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**An Evaluation of a Dairy Systems Study of the
Effects of Contrasting Spring Grazing
Managements on
Pasture and Animal Performance**

A thesis submitted in partial fulfilment
of the requirements for the degree of

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Abstract

Traditionally, the emphasis in dairying systems in New Zealand has been on maintaining pasture quality in late spring through increased grazing pressure and occasionally topping. Recent studies have reported an increase in summer and autumn herbage production by allowing some reproductive development during spring, followed by a period of hard grazing at the time of anthesis when seed heads are immature and still palatable (late control), through effects on tiller population and size. The objectives of this study were to (i) evaluate whether the benefits of late control can be measured within the management constraints of a self-contained spring calving dairy production system, (ii) investigate the conditions under which late control spring grazing management can be implemented, and (iii) investigate the options available for the use of additional feed over spring and summer assuming late control spring grazing management is effective.

A dairying systems study at No 4 Dairy Unit, Massey University was set up in which two 20-paddock perennial ryegrass/white clover dominant farmlets of 45 hectares were each stocked with 120 spring calving Friesian cows in October 1993 and run for three lactations until May 1996. With the exception of spring grazing management and spring supplement feeding the farmlets were balanced.

The first treatment, designated early control (EC), involved strict control of grazing throughout the spring and summer with average pasture cover targeted at approximately 2000 kg DM ha⁻¹ and a post-grazing residual of approximately 1500 kg DM ha⁻¹. Pastures in the second treatment (late control - LC) were allowed to develop some reproductive growth through October and November for removal in December. Average pasture cover target was 2700 kg DM ha⁻¹, with a post-grazing residual of approximately 2000 kg DM ha⁻¹ over spring. Average pasture cover was reduced to 2000 kg DM ha⁻¹ in December by grazing to lower residuals while at the same time removing paddocks from grazing for immediate conservation.

Bayesian smoothing provided an alternative to analysis of variance (ANOVA) for those variables where both treatments and/or all replicates were not measured at the same point in time, and for large data sets and produced mean values close to those that would be produced by conventional analysis methods without the need to group arbitrarily.

The development of a dynamic rising plate meter calibration equation which accounts for seasonal differences in pasture density allowed clearer definition of herbage mass estimates from rising plate meter measurements. Mass per unit height values showed a distinct seasonal pattern reflecting changes in the sward. The bulk density of pasture in the summer was found to be twice that in the winter.

Overall, there was no extended period of difference between early control and late control in either pasture production or animal production during the three years of the trial. However, large differences in animal performance would not be expected considering the marginal differences in pasture production achieved. While treatment differences in average pasture cover and pre- and post-grazing cover were achieved over late spring in all three years, the pasture cover differences required for the late control treatment were not achieved, and as a consequence the response in animal performance was smaller than the results of previous small-plot and paddock-scale experiments suggested.

The results of the trial showed good internal consistency between production components and good control of variability was achieved in this large systems trial, providing an objective basis for evaluation. A number of the variables (clover contents and tiller densities) measured during the trial suggest the potential for contrast in system performance between early control and late control. The ability of the system to buffer changes contributed to the difficulties in achieving treatment specifications. Systems research of this type needs to include tight specifications and control of pre- and post-grazing pasture cover in addition to average pasture cover. More flexibility in stocking rate or use of supplements may be needed to establish spring pasture cover contrasts in future studies.

A whole farm simulation model (UDDER) was used to investigate alternative management strategies for utilising grazed and conserved herbage, after modifications to achieve effective matching between predicted and measured levels of pasture production and animal performance. The level of milk production predicted by UDDER was not achieved in the field over three years using the same inputs, possibly due to the inability of the model to cope with the limitations of colder/wet winters and wetland dairy farming. The adjustments made to the parameters of UDDER were in general successful, allowing daily and annual milksolids production to be modelled. However, herbage intake was insensitive to higher spring pasture covers and resultant increase in allowance. For most of the year UDDER predicted the herbage intake of lactating cows to be at or near their potential.

Early control and late control base models were used to evaluate alternative management strategies for using the extra herbage accumulation generated under the late control management, including feeding conserved forage during summer to lactating cows or during winter to dry cows, stocking rate (2.6, 2.8 and 3.0 cows ha⁻¹) and the level of conservation (none versus increased).

The loss of quality associated with conservation meant that conserving and adding silage back into the system did not increase milksolids production or gross margin, particularly when UDDER predicted that no real feed shortage existed. However, in practice conserving herbage reduces the risk associated with poor growing years. The low stocking rate policy was the best for early control, although the stocking rate policy with 2.8 cows ha⁻¹ and conserved supplements being fed back to lactating cows in summer was similar. The latter policy was the best for late control. At the high stocking rate the flexibility of the system was reduced. In general, milksolids production and gross margin were higher for late control than early control, provided the increase in herbage accumulation rate associated with lax spring grazing management (late control) was factored in.

Since a search of the literature failed to identify a model capable of predicting the response of pastures to late control spring grazing management, an attempt was made to develop a tiller-based model to allow the late control system to be investigated further. The model developed estimates equilibrium tiller density based on size or mass of ryegrass tillers at the environmental ceiling leaf area based on daily levels of photosynthetically active radiation. However, there was insufficient detailed sward data available to provide conclusive evidence for the validity of the tiller model.

Despite the lack of consistent treatment differences obtained from the trial and the difficulties experienced when modelling late control management alternatives, this project has provided a comprehensive data set and considerable insight into the dairy production system. Late control spring grazing management can potentially increase the overall productivity of the seasonal dairying systems of New Zealand. In practical terms the main requirement is for a change in conservation management over the spring period, with no other direct costs involved. However, the timing limitations which are an inevitable consequence of rotational grazing systems restrict the opportunity to impose late control management with the rigorous timing that component research suggests may be necessary. During the course of this trial spring grazing management on dairy farms has tended towards that of late control management, with farmers operating grazing systems with higher average pasture covers through the spring with the aim of improving per hectare production through per cow performance.

Dedicated to my wife, Sharon Bishop-Hurley

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