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MANAGEMENT OF GRAZING SYSTEMS

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Abstract

Recent assessments of the relative importance of stocking rate. stocking policy and grazing management on the output from pastoral systems are used as a starting point to argue the need for objective pasture assessments to aid control of livestock enterprises to meet production targets. Variations in stocking rates, stocking policy and other management practices all provide alternative means of control of pasture conditions which are the major determinants of pasture and animal performance. Understanding of the influence of pasture conditions on systems performance should provide a better basis for management control and for Communication between farmers, extension officers and researchers.

Keywords: Stocking rate, pasture condition, pasture cover

INTRODUCTION

The importance of control of pasture quality and quantity in maintaining productive performance and stability in grazing systems has often been emphasised (e.g. Bryant 8 Sheath 1987). This becomes more critical with increases in the intensity of farming or in the variability of pasture production (Sheath et *al.* 1987). The objective in this paper is to consider briefly the inter-relationships between the factors influencing pasture production and demand, and their use as management tools in grazing systems.

MANAGEMENT STRATEGY

Management strategy in pastoral systems can be outlined as shown in Fig. 1, where planning and management decisions are made in relation to a defined production objective and are modified in response to monitoring of system performance (Milligan et *al.* 1987). A distinction is drawn here between planning and management decisions in terms of their flexibility and the ability of the farmer to make adjustments in response to changing conditions. Management options are determined partly by initial planning decisions, and partly as a response to feedback from monitoring programmes. Some options (e.g. decisions on purchase or sale of animals, use of conservation) may be part of both initial planning and management responses.

Sheath et al. (1987) identified five major rules of management: the need to match pasture supply and demand as far as possible; to maintain desirable pasture compostion, pasture density and pasture quality; and to be flexible in management. The main management tools available to meet these management requirements (Bryant 8 Sheath 1987) are choice of stocking rate, stocking policy (class of stock, timing of lambing or calving, timing of purchase or sale) and grazing management (defined by the authors as methods of grazing used to control rate of feed use, severity and frequency of grazing). Stocking rate and stocking policy influence the level and seasonality of feed demand respectively, whereas grazing management may influence seasonality of both feed production and use. To these tools should be added choice of plant species or cultivar, and fertiliser policy, which influence total or seasonal feed production (Korte et a/. 1987; Milligan et *a/.* 1987), and conservation policy which influences seasonality of use. The choices made within

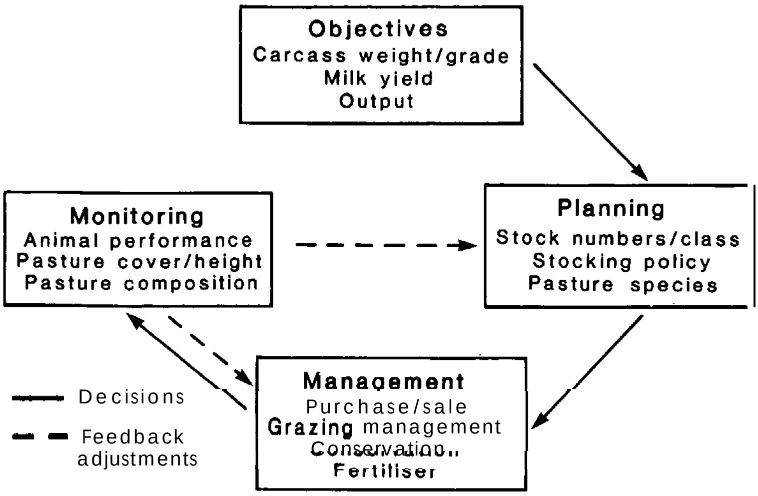


Figure 1: Management strategy in pastoral systems.

this array of management options influence the balance between pasture supply and demand both in total and seasonally, and exert a substantial influence upon the output of animal products from a grazing system.

Bryant & Sheath (1987) suggest that control of stocking rate and stocking policy accounts for a major part of the increase in output from New Zealand farms over the last 35 years, whereas grazing method as defined above has had an influence only at the level of fine tuning. However, the relative importance of these management controls is likely to be influenced by particular farm circumstances. Thus, substantial variations in grazing management may have little influence on animal output where pasture production exceeds demand, but even minor management adjustments can have a substantial influence where the balance between pasture supply and demand is precarious (Bircham 1984). Furthermore, rates of net pasture production may be affected to only a limited extent by variations in grazing management (Parsons *et al.* 1988) or stocking rate (Campbell 1966), but pasture control can clearly have effects upon seasonal variations in botanical compostition (Hay 8 Baxter 1984), pasture quality (Butler & Chu 1988) and feed flow (Sheath et al 1987).

Thus, all of the management tools outlined above are of potential importance in considering system adjustments on either a long-term or short-term basis in order to maintain the viability of a grazing enterprise. Sensitivity in managing the balance between feed supply and demand, and especially in anticipating the need for adjustment, is then heavily dependent upon an adequate pasture monitoring programme (Milligan et a/. 1987). This in turn requires a proper understanding of the influence of pasture conditions on both animal and pasture performance so that management responses can be as objective as possible. Good grassland managers probably make subjective assessments automatically and accurately, but one of the real problems of pasture evaluation is that, without qualification, it is very difficult to use this accumulated experience either to help inexperienced people to improve their management efficiency or to provide a firm basis for linking research and practice.

PASTURE CONDITION

Evidence is now abundant that rates of net herbage production in ryegrass-based temperate pastures are relatively insensitive to substantial ranges of variation in pasture condition or grazing management (Korte et *al* 1987; Parsons *et* al. 1988; see Fig. 2). Pasture growth rates are maintained by compensating variations in the populations of units of growth (grass tillers or clover nodes) and in size and production per unit (Bircham & Hodgson 1983). However, compensation may break down at low levels of tiller population density (L'Hullier 1987), and particularly severe grazing may result in a depression in both tiller population and production (Bircham 8 Hodgson 1983). Low levels of herbage utilisation result in excessive senescence losses, a rapid decline in tiller populations and, eventually, a fall in the productive potential of the pasture.

Figure 2: The influence of sward surface height on rates of pasture growth, senescence and net pro duction under continuous stocking management with sheep: perennial ryegrass/white clover pastures in the UK receiving 123 kg N/ha (From Bircham 8 Hodgson 1983).

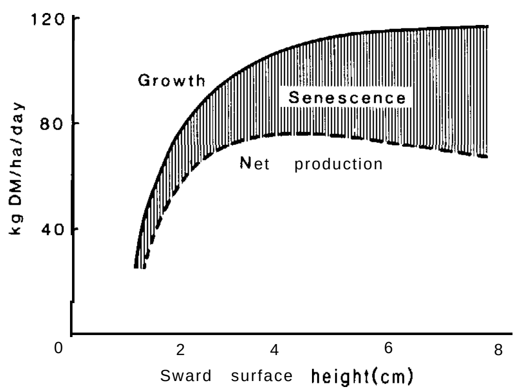
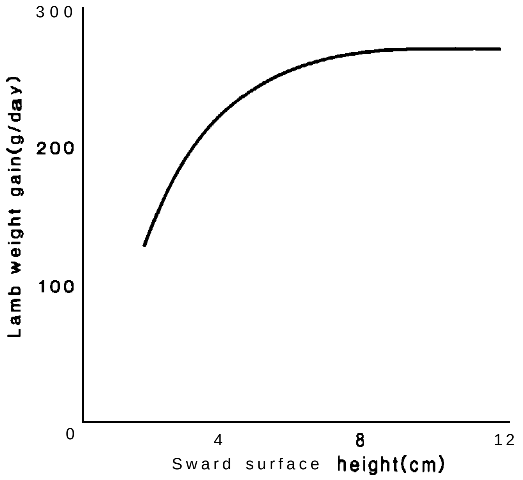


Figure 3: The influence of sward surface height on animal performance: twin lambs suckling cross-bred ewes on perennial ryegrass/white clover pasture in the UK (From Hodgson *et al.* 1986).



The limits to these adjustments, which are conventionally described as "over-utilisation" and "under-utilisation", could be defined more objectively in terms of tiller and node populations, or leaf area and mass (Bircham 8 Hodgson 1983;

Parsons et a/. 1988). Experimental evidence is now available to help to describe these limits for ryegrass-based pastures, and to relate them to simple pasture measurements in a way which will provide guidance for management decisions (Hodgson et a/. 1985). Little information is available for other pasture species, however, though it is clear that many of these have a much narrower range of tolerance to mangement variation than does perennial ryegrass (e.g. Black & Chu 1989).

Herbage intake and animal performance are much more sensitive than pasture production to variation in pasture conditions (Hodgson et a/. 1986; Fig. 3). This means that, within the limits of flexibility of pasture production already defined, management can be planned primarily to meet specified targets of animal performance (Hodgson et *al.* 1986). Patterns of animal response to variables like sward height (Hodgson 1985) and herbage mass (Rattray et a/. 1987) are well defined for sheep and cattle, but there is as yet little information for deer or goats (Nicol 1987).

PASTURE MONITORING

Herbage allowance (Rattray et al. 1987), pasture cover (Milligan et a/. 1987) and sward height (Hodgson et a/. 1986) have all been used with various degrees of success as predictors of either pasture or animal performance. Pasture cover has the additional advantage of providing the basis for assessment of current feed supplies and for feed budgeting (Milligan et *al.* 1987), and is a necessary preliminary to the definition of herbage allowance. Herbage allowance is more appropriate for predicting animal performance than pasture performance, and is best qualified for variations in pasture cover either before or after grazing (Rattray et al. 1987).

The effectiveness of all three predictors is limited by variations in the relative proportions of live and dead material, and of leaf and reproductive stem in the pasture. Thus, predictions of animal performance are better when allowance is expressed in terms of green rather than total herbage dry matter, and better still when expressed in terms of live leaf (Butler et *a/.* 1987). A direct measure of leaf mass in the pasture probably would be a better predictor of both pasture and animal performance than any of the current assessment procedures (Hodgson 1985; Milligan et a/. 1987; Parsons 8 Penning 1988). There are no easy procedures for making this measurement reliably, but simple measurements of sward height or pasture cover can provide reasonable estimates of both leaf mass and tiller population density under controlled management conditions (Bircham 1981).

The conventional estimates of pasture cover, herbage allowance and sward height all work best when applied within pastures, seasons or grazing managements, when variations in leaf/stem and live/dead ratios are minimised. For example, under continuous stocking management in the UK, sward surface height has given repeatable predictions of both pasture production and animal performance responses (Bircham & Hodgson 1983; Hodgson & Maxwell 1984). In

Table 1: Stability of lamb performance in grazing systems held to similar sward height (from Maxwell & Treacher 1987)

Stocking rate (ewes/ha)	20		12	
Nitrogen use (kg N/ha)	200	100	200	100
Lamb:ewe ratio	1.20	1.20	1.20	1.20
Lamb weaning wt (kg)	29.3	28.8	29.6	29.5
Lamb weaned per ha (kg)	705	666	420	429
Proportion area conserved	0.19	Nil	0.50	0.40

these conditions, control of sward height appears to give remarkably precise control of individual animal performance at widely different stocking rates and levels of fertiliser N (Maxwell & Treacher 1987; Table 1).

APPLICATION

The ability to predict plant and animal performance from assessment of pasture conditions provides both the opportunity to set pasture targets appropriate to specified levels of system performance, and an objective basis for controlling the balance between feed supply and demand in order to meet these targets (Hodgson et al. 1986; Milligan et a/. 1987). Though this is now possible for ryegrass-based Pastures, more information is needed to define acceptable limits of tolerance in alternative plant species. In achieving these controls the array of management tools available, involving choice of plant material and fertiliser use, stocking rate and stocking policy, and detailed manipulation of grazing and conservation management, all have their part to play.

The definition of objective pasture criteria does not guarantee management success, but it provides a much firmer basis upon which to plan and monitor grazing systems, and against which to assess management adjustments, than is possible with more subjective pasture assessments. Of the alternative criteria available, measurement of pasture height is the simplest and probably gives the best prediction of both pasture and animal performance within defined management systems, but it does not provide an appropriate basis for feed budgeting unless it is also used to estimate pasture cover. There is a need for further development work on simple pasture measurement devices. However, in the search for greater control and predicatability in grazing systems there is scope for wider use of the monitoring systems which are currently available.

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