Grazing management and pasture innovations: what's best for your farming system?

K. Behrendt [AB]

[A] Agrorum Consulting, PO Box 2086, Bathurst NSW 2795
[B] PhD Candidate (Sheep CRC), School of Economics & School of Rural Science and Agriculture, University of New England, Armidale NSW 2351

Abstract. Increasing and maintaining higher levels of productivity from our pastures which are being utilised in the most profitable way is still and will continue to be one of the highest priorities of producers involved in extensive large animal production. There is a broad range of technologies and strategies available to change the composition of pastures and the whole farms pasture base in an attempt to increase long term production and profit. But identifying the optimal farm development path over the long term is difficult given the complexity of the farming system within a multidimensional landscape. The impact of labour constraints and costs, the degree of capital invested and the timing, riskiness and persistency of returns are critical to the economic efficiency of a technology, as is its interaction with current and future pasture and livestock production, and the long term environmental impacts.

The optimal grazing management system or *rotation intensity* would be expected to balance botanical stability and animal production while not being onerous in the need for additional labour or capital. The broad array of investment alternatives for the development of the farm, such as grazing management, pasture improvement or increasing soil fertility, that may be adopted demands a strong need for managers to improve their knowledge of how the different options interact to determine not only pasture, livestock and economic outcomes, but also environmental. The optimal development path for each individual property and business will vary depending on the inherent landscape of the property, the state of the current pasture base and infrastructure, the livestock enterprises operating, the level of capital and/or labour constraints, and the risk adversity of the business managers.

Introduction

There is nothing new about many of the external pressures experienced by producers. Declining terms of trade, recent extreme climatic variations, tangible differences between the prices of substitutable products, as well as a greater realisation of environmental and catchment responsibilities over the past two decades.

In combination they are sending signals to producers to increase productivity, reduce their cost of production, and improve profitability within environmental and sustainability constraints. Increasing and maintaining higher levels of productivity from our pastures which are being utilised in the most profitable way is still and will continue to be one of the highest priorities of producers involved in extensive large animal production.

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Interactions between the rate of response to inputs, the cost of inputs and capital, and the value of livestock products determine the economic attractiveness of the different pasture improvement options and their rate of implementation (Behrendt 2005). If production and profit is the primary focus for a paddock, area of the farm or the whole farm, then the decision of adopting grazing management or other pasture improvement innovations need to be based on how efficiently these tools can be used to develop and sustain a more desirable species mix.

The most desirable species mix, in this instance is defined as the species mix that optimises long term livestock production, business profit and the sustainability of the grazing system. The most desirable species mix will vary depending on the livestock production system and the landscape which the producer operates within (Wilśon and Simpson 1994).

Grazing Management

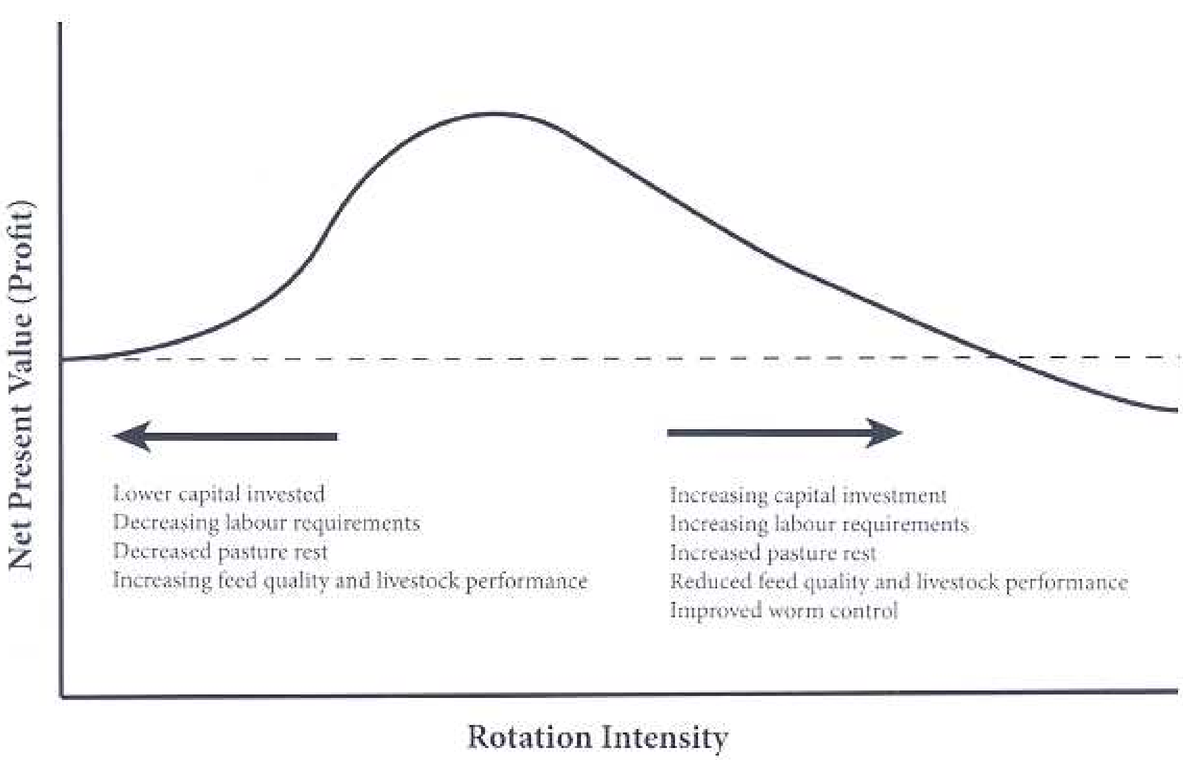
In the simplest of terms, grazing management involves the movement of animals to vary the timing, period, frequency and intensity of grazing and in a broader sense must take into account the interactions between livestock enterprise type and management (Beattie 1994; Lodge 1995). But in a grazing based business were the objective is to maintain long term viability, the assessment of grazing management technology needs to also consider interactions with the benefits and costs to the business at a whole farm level.

The impact of labour constraints and costs, the degree of capital invested and the timing, riskiness and persistency of returns are critical to the economic efficiency of such a technology, as is its interaction with current and future pasture and livestock production, and the long term environmental impacts (Jones and Dowling 2004b). With the real cost of farm labour continually rising since the 1960's at around 2.6% per annum and already representing the largest single area of expenditure in any grazing enterprise, the effective cost of labour and its efficiency in increasing the levels of production will become increasingly important (Behrendt, 2002).

Identifying the optimal grazing management system within a season or over the longer term is complex due to the large number of interactions and their long term dynamics. Hypothetically though, it is feasible to consider grazing management in terms of rotation intensity (Figure 1) where long term livestock production and business profit is the primary objective. Figure 1 is presented to only highlight and raise discussion for the need to balance the grazing system between botanical stability, minimising environmental impacts, livestock production and long term business profitability.

In this case the term *Rotation Intensity* is being used to loosely define the degree of subdivision and potential length of pasture rest being achieved, and hence also the impact on the pastures composition and quality for livestock production. For example,

Figure 1. Theoretical relationship between rotation intensity and net present value



a grazing management system with a high Rotation Intensity is based on a paddock number to mob number ratio of 30:1 with long pasture rests of 60-100 days, while a low rotation intensity is a system based on a paddock to mob number ratio of 1:1 (set stocking) or 2:1 with very little opportunity for pasture rest (0-20 days).

At the lower end of the rotation intensity spectrum, pasture composition will tend to move towards one with a higher proportion of annual grass and broadleaf species due to a reduction in the stability and persistence of most perennial species, as has been evident throughout many regions of New South Wales (Dellow, Wilson *et al.* 2002). Although this level of management requires the lowest levels of inputs in terms of labour and capital, maintains adequate levels of pasture quality throughout the growing season with an enormous potential for livestock to selectively graze and achieve higher levels of production, it does present a more unsustainable pasture state were resowing of desirable introduced perennials is likely to be required or desirable native perennials diminish in the contribution to pasture production.

At the higher end of the rotation intensity spectrum, pasture composition tends to move towards one with greater diversity, with a greater proportion of species within the pasture sward less responsive to grazing and fertiliser inputs (Scott, Mulcahy *et al.* 2005). There is also evidence indicating improved round worm control of some species with longer rest periods from grazing (Healey *et al.* 2005). Maintaining high levels of biodiversity within pasture systems where sustainable production and profits are to be maximised, is unlikely to play a critical role. Rather as biodiversity increases from a single species population, it would be expected that there be a trade off between higher levels of production and profit (depending on the appropriateness of the species to the environment), and the variation in production, profit and the stability of the grazing system.

The complicating results of such a system on whole farm profit are that the ensuing lower levels of pasture quality and subsequent livestock production, higher labour and capital requirements can potentially reduce long term profit below what can be achieved through set stocking (zero rotation intensity) and less persistent pasture states with a greater environmental impact.

The region of optimality would be expected to balance botanical stability and animal production while not being onerous in the need for additional labour or capital.

The most productive species mix would minimise erosion, improve water quality, nutrient cycling and have the potential to provide high quality feed over an extended growing season to enable higher livestock production.

The key will be to use grazing management to maintain a balance between providing sufficient grazing rest to enable pasture persistency and higher levels of production, and applying sufficient grazing pressure to maintain pastures in a state of high enough quality. The strategic resting of pastures from grazing and maintaining adequate soil fertility levels have the potential to maintain pastures within a desirable range of species composition.

Other Pasture Innovations

Grazing management is just one strategy in a suite of options available to increase long term profit. Although there is large amounts of evidence available to suggest using tactical grazing management to improve pasture persistency and the economics of the grazing system (Jones and Dowling 2004a; Scott, Lodge *et al.* 2000; Vere, Jones *et al.* 2001), there is also sufficient evidence to suggest that the sowing of improved perennial pastures is still profitable even with continuing declines in the terms of trade (Stevens, Gibson *et al.* 2000; Vere, Jones *et al.* 2001).

The success and profitability of pasture improvement is not only influenced by the risk of the pasture germinating and establishing, but also driven by the persistency of the pasture and its utilisation by livestock enterprises to increase whole farm production and profit over the long term. Utilisation of pastures is largely driven by stocking rate and the management structure of the grazing enterprise. The interaction between enterprise type and its management, which is an integral part of the complex grazing system, also influences the expected returns from investing in a range of pasture improvement strategies, be it sowing new species, increasing soil fertility or grazing management.

Some recent modelling has found that much higher rates of pasture improvement are optimal for risk indifferent producers than what currently occurs in industry (Behrendt 2005). The optimal rate of improvement does depend on the environment in which the pastures are being sown, the state of the current pasture base and the ability of the producer to fully utilise sown pastures by sustainably doubling or tripling their stocking rates above that of what they achieve on their base pastures. Rates of pasture improvement significantly higher than the estimated rates of pasture resowing in high rainfall zones of less than 2% per annum (Ward & Quigley 1992) were found to be economically feasible.

There is also the option of implementing a fertiliser strategy to induce a change in the composition and productivity of the pasture base. Large amounts of evidence exist to show the positive economic benefits from investing in improved soil fertility (Chapman, McCaskill *et al.* 2003; Scott and Cacho 2000; Trompf 2002). The success of investing in a fertiliser strategy is well known to depend on the rate of utilisation as pastures increase in their productivity, the ability of the base pasture to respond to increased fertiliser inputs, the responsiveness of the livestock enterprises to changes in the quality and quantity of available pasture, and the effect climate has on the rate of response to improved soil fertility.

Table 1 shows the aggregated results from 6 Triple P groups located through out the central and southern tablelands of NSW. It demonstrates that the establishment of high input pasture systems based on existing pastures, which included a mix of naturalised and introduced pastures and a broad range of livestock enterprises, had large variations in the response over the last 3 years of drought. The economic analysis has been calculated using average prices from 1999 to 2004 and the high input paddocks development is accelerated to reach target soil nutrient levels within 2 years.

The high input (productivity) paddocks with the highest responses during 2002 were paddocks that were set up in 2001 (pre-drought). Most of the gains in 2002 were made by participants utilising there current feed resources. During 2002 the quantity of feed grown rarely increased but major differences in quality were identified at many trial sites.

During the 2003 growing season all but one trial site achieved large increases in profitability with most recouping the losses from the drought year. The flow on effects in the high input paddocks significantly increased stocking rate and per head production when compared to the control paddocks which were still largely suffering from the drought. During 2004, the profitability of the high input systems was driven largely by enterprise type, with sheep meat producing enterprises all being capable of generating profits well in excess of the control paddocks.

On average, productivity paddocks were grazed longer than control paddocks and experienced more rapid post drought responses in both naturalised and introduced perennial pastures. The profitability of investing in increased soil fertility is high and the risk is low given the longer term implications on productivity and pasture persistence. Such factors need to be considered when identifying the optimal allocation of funds.

Optimal development paths

Achieving the optimal mix of investment in developing the farm is becoming increasingly important. The optimal development path for each individual property and business will vary depending on the inherent landscape of the property, the state of the current pasture base and infrastructure, the livestock enterprises operating, the level of capital and/or labour constraints, and the risk adversity of the business managers.

Table 1. Aggregated Triple P data from the central tablelands of NSW *

	2002	2003	2004
% Increase in Stocking rate of Productivity v Control paddocks	20% (0% to 88%)	43% (0% to 72%)	35% (0% to 134%)
$ Return per $ invested	$0.97 (-$0.92 to $2.92)	$2.00 ($0.54 to $3.78)	-$0.02 (-$5.98 to $2.41)
% Increase in Profit of Productivity v Control paddocks	2%(-24% to 30%)	26% (-9% to 50%)	7% (-111% to 171%)

*Mean with range in parenthesis

Since the post world war II pasture improvement and fertiliser boom, continuing declining terms of trade has been found to increasingly influence the adoption of pasture improvement (Vere and Muir 1986) and has encouraged producers to search for alternative strategies and technologies to increase profitability. A broad array of investment alternatives for the development of the farm are being adopted and there is a strong need for managers to improve their knowledge of how the different options for development interact to determine not only pasture, livestock and economic outcomes, but also the long term environmental impacts.

Given that hopefully most graziers are now entering a post drought period, during which many pastures have degraded and farm debt levels have increased, there is an overwhelming need for prudent capital investment to ensure the long term profitability and viability of many farming businesses. In stating the obvious, the largest and most rapid responses to invested capital will be required to achieve the viability objectives of many graziers and for most an investment in learning how to assess investment alternatives and improve decision making will be more important than the need for learning how to use the latest widgets.

In reality, most farming businesses will benefit from undertaking more than one option concurrently to develop the farm and improve long term profitability. The challenge is for producers to identify and plan out what actions will best suit the development of their own farm under their own conditions, whether they are financial, physical or personal.

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