as the stand age increases. As regrowth occurs the ratio of leaf to stem material decreases and the stems become lignified (woody). Forage quality is highest for the first spring regrowth because it remains vegetative. When a stand has less than about 1500 kg DM/ha (20 cm tall) it could all be considered as palatable with a metabolisable energy (ME) content of at least 12.0 MJ/kg DM and a crude protein (CP) content above 30% (Brown and Moot 2004). As the yield increased to over 4.0 t DM/ha, the ME of the palatable leaf remained constant and above 12.0, and the CP was about 26%. The stem fraction retained an ME of 8.0 and CP of about 10%. The main change over time is in the proportion of stem herbage. Selective grazing enables livestock to have ME and CP intake significantly above the mean of the feed on offer as the stand matures (Figure 3).

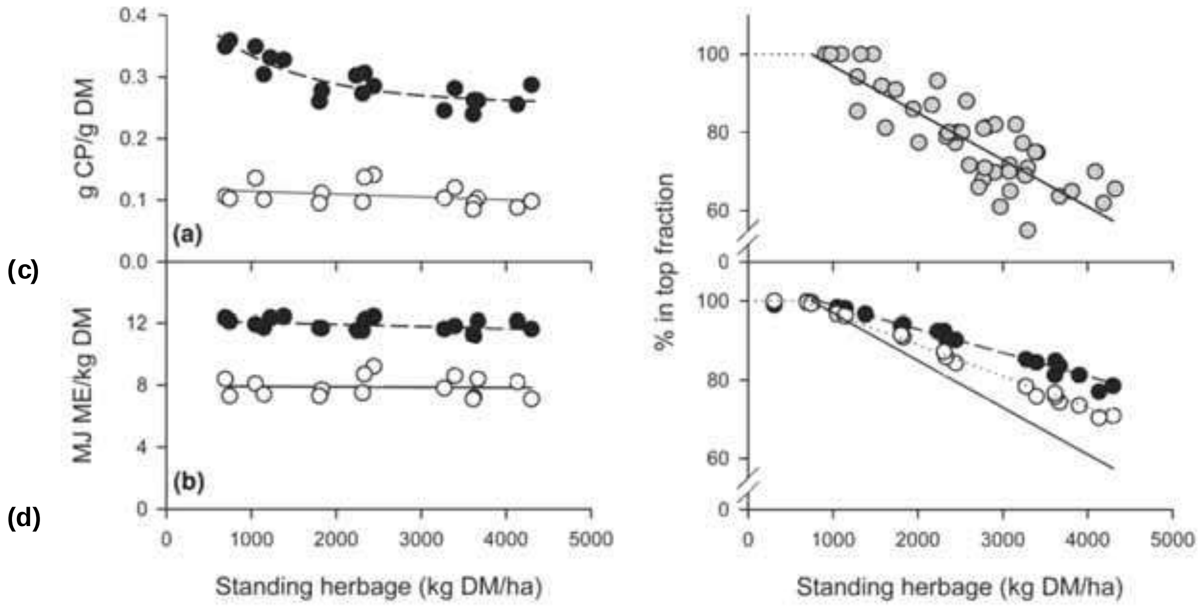

Figure 3 Relationship between (a) crude protein (CP), (b) metabolisable energy (ME) content of palatable (●) and un palatable (○) fractions of 'Kaituna' lucerne herbage in relation to above ground yield (kg/ha) and (c) is the percentage of total herbage in the palatable fraction as standing yield increases throughout regrowth and (d) is the percentage change in CP (●)and ME (○) in the palatable fraction of lucerne regrowth over several regrowth cycles at Lincoln University, Canterbury (Brown and Moot, 2004).

3.10 Nutrient content and quality of hay

The majority of lucerne grown in New Zealand has traditionally been conserved as hay or silage. How much lucerne is conserved is unknown because separate statistics for the crop are no longer kept. For many farmers the appeal of conserved lucerne is that it provides high quality feed that can be stored for later use. The quality of this feed is usually higher than that required for maintenance of livestock. Farmers who direct graze lucerne have a reduced need for conserved feed (Avery *et al.*, 2008). Despite this the main use of lucerne currently remains as conserved feed. In New Zealand a summary of the nutrient content of hay and silage shows an average CP of 21% and ME of 10 MJ/kg DM for both forms of conserved feed (de Ruiter *et al*., 2008).

For lucerne herbage potassium values are higher than found in most other temperate plants. This is because sodium is stored in the roots so a higher concentration of potassium is found in the herbage. Analyses of lucerne hay showed lower critical values associated with the increased proportion of stem. Despite the available potassium in the majority of alluvial based soils (e.g. in Canterbury) there still appears to be a need for potassic based fertilizers with deficiency occasionally observed in the field. For heavily irrigated crops sulphur deficiency can occur although the symptoms often appear similar to nitrogen deficiency.

In addition to N, the mineral content of lucerne hay and silage have been extensively reported, particularly in the USA (e.g. Undersander *et al*., 2000). For actively growing lucerne the young leaves and tops of plants should be sampled to detect any nutrient deficiencies. This is particularly important for lucerne crops that are continuously conserved whereby no nutrients are returned in animal excreta.

During the hay making process some changes in herbage quality can also be expected. Conditioning of lucerne cut for hay (whereby stems are crushed/bent/broken by rollers to allow stem material to dehydrate more rapidly than intact stems under field drying conditions) can reduce the amount of time the lucerne is at risk of being rained on. Rain reduces the quality and quantity of hay due to washing out of soluble carbohydrates. Conditioning, or physically damaging the stem to allow rapid water loss, can cause losses of higher quality leaf and less lignified stem material. This can account for about 50% of the total mechanical losses during the harvesting process. Losses during haymaking occur from respiration (up to 10%), leaching (up to 30%) or rain (sometimes complete crop loss) and mechanical (raking 5-10%) or shatter losses.

Please Note: This article is a section of a report that was prepared for by the NZFEA Trust and MAF - July 2009.