Improving summer and autumn feed quality in New Zealand hill country

G.M. RENNIE¹, W.McG. KING¹, T.L. KNIGHT², B. DEVANTIER³ and C.J. HOOGENDOORN³

¹AgResearch, Ruakura
²AgResearch, Lincoln
³AgResearch, Grasslands

grant.rennie@agresearch.co.nz

Abstract

Management of late spring surpluses to restrict reproductive growth can increase the quality of hill-country pastures during summer and autumn. This occurs through a reduction in accumulated stem and dead material and an increase in clover content. However, there is little information on the magnitude and longevity of these effects. This trial investigated the effects of four late spring defoliation intensities on herbage quality, measured at the end of spring and during summer. Treatments were applied through regular cutting of hill pastures in areas of medium fertility and slope on two aspects in each of four geo-climatically different hill-farming regions over two years. Pasture herbage quality at the end of spring followed expected trends: defoliation to low residual pasture height led to higher quality herbage. The maximum difference in quality between the lowest cutting height and nil cutting at this time was nearly 2 MJME/kg DM. With a change to uniform cutting height across all plots in early summer, these pasture quality differences reduced and disappeared.

Keywords: Pasture quality, hill country, grazing management

Introduction

With the ongoing development of much of New Zealand’s flat and rolling land into dairying or dairy support, there is increasing pressure on hill country to improve productivity. Ideally, this means trying to grow and finish young stock on country previously used for breeding stock. This demands higher pasture quality than is typical on hill country. Pasture management in mid to late spring has a strong influence on pasture quality in summer and autumn in New Zealand hill country pastures. Manipulation of defoliation frequency and intensity during mid to late spring can impact summer and autumn pasture quality and quantity (Orr et al. 1988). Summer/autumn management is mainly concerned with maintaining herbage quality in summer wet areas and controlling animal pressure in summer dry areas for drought management and winter feed stocks (Clark 1994). Deferred grazing to effectively transfer pasture from late spring into summer and autumn is difficult due to detrimental effects on pasture quality, plant density and species composition (Sheath et al. 1987). Various grazing management guidelines have been published to inform hill farmers of pasture management considerations during this period (Sheath & Bircham 1983; Sheath et al. 1987; Smith & Dawson 1977). The effect of defoliation intensity and frequency on summer and autumn net herbage accumulation has been well studied (Sheath & Boom 1985; Orr et al. 1988), as well as the animal production costs of carrying out these defoliation strategies (Smeaton et al. 1984).

It has previously been shown that management of late spring surpluses to restrict/remove reproductive growth will increase summer pasture quality through a reduction in accumulated stem and dead material and an increase in clover content (Sheath et al. 1987). However, qualitative results of the metabolisable energy (ME) changes in hill country pastures have not been published. In addition there is no information available on the longevity of these effects following uniform defoliation over summer. This trial aimed to determine the effect of different defoliation intensities during spring on herbage quality and composition throughout the subsequent summer-autumn period.

Methods

In 2011, experimental plots were set up in four climatically distinct hill country farming environments: summer dry (Cheviot, North Canterbury), summer dry/moist (Poukawa, Hawke’s Bay; Woodville, Southern Hawke’s Bay/Tararua), summer moist/wet – (Ngaroma, King Country/South Waikato), with a range of average summer (December to February average) rainfall (150–320 mm) and an average summer (December to February average) soil water deficit (-91 to -52 mm, calculated with soil water balance equations described by Scotter et al. (1979)). Further site information has been published by Tozer et al. (2013). Plots sized 5m × 5m, were allocated to treatments on areas of moderate slope (15–25°) without extensive tracking.

The experimental period was separated into two phases; a spring “prevention” phase (September to
December 2011) and a summer/autumn “maintenance” phase (January to April 2012). The trial contained four spring defoliation treatments (Figure 1) replicated three times on two aspects at each of the four sites. Maintenance phase defoliation was to a common height. Defoliation was achieved with a rotary lawn mower or line trimmer, at 3-weekly (20–25 day) intervals during spring, with summer cutting frequency being climate and growth dependent. Cut pasture was removed from the plot. Fertility removed with pasture was replaced using a fertiliser blend (N:P:K:S:Ca:Mg – 10.4:3.2:20:3.9:7:1.3) to replace the calculated pasture-N removed from each plot. Replacement fertiliser was added following every two to four cutting events, weather dependent, at a rate no greater than 50 kg N/ha per application. Pasture quality samples were cut to near ground level prior to cutting plot treatments, dried at 65°C for 24 hours, ground and analysed for metabolisable energy content (ME) by feedTECH, Palmerston North, with standard commercial near infrared spectroscopy techniques for pasture quality. In spring 2012 the treatments were reapplied to the same plots without re-randomisation to determine if observed changes in pasture quality were cumulative.

Results

Summer rainfall and calculated summer soil water deficit are presented in Table 1. The climate data was taken from the NIWA virtual climate station database.

<table>
<thead>
<tr>
<th>Region</th>
<th>Cheviot</th>
<th>Poukawa</th>
<th>Woodville</th>
<th>Ngaroma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall 2011/12</td>
<td>186</td>
<td>217</td>
<td>292</td>
<td>429</td>
</tr>
<tr>
<td>Rainfall 2012/13</td>
<td>156</td>
<td>52</td>
<td>233</td>
<td>168</td>
</tr>
<tr>
<td>40-y av. rainfall</td>
<td>163</td>
<td>164</td>
<td>272</td>
<td>323</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>78</td>
<td>87</td>
<td>102</td>
<td>115</td>
</tr>
<tr>
<td>sSWD 2011/2012</td>
<td>-83</td>
<td>-87</td>
<td>-43</td>
<td>-52</td>
</tr>
<tr>
<td>sSWD 2012/2013</td>
<td>-79</td>
<td>-109</td>
<td>-97</td>
<td>-115</td>
</tr>
<tr>
<td>40-y av. sSWD</td>
<td>-73</td>
<td>-91</td>
<td>-72</td>
<td>-52</td>
</tr>
</tbody>
</table>

The above results are separated into region and aspect in Figure 3. Most region/aspect combinations showed significant differences between treatments at the changeover. In year 1, six of eight site/aspects were
Discussion

The defoliation treatments in this experiment were imposed by cutting. This enables idealised defoliation to quantify the potential pasture quality that could be achieved. In a typical hill farming situation grazing is less uniform and controlled. Careful consideration of factors influencing hill pasture utilisation, such as subdivision, stock water and stock intensity would be required for grazing systems to replicate the findings of this experiment.

The defoliation treatments created differences in pasture ME which were at their greatest at the completion of the treatment period in late spring. They followed the expected trend of defoliation to shorter heights resulting in better herbage quality (Binnie & Chestnutt...
1994; Orr et al. 1988). However, the ME differential began to rapidly equalise following the changeover to uniform defoliation heights. The ME value at which the treatments stabilised could be described as a function of a possible recovery potential of the pasture to the new defoliation regime. It would be difficult for a grazing system to replicate the uniform removal of pasture surplus to a 5 cm residual in early summer. To continue producing pasture at the developed quality into the summer, soil moisture is required for regrowth.

Weather conditions play a part in maintaining, or reducing, the quality of pasture. The energy content of the pasture over summer was related to regional summer rainfall with higher summer rainfall and available soil moisture generally resulting in higher pasture ME. In Year 1 of the trial, the greater than average summer rainfall resulted in a pasture quality level throughout summer around 1 MJME greater than in year 2. While soil moisture is thought to have a relatively small effect on pasture quality itself (Lambert & Litherland 2000), the effect of water stress on the regrowth of higher quality portions of the pasture, such as green grass leaf and legumes, could drive the differences observed. Where moisture is available for growth the pasture is able to adapt to the new defoliation height and produce new growth of higher quality.

The variation in pasture quality driven by summer rainfall dwarfed any residual pasture quality effects resulting from the treatments. This indicated that, with idealised defoliation through cutting, the quality of an uncontrolled sward may be recoverable where summer rainfall is adequate for continued growth. This is supported by the results at wetter site/aspect/season combinations (Year 1, Woodville; south aspect and Ngaroma; both aspects) where the pasture fallow or “deferred grazing” treatment recovered to a higher value than the remaining treatments. Where plant growth and sward recovery is likely to be inhibited due to low soil moisture continued high intensity defoliation into summer may maximise the quality of harvested pasture but would reduce the net herbage accumulation as well as the quantity available at the onset of drought.

Under typical farming practice it may be difficult to replicate this idealised removal of pasture mass through animal grazing in a hill country environment unless sufficient grazing pressure is available.

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REFERENCES


