A STUDY ON THE EFFECT OF SWARD CONDITIONS ON HERBAGE ACCUMULATION DURING WINTER AND SPRING.

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ABSTRACT

Recently there has been an increased trend for farmers to adopt farm systems that operate at a reduced stocking rate, with the aim to improve per hectare production through achieving higher production per cow. The emphasis of these farming systems is on improving cow intakes and production and increasing herbage accumulation through the maintenance of pasture conditions with emphasis on pasture quality and higher post grazing residuals. A key issue at the centre of such a grazing system is whether the increase in pasture accumulation will outweigh the decrease in pasture utilisation at the time of grazing, thus increasing overall efficiency. The objectives of this study were to measure the effect of herbage mass present after grazing on subsequent net herbage accumulation rate, and to explain these differences through monitoring changes in sward components, as well as discussing the practical implications of these within a dairy farming system.

Two experiments were conducted on a commercial dairy farm near Dannevirke in 1998, Experiment I over winter (June 19 – August 28) and Experiment II in spring (September 18 – October 28). The farm was situated approximately 300m A.S.L, with the soil type being a combination of an Ashhurst stony silt loam and a Dannevirke silt loam, with high soil fertility levels. Treatments involved a range of post-grazing residuals representing cow intake levels from under fed to ad-lib (900, 1200, 1500, 1800, 2100 kg DM/ha in winter and 1200, 1500 1800 2100 kg DM/ha in spring, Treatments 1-5 and 1-4 respectively). The spring experiment also involved nitrogen treatments at rates of 0, 25 and 50 kg N/ha. Heifers and dry cows were used to graze plots with grazing intensities calculated for stock to reach the targeted residuals in 24 hours (Experiment I) and 8 hours (Experiment II). Experiment I was designed as a randomised complete block design, and Experiment II as a randomised split plot design. Both experiments were replicated three times.

In both experiments a range of post-grazing residuals was achieved (870, 1140, 1394, 1635, 1917 in Experiment I, and 1098 1424, 1704, 1913 in Experiment II). Post-grazing residuals in both experiments were significantly different ($P<0.05$).

A post-grazing residual of 1394 and 1704 kg DM/ha in winter and spring respectively resulted in the greatest net herbage accumulation rates (16.3 and 81.7 kg DM/ha/day) from grazing until a pre-grazing target level of 2600-2700 kg DM/ha was achieved. Net herbage accumulation rates measured in both experiments were higher than those used in practice on the case farm. No statistical differences existed in Experiment I. In Experiment II Treatment 3 (1704 kg DM/ha residual) was significantly ($P<0.05$) higher than the other treatments. The relationship between herbage mass and net herbage accumulation rate showed a positive trend in both experiments. The herbage mass at which pasture accumulation was optimised was greater in spring (2900 kg DM/ha) than winter (2500 kg DM/ha).

In both Experiments tiller density was greater in more intensely grazed swards, and showed a compensation effect with tiller weight. In Experiment I all treatments increased in tiller density with Treatment 1 having a significantly greater ($P<0.05$) increase than the other treatments. In Experiment II tiller density in all swards declined over the entire experiment, being greatest ($P<0.01$) in Treatment 3. Leaf extension rates had a similar trend to tiller weight in Experiment I with the laxer treatments (Treatments 3-5) having a significantly higher ($P<0.01$) extension rate than Treatments 1 and 2. Treatment 3 also had the fastest leaf appearance rate (17.1 days/leaf), although this was only statistically different to Treatment 5. Leaf appearance rates in Experiment II showed no trend, with Treatments 2 and 4 having the fastest appearance rates, and Treatment 3 the slowest. Tiller appearance rates showed some evidence of a trend (although not significant) with more intensely grazed swards tending to have a slightly faster appearance rate compared to more laxly grazed swards.

Tiller weight and leaf extension rate were significantly correlated ($P<0.05$) to net herbage accumulation in winter. In spring all sward components measured were correlated ($P<0.01$) to net herbage accumulation with leaf appearance rate being the most significant ($P<0.001$).

Botanical composition in Experiment I showed that more intensely grazed plots had a greater ($P<0.05$) proportion of leaf, lower proportion of dead material and higher clover content. In Experiment II the trend between variables and grazing level was similar but not significant. The proportion of clover and dead material in spring swards was low (averaging 9.8 and 14.9% respectively) given the herbage mass levels reached. NIR results in general reflected the changes in botanical composition.

It was concluded that there is benefit in the use of sward conditions (targets) in the planning and management of grazing systems in enhancing both pasture and animal performance.

Compensatory effects between sward components resulted in non-significant differences in herbage accumulation rates, and in practice, differences in pasture growth are likely to occur at extreme grazing residuals. Grazing management decisions are therefore more likely to be based on residual dry matter to achieve desired intakes for high per cow production, high pasture utilisation and high pasture quality, rather than to optimise pasture accumulation. It is recommended that residual herbage mass after grazing should be 1200-1300 kg DM/ha and 1500-1600 kg DM/ha in winter and spring respectively. The practical implications of these are discussed.

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1.0 INTRODUCTION

In recent times there has been a tangent in the way of thinking by some dairy farmers and advisers. In the early 1960's it was recognised that dairy production on most farms was limited by pasture utilisation, rather than the amount of pasture grown (McMeekan 1961). Subsequently over the next 10 years stocking rate increased from 2.1 to 2.5 cow/ha between 1981 and 1991 (LIC 1997). This higher stocking rate resulted in a higher proportion of the feed grown being harvested (especially over spring), but lead to cows being underfed (Matthews 1995). However the higher stocking rate in general required that the herd calve later to ensure adequate feed (unless large amount of supplements were used), and also resulted in short lactation lengths due to cows having to be dried off progressively over the summer as pasture growth declined. Thomson & Holmes (1995) stated that the average lactation length of 230 days was 75 short of the potential 305 days. Macdonald & Penno (1998) stated that stocking rate is often cited as the cause for poor per cow production. However the reason that farmers do not achieve a long lactation and high per cow production is due entirely to the lack of pasture quality and quantity relative to stock numbers (Penno et al 1996).

Recent trends see farmers adopting systems that operate at a reduced stocking rate, with the aim to improve per hectare production through achieving higher per cow production targets. This means an increase in the strategic use of supplementary feeding to overcome shortfalls in pasture supply, and grazing management which allows high intake of high quality pasture (Cassells & Matthews 1995; Brander & Matthews 1997).

The overall emphasis of these farming systems is on improving cow intake levels and increasing pasture production through maintaining higher post grazing residuals (and hence higher pasture cover levels) throughout the year. It is proposed that these higher levels of pasture cover will allow improved net herbage production through gaining the optimum balance between leaf senescence and leaf growth (Matthew et al 1995). The common objectives of these farmers were stated by Waugh (1998), and are:

- To maintain emphasis on the efficient utilisation of pasture.
- To overcome the limitations in the underlying pasture supply.
- To develop strategies for the strategic use of supplements to improve farm production and profitability.

Research on the relationship between herbage mass and pasture growth has produced variable results, reflecting both negative (Clark et al 1994) and positive (Brougham 1957; Bluett et al 1998) relationships as well as no relationship. Thus, not surprisingly, it is difficult to draw any firm conclusion of the relationship between herbage mass and pasture growth. Yet the key to these reduced stocking rate farming systems targeting higher per cow production, is that the higher grazing residuals resulting from high pasture allowance to achieve high cow intakes will increase pasture production that will outweigh the reduction in pasture utilisation. Some farmers are budgeting on pasture growth rates increases up to 25% over the winter period through operating at lower stocking rates and higher pasture cover (Matthews pers comm). It is important that farmers have a sound knowledge of the changes occurring to their farm systems through changes in management so that efficient low cost farming can continue.

The experiments presented in this thesis were designed to provide further information on the relationship between herbage mass and pasture growth. With a number of farmers adopting a farming system aimed toward reduced stocking rate and improved per cow production, and with a positive relationship between mass and growth being a key variable in terms of the success of these systems, this research is pertinent to the continued success of efficient dairy production.

This study has been designed to test the hypothesis that higher post-grazing levels (and hence higher pasture cover levels) will result in a positive effect on pasture growth rates over winter and early spring. The objectives of this study are therefore:

- To study the effect of herbage mass present after grazing on subsequent net pasture accumulation rate.
- To take detailed sward measurements to explain the effect of post-grazing herbage mass on pasture accumulation rate.
- To discuss the implications of these results to the management of dairy grazing systems.