Feed planning – alternative approaches used by farmers

D.I. GRAY[1], W.J. PARKER[2], E.A. KEMP[1], P.D. KEMP[1], I.M. BROOKES[1], D. HORNE[1], P.R. KENYON[1], C. MATTHEW[1], S.T. MORRIS[1], J.I. REID[1] and I. VALENTINE[1]
[1]*Massey University, PB 11 222, Palmerston North*
[2]*AgResearch, Ruakura Research Centre, PB 3123, Hamilton*
D.I.Gray@massey.ac.nz

Abstract
The effort to promote formal feed planning and monitoring systems in New Zealand has been considerable. Despite this, several studies indicate that relatively few farmers have adopted these systems. Reasons for non-adoption of formal feed planning systems have been identified, but little is known about how farmers manage their pastoral farms in the absence of these systems. To this end, the feed management processes used by three successful farmers (2 dairy, 1 sheep and cattle) were investigated.

Farmers separated the year into distinct planning horizons and alternated between formal and informal feed planning. Formal feed planning was used when critical decisions had to be made, accurate pasture measurement could be undertaken and the level of environmental uncertainty was perceived to be low. Informal feed planning, used at other times of the year, involved farmers accessing, from memory, plans that had worked in the past. These "typical" plans were modified in response to learning. In the face of uncertainty, micro-budgets were prepared at paddock level. Our findings raise the question with respect to planning and monitoring – should we continue to promote formal systems or learn how farmers do this and develop decision support systems in this context?
Keywords: decision making, farmer knowledge, feed budgeting, planning, tactical management

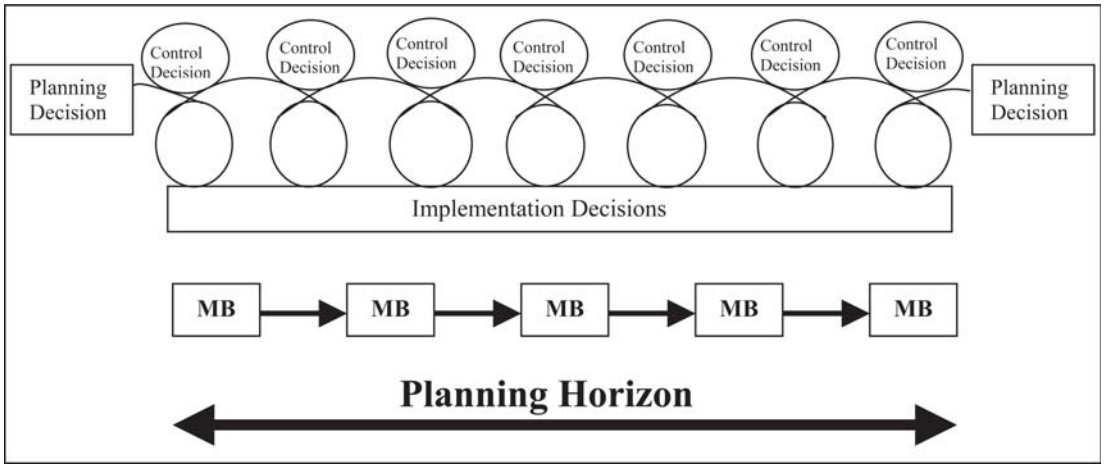
Introduction
Considerable effort has gone into the extension of formal feed planning and monitoring systems to New Zealand pastoral farmers. It has been assumed that extension efforts will enhance managerial ability and thus productivity and profitability. However, several authors (Nuthall 1992, 1996; Parker *et al.* 1993; Nuthall & Bishop-Hurley 1999) have reported that between 60-80% of the pastoral farmers surveyed did not use formal feed planning and/or monitoring methods. Important questions arise from this. For example, (1) why, despite the large extension effort, are so few farmers using formal feed planning and monitoring systems, and (2) what alternative procedures are they using?

There is some empirical evidence about why farmers do not adopt formal feed planning procedures. Nuthall & Bishop-Hurley (1999) identified, in order of importance, time and resource requirements, difficulty in predicting weather, and inaccuracy associated with estimating dry matter yield of pasture and forage crops as the main reasons. Some 60% of farmers did not perceive feed budgeting to be beneficial, while the level of uncertainty about future pasture growth rates (10%) and lack of knowledge (10%) were other reasons given for not undertaking feed budgeting. In contrast, the main benefits associated with feed budgeting were from efficiency improvements (24%), determining when to make critical feeding decisions (31%), prediction of feed surpluses and deficits (18%), and the provision of a sense of security (11%). Nuthall & Bishop-Hurley (1999) shed less light on the procedures farmers prefer to use. Here we report on a study of the decision-making processes used by three high performing farmers, one sheep and cattle and two dairy farmers, that provides further insight on this matter.

Method and materials
A multiple-case study design (Yin 1993) was used to investigate the tactical feed management processes used by three "*expert*" pastoral-based farmers. Cases were selected on their high levels of performance for the district and expertise in tactical feed management. Data collection was primarily through semi-structured interviews supported by field observations and the collection of relevant secondary data (Gray 2001). Interview and collected data (monthly) were transcribed verbatim to minimise bias (Denzin 1989). Data were analysed using qualitative techniques (Dey 1993; Miles & Huberman 1994) and the computer programme NVivo (Richards 1999). Models of the farmers' decision-making processes were derived from the data, verified with the farmers and compared with the literature.

Results and discussion
Approaches
The feed management process used by the farmers

Figure 1 Representation of the feed management process used by the farmers.



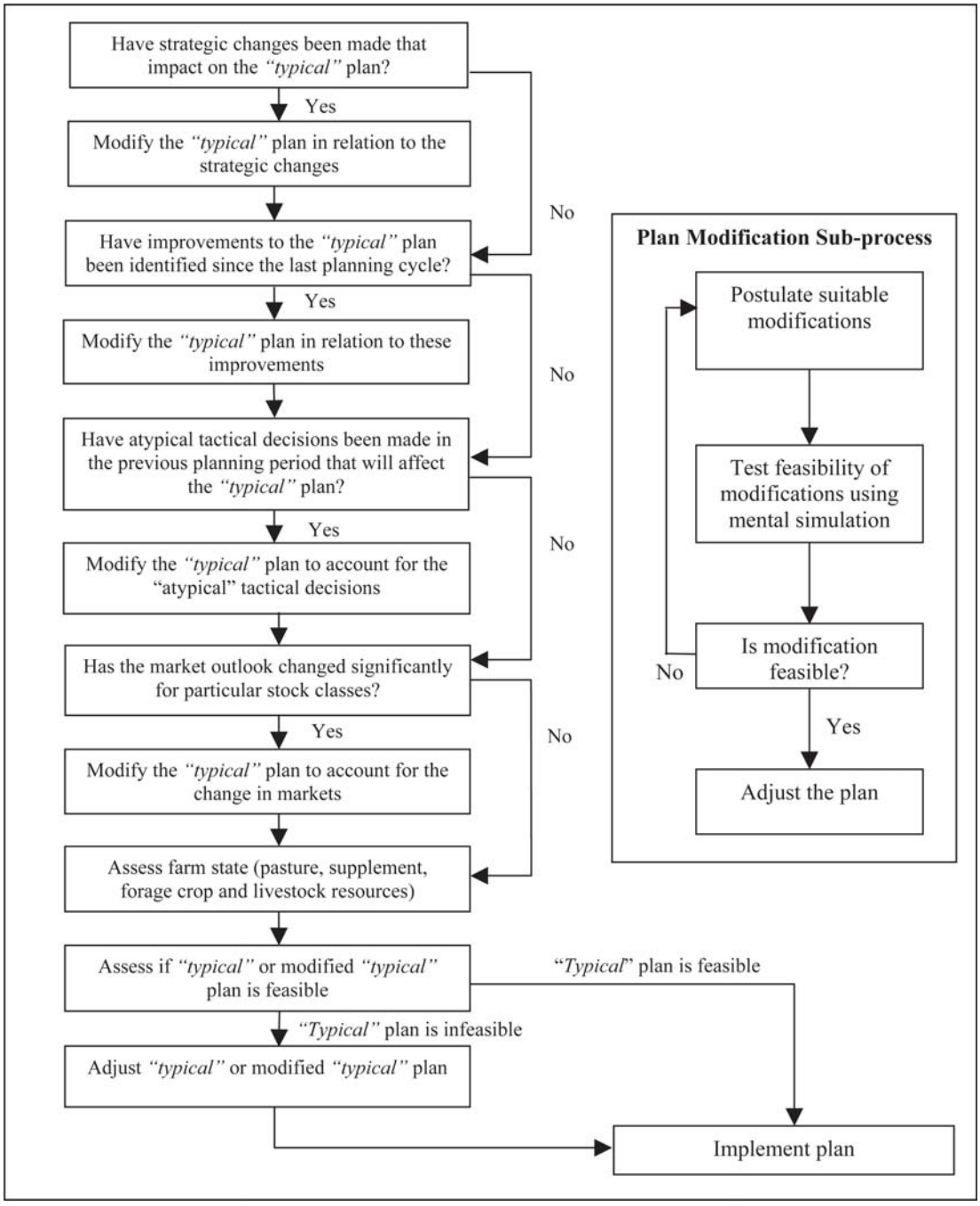
can be represented as a cyclical process (Figure 1) of planning, implementation and control (Boehlje & Eidman, 1984). Planning decisions to determine the nature of their plan for a specific planning horizon or period were made by the farmers just prior to the start of the planning period. In essence the farmers develop a plan, initiate it and then use control decisions or "*regulations*" (Aubry *et al.* 1998) to manage deviations from the plan due to variations in the environment. If the farmers were using an informal planning approach, they also used micro-budgets (MB) (Figure 1) to identify short-term feed deficits or surpluses every 2 – 4 weeks. This is similar to rolling planning (Hanf & Schiefer 1983).

For planning purposes, the farmers separated the year into several periods. For the dairy farmers these were from late-December until mid-March when the autumn rains arrived, mid-March to calving or balance date and from calving or balance date until late December. Balance date is the point in time during the spring when pasture growth rates equal feed demand. After this point, a farm moves into a feed surplus situation. Corresponding planning periods for the sheep and cattle farmer were from set stocking to weaning, weaning to flushing, flushing to the start of winter, and start of winter to set stocking. These planning horizons primarily reflect seasonal changes in the physiological state of the pastures, the balance between pasture growth and feed demand, and the goals and tasks associated with these changes. Proximity to critical events such as tupping or drying off also influenced the farmers' choice of planning horizon.

Farmers alternated between using formal feed budgets and more informal approaches to plan. Other researchers (Parker *et al.* 1993; Nuthall 1996; Nuthall & Bishop-Hurley 1999) have not explored the reasons underlying the transition from one approach to the other. The farmers' transition from informal to formal feed planning was initiated by the interval to a critical event or decision. The dairy farmers used a feed budget to determine the critical decision point, i.e., the drying off date that would ensure the herd calved in good condition and with adequate feed. The approach of a critical event, flushing, triggered the sheep and cattle farmer to use a feed budget to test the feasibility of his plan for the coming year, and in particular his ability to feed stock through the winter and early spring. These results, particularly given the importance the farmers placed on the drying off or wintering decisions, support Wright's (1985) argument that the perceived net benefits from planning determine the effort farmers put into it. Like the farmers in Nuthall & Bishop-Hurley's (1999) survey, these farmers saw the benefits from feed budgeting for identifying when to time critical feeding decisions (e.g., drying off) and/or predicting feed deficits or surpluses.

The dairy farmers did not undertake formal feed budgeting until March because they believed summer sward conditions precluded accurate measurement of pasture cover with a rising plate meter. Farmers in Nuthall & Bishop-Hurley's (1999) survey gave the same response. However, this was not an issue with the sheep and cattle farmer because he did not measure pasture cover objectively and instead used visual assessment. During spring and summer, insufficient benefit was perceived to be realised from formal planning relative to what the farmers currently did, particularly given the high level of uncertainty in relation to pasture growth rates over these periods. Some 60% of the farmers in

Figure 2 The informal planning process used by the farmers.



Nuthall & Bishop-Hurley's (1999) survey also believed that the benefits derived from formal feed budgeting were insufficient to justify its adoption. Rather, formal planning and its associated pasture measurements incurred additional time costs. The adoption of informal planning during spring and summer supports Wright's (1985) contention, verified by Nuthall & Bishop-Hurley (1999), that informality increases with uncertainty.

Informal planning process

At its simplest level, the informal process used by the

farmers was to recall a successful plan from the past. This largely sub-conscious approach required much less cognitive effort than more formal planning (Gladwin & Murtaugh 1980). Predefined or *"typical"* plans were used except when circumstances forced the farmers out of "*plan mode*" and into "*decision mode*" to choose between plans (Figure 2). A broadly defined set of farm state conditions was required at the start of the planning period for the *"typical"* plan to be feasible. If conditions were outside this range, the plan was modified. Although several studies (Cerf *et al.* 1993; Fleury *et al.* 1996) mention that farmers use *"typical"* plans, only Aubry *et al.* (1998) reported that such plans are modified in response to specific circumstances. The farmers also modified their *"typical"* plan in response to prior learning, previously made strategic and tactical decisions, and significant changes in the market (Figure 2). Although implicit in the hierarchical nature of plans (Wright 1985), no mention is made of the influence of strategic decisions on farmers' *"typical"* plans in the farm management literature. However, Aubry *et al*. (1998) mentioned learning. Similarly, there is no reference to the influence of tactical decisions made in the previous planning period or changes in market conditions on the structure of the *"typical"* plan.

To modify a plan, farmers postulated the nature of the change required and then tested its feasibility (Figure 2). At its simplest, this required the modification of some simple heuristics (rules of thumb) in the plan, e.g., the substitution of one type of supplement (grass silage) to make up for the loss of another (forage crop). More complex changes (e.g., the introduction of maize silage or adjustments to cope with an extreme drought) usually took several iterations of adjustments and the associated use of mental feed budgeting to quantify the impact of the change.

The plan

The "*typical*" plans used by the farmers contained six important components: a planning horizon, the goals for the planning horizon, a predictive schedule of activities designed to achieve the goals, a set of targets for controlling the implementation of the plan or the introduction of contingencies, contingency plans that can be implemented if a deviation from the plan occurs, and a set of decision rules that were used in conjunction with the targets to implement the plan, or if required, the various contingency plans (Figure 3). This structure is similar to those reported from other studies (Fleury *et al.* 1996; Aubry *et al.* 1998). A set of heuristics or rules of thumb similar to those identified by Aubry *et al.* (1998) made explicit the important planning decisions to be taken including:

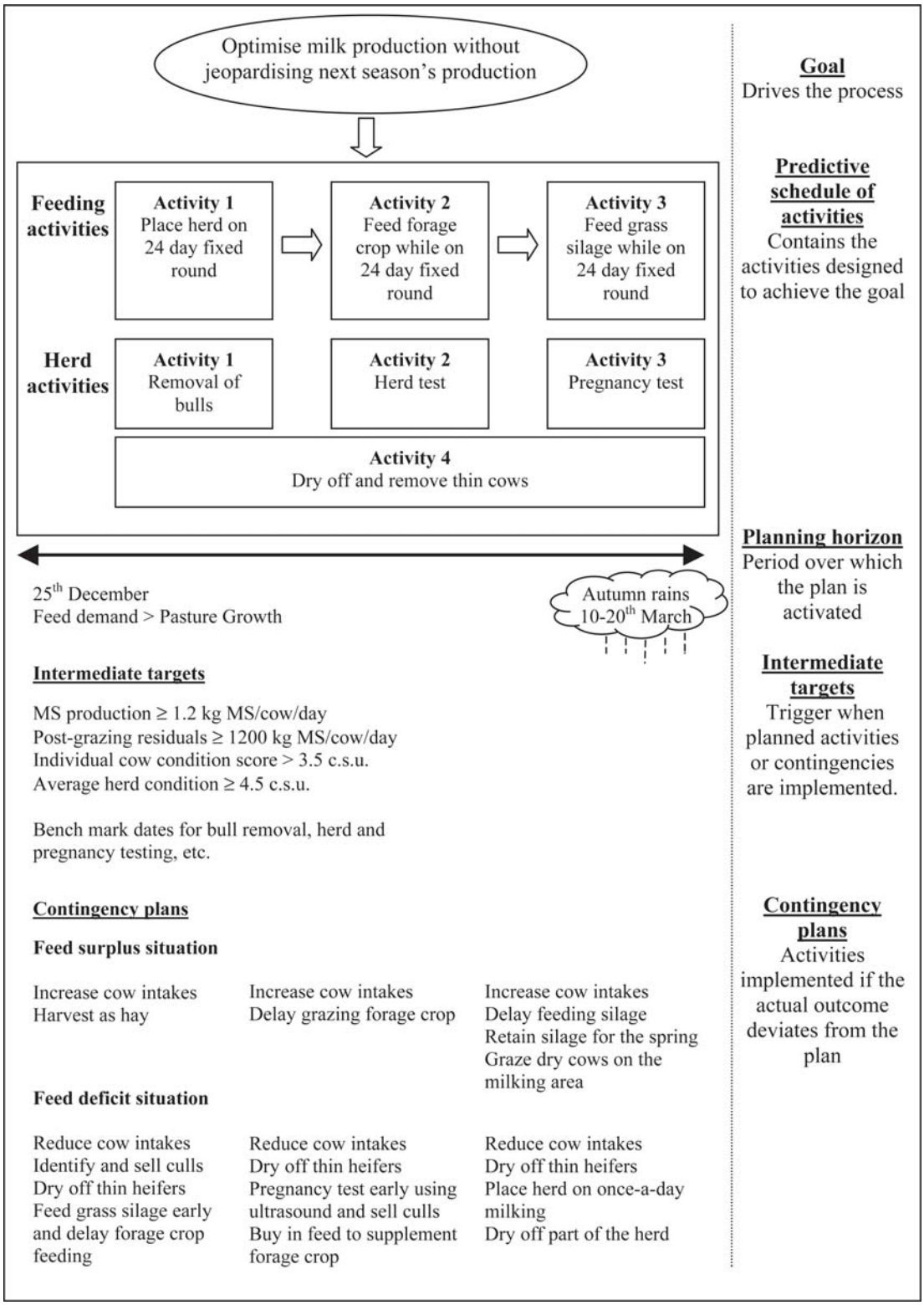
1. What activities should be included in the plan?
2. How should the activities be sequenced?
3. When should an activity be activated and terminated?
4. What inputs, or combination of inputs should be used?
5. What level of inputs should be used?
6. What should be given priority in terms of resource use?
7. What targets should be set to control the implementation of the plan?

The choice of planning heuristics determine the plan's structure, and these cognitive or mental processes are central to planning (Wright 1985). The choice of planning heuristics and organisation is therefore a critical event in the planning. Priority of resource use within the farmers' plans was based on the criteria of "*impact on final yield*" (Aubry *et al.* 1998). The impact of a planning decision on the current, as well as next season's production, where this had priority, was taken into consideration. Concern for longer-term productivity was also reported by Buxton & Stafford Smith (1996).

Micro-budgets

Once an overall plan for a period had been developed, what we term "*micro-budgets*" were used to control the implementation of the plan in the face of uncertainty. These micro-budgets operated at a paddock rather than the whole-farm level. For example, during summer, each time the dairy farmers shifted the herd, they estimated the post-grazing residual. They then estimated, given their knowledge of current and future climatic conditions, how much pasture would grow between now and when the herd returned to the paddock in 3 – 4 weeks time. From this they estimated the proportion of the herd's diet that the paddock was likely to supply at the next grazing. This gave them 3 – 4 weeks warning of an impending feed deficit and allowed them considerable time to evaluate alternative options. As this process was repeated every day, the farm's future feed position was being continually updated. The sheep farmer used a similar process over spring when his sheep were set stocked. Pasture cover in each paddock was recorded fortnightly in the sheep block, along with the degree of seed head development. Feed demand for the number of sheep and cattle in each paddock for the next 2 weeks was estimated and compared

Figure 3 A diagramatic representation of a farmer's plan.



with expected pasture growth for that paddock. The size of the feed deficit or surplus over the next 2 weeks was derived. Cattle per paddock were then adjusted to ensure ewes were fed to appetite or to ensure pasture quality was maintained.

These micro-budgeting processes are similar to a rolling planning process (Hanf & Schiefer 1983). They are much simpler and faster than undertaking a whole-farm feed budget, particularly in the case of the dairy farmers. The farmers' micro-budgeting processes are similar to the process captured in QuickFeed (Woodward *et al*. 2000). However the focus of QuickFeed is to determine if stock will be fed to requirements in a specific paddock, whereas the sheep farmer uses his approach to identify potential feed surpluses and deficits across his entire sheep block. The dairy farmers' micro-budgets forecast the amount of feed available to the herd in a paddock in 3 – 4 weeks time, whereas QuickFeed analyses feeding levels for a paddock to be grazed in the immediate future. Relatively simple modifications could be made to QuickFeed to allow it to undertake the same processes as used by the farmers.

Conclusions

Pasture management expertise is integral to successful livestock farming in New Zealand. Despite this, understanding of how farmers plan and control grazing decisions remains limited. Here we have provided some insight into how some farmers manage effectively without formal feed budgeting. Extrapolation of these results from "experts" to the wider farming community must be taken with some care. Nevertheless, the results suggest that rather than continue to unquestioningly promote the adoption of formal feed planning, researchers, extension agents and consultants need to look at how farmers currently manage their feed, and at their requirements for simple, low cost (time and capital) management tools. The expert farmers in this study were found to manage their feed by a combination of formal and informal planning with an emphasis on micro-budgets. Improvements in feed planning by farmers are more likely to come from better advice and support tools that enable farmers to quickly monitor feed supply and make decisions, than from encouraging farmers to regularly use formal feed budgeting.

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