
THE PROCEEDINGS OF THE
NEW ZEALAND SOCIETY
OF
ANIMAL PRODUCTION
VOLUME 62 2002

Evaluating the business risk associated with feeding supplements to dairy cows on pasture.

LABORDE, D.,[1] SHADBOLT N.M.,[2] PARKER, W.J.[1]

Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Palmerston North, New Zealand.

ABSTRACT

The beta analysis technique provides a practical tool for evaluating the business risk associated with feeding supplements to dairy cows. The break-even cost, the expected profitability and the probability of making a profit can all be derived by predicting the marginal milksolids (MS) response, and applying prices for MS and supplements. The range of possible outcomes is simulated from specified maximum and minimum values, and the associated response distribution for each of these variables. The profitability of feeding maize silage on a market milk supply dairy farm was used to demonstrate the possible application of formal risk analysis to dairy herd management with a 50% spring: 50% autumn calving pattern. To be profitable, the marginal response to maize silage has to be maximised when no milk premium is paid, but, in the months when a premium is earnt, the risk of not making a profit is small.

Keywords: dairy supplements, risk, pastoral systems.

INTRODUCTION

Milk production in New Zealand is based almost exclusively on pasture and this helps to maintain low production costs and international competitiveness (Holmes, 1990). However, dairy cows in New Zealand have the genetic potential to perform at much higher levels of production than those currently achieved on pasture-only diets (Peterson, 1988; Edgecombe, 1994). A small proportion of farmers have already realised their milk production potential from pasture (Bryant, 1990). Supplements have been suggested as one way to improve milk yield per cow and per hectare (Edwards and Parker, 1994; Van der Poel, 1996), and at the same time reduce the inherent production risk associated with pastoral systems (Edwards and Parker, 1994). The profitability of this strategy has been strongly debated in recent years (Penno and Clark, 1997; Van der Poel, 1996; Hamilton, 1997). Supplement use increases the cost of production and may increase pasture wastage through the substitution effect (Brookes, 1993). Both of these factors reduce dairy farm profitability (Deane, 1993). On the other hand, farmers with the highest profitability in 1996/97 were those who had high milk production per cow and per hectare, very good pasture utilisation and relatively high expenditure on extra feed (Howse and Leslie, 1997). Thus, supplements should not be used before completing a careful evaluation of the physical and financial effects for each individual farm, and assessing the management capabilities of the farmer (Parker and Edwards, 1994).

The profitability of supplement use on a dairy farm is a function of the milk price, the cost of supplement consumed and the marginal MS response (Parker, 1996). Of these three variables, the marginal response is the most difficult to predict because it is affected by a multiplicity of factors (Brookes, 1993). The responses reported in the literature vary between 30 and 150 g MS/kg DM (McCallum, 1995; Penno and Clark, 1997; Pinares and Holmes, 1996; Thomson et a1., 1997). However, these may not be a particularly helpful guide for an individual farm because it's resources, and therefore input:output production function for milk, will be different to those of research stations. In addition, as the decision to buy supplements are sometimes made 6-12 months before they are used, and the price has to be negotiated at this time, the dairy farmer may not know the actual values for any of the three variables that drive the profitability of supplementary feeding. Therefore, managers must take uncertainty into account when making decisions about how much supplement to use and how much to pay for it. Calculations based on average values, while simple to follow, fail to account for the inherent production uncertainty that exists in dairy farm systems and how this may impact farm profit.

The aim of this paper is to describe the use of a risk analysis technique (based on the beta function in Microsoft Excel) for evaluating the business risk associated with feeding supplements on a dairy farm. This technique requires the estimation of maximum and minimum values for the variables of interest and a description of their response distribution (normal, left skewed or right skewed). These values and distributions can be altered according to the expectations for milk price or herd characteristics, resource quality and /or management skill.

METHOD

Case study farm

The 50% spring:50% autumn farmlet from the Calving Date System Comparison (CDSC) at the Massey University Nº 1 Dairy Farm (CDSC, First Annual Report: July to June 1996/97) was used as a case farm to illustrate the application of risk analysis. The main physical characteristics and pasture targets of the farm are summarised in Table 1. A simple feed budget indicated that supplement must be strategically used mainly in summer and winter in order to

[1] Present address: Fondar 831. Trinidad, Flores.Uruguay. mail uy38632@antel.com.uy
[2] Corresponding Author, Institute of Food, Nutrition and Human Health (Massey University).

achieve milk production and pasture management targets. Maize silage was purchased at $0.18/kg DM covered in the stack. The cost of machinery ($20 per hour) and labour ($10 per hour) and a silage wastage factor of 10% were included in the final price of $0.26 per kg DM of maize silage eaten. Maize silage was fed at less than 25% of the total DM intake and other additives were not necessary to balance the diet.

To assess the profitability of using maize silage at this price, the manager needs to predict both the future price per kg MS and the marginal MS production response. Beta analysis was used to predict both variables. The MS price for 1997/98 was estimated to be between $3.00 and $ 3.80 kg MS (minimum and maximum values, respectively) and to have a normal distribution. The maximum and minimum values for marginal responses to maize silage were 30 and 120 g MS/kg DM, respectively. These values reflect the range of responses reported in the literature (Stockdale, 1995; Penno and Clark, 1997).

Scenarios for "good", "average" and "poor" expected marginal MS responses were simulated assuming a distribution skewed to the right, a normal distribution and a distribution skewed to the left, respectively. These different curves were evaluated for variables such as the management skill of the farmer, farm stocking rate, stage of lactation and herd genetic merit, all of which can affect the marginal MS response (Brookes, 1993). Possible MS price and marginal response combinations were simulated 100 times and multiplied to obtain the break-even cost for using maize silage. As a market milk dairy farm, the winter and the remainder of the year have different MS prices. In May, June and July, a premium of 32 cents above the normal spring price for 840 litres/day of milk is received. Therefore, the profitability of options was assessed separately for the two payments periods.

TABLE 1: Main characteristics and management targets for the 50% Autumn/50% Spring Farmlet at the Nº1 Dairy Farm (Massey University).

Pasture produced (kg DM/ha/year)	12,700
Stocking rate (cows/ha)	2.16
Planned Start of Calving and days in milk for the Autumn and Spring herds	Autumn: 10th March (284 days) Spring: 1st August (268 days)
Pasture cover at calving (kg DM/ha)	2200
Average pasture cover (kg DM/ha)	> 2000
Post grazing residual mass (kg DM/ha)	1500-1700
Pasture utilisation	72%
Supplement fed (kg DM/cow)	800
Milk production (kg MS/cow)	371

RESULTS AND DISCUSSION

Profitability of supplement when no milk premium is received

The average MS price and response, the break-even cost for maize silage, the average profit expected for each kg DM fed to the cows, and the probability of making a profit under "poor", "average" and "good" management scenarios, are shown in Table 2. The probability of making a profit was estimated by the proportion of outcomes above the final cost of 1 kg of silage DM. The results show for the assumptions made, that maize silage feeding on a seasonal dairy farm would only be profitable close to 66% of the time if the marginal response was maximised. Obtaining an average response (79 g MS/kg DM) had a 52% likelihood of generating a profit. However, if an average marginal response of 59 g/kg DM is expected, the probability of making a profit would only be 0.12. In other words, a profitable outcome is obtained only when all of the factors affecting the marginal MS response are managed to a high standard. The possible positive effects of improved feeding on the reproductive performance of the cows was not considered (Parker and Edwards, 1994).

TABLE 2: Expected MS price, MS marginal response, break-even cost, profitability and probability of achieving a profit by using maize silage for three scenarios assuming an expected MS price of $3.38kg.

	"Poor"	"Average"	"Good"
MS price ($/kg)	3.38	3.38	3.38
Average MS response (g/kg DM)	59	79	91
Break even cost ($/kg DM)	0.20	0.26	0.31
Maize silage ($/kg DM)	0.26	0.26	0.26
Profitability ($/kg DM fed)	-0.06	0	0.05
Probability of making a profit	0.12	0.52	0.66

Profitability of using maize silage during May, June and July

The risk and profitability of supplementary feeding during the winter (May, June and July) when milk premiums are available is very different to that of seasonal calving. The final price received during these three months was estimated to be $5.40/kg MS, assuming a MS concentration of 8% and a daily volume of milk sent to the factory that was 20% above the quota. At this price, using maize silage is much less risky than for spring calving. Even with "poor" management of the supplement, the farmer will make money. The probability of not making profit is 42, 12 and 2%, respectively, for "poor", "average" and "good" management scenarios. The positive effect that the use of maize silage could have on decreasing below quota production penalties was not quantified, but would nevertheless influence farmer decision making concerning supplement use.

TABLE 3: Expected MS price, MS marginal response, break-even cost, profitability and probability of achieving a profit by using maize silage under three management scenarios assuming an expected MS price of $5.40/kg.

	"Poor"	"Average"	"Good"
MS price ($/kg)	5.40	5.40	5.40
Average MS response (g/kDM)	59	79	91
Break even response ($/kg DM)	0.32	0.43	0.50
Maize silage ($/kg DM)	0.26	0.26	0.26
Profitability ($/kg DM)	0.06	0.17	0.24
Probability of having a profit	0.58	0.88	0.98

SUMMARY

The beta analysis function within the Excel spreadsheet can be used to formally evaluate the risks associated with feeding supplements by predicting prices and responses from the appropriate values and distributions for key performance variables. The characteristics of uncertainty are incorporated within the production functions. The results concerning the level of response required to achieve a profit can be assessed relative to the information reported in the literature. For instance, for the dairy farm example presented, if no winter premium is received for milk, the high marginal responses required for maize silage feeding to be profitable, must occur during autumn to extend lactation (Pinares and Holmes, 1996; Clark, 1994), in early lactation in association with an earlier calving date (Thomson *et al*., 1997) or were a substantial shortage of pasture occurs (Grainger *et al*., 1989). The relatively straightforward procedures outlined in this paper suggest that the effects of both production and price risk on achieving a profit from supplementary feeds inputs to a pastoral system can be quantified. This information is very useful to a farmer who needs to determine the price that can be paid for a supplement well in advance of its use on the farm.

ACKNOWLEDGMENTS.

The authors thank Dr Colin Holmes for his valuable comments.

REFERENCES

Brookes, I.M. (1993). The effect on milk production of supplementing pasture feed dairy cows. Pp.83-93. *In:* Improving the quality and intake of pasture based diets for lactating dairy cows. N.J. Edwards and W.J. Parker (ed). Occasional Publication Nº 1. Department of Agricultural and Horticultural Systems Management, Massey University, New Zealand.

Bryant, A.M. (1990). Optimum stocking and feed management practices. *Proceedings of the Ruakura Farmers' Conference* **41:** 55-59.

Clark, D.A. (1994). Silage for milk production. *Proceedings of the Ruakura Farmers' Conference* **45:**41-46.

Deane,T.H. (1993). The relationship between milkfat production per hectare and economic farm surplus on New Zealand dairy farms. *Proceedings of the New Zealand Society of Animal Production* **53:**50-53.

Edwards, N.J. and Parker, W.J. (1994). Increasing per cow milk solid production in a pasture based dairy system by manipulating the diet : A review. *Proceedings of the New Zealand Society of Animal Production* **53:**267-273.

Edgecombe, F. and Edgecombe,G. (1994). High production from higher levels of supplements. *Dairyfarming Annual, Massey University* **46:** 44-49.

Grainger, C. and Mathews, G.L. (1989). Positive relation between substitution rate and pasture allowance for cows receiving concentrates. *Australian Journal of Experimental Agriculture* **29:**355-60.

Hamilton, T. (1997). Why farm at a low cost structure? *Proceedings of the Ruakura Farmers' Conference* **48:** 12-16.

Holmes, C.W. (1990). Principles and practices of profitable dairy farming. *Proceedings of the Ruakura Farmers' Conference* **41:** 60-67.

Howse, S. and Leslie, M. (1997). Can dairy farmers make money by spending money? *Proceedings of the Ruakura Farmers' Conference* **48:**42-53.

Mc Callum , D., Thomson, N. and Clough, J. (1995). Use of concentrate feed to maintain the feed supply at high stocking rate: Demonstration Farm at Waimate West. *Dairyfarming Annual, Massey University* **47:**15-19.

Parker, W.J. and Edwards,N.J. (1994). Valuing supplementary feeding in a pasture-based dairy system. *Dairyfarming Annual, Massey University* **46:**29-38.

Parker, W.J. (1996). How to analyse your inputs and costs. *Dairyfarming Annual, Massey University* **48:**48-56.

Penno, J.W. and Clark, D. (1997). Silage for milk production and profit. *Dairyfarming Annual, Massey University* **49:**50-57.

Peterson, R. (1988). Comparison of Canadian and New Zealand sires in New Zealand for production, weight and conformation traits. Research bulletin Nº 5, Hamilton, New Zealand, Livestock Improvement Corporation Limited.

Pinares, C. and Holmes, C. W. (1996). Effects of feeding silage and extending lactation on the pastoral dairy systems. *Proceedings of the New Zealand Society of Animal Production* **56:** 238-240.

Stockdale,C.R. and Trigg, T.E. (1995). Effect of pasture allowance and level of concentrate feeding on the productivity of dairy cows in early and late lactation. *Australian Journal of Experimental Agriculture* **25:**739-44.

Thomson, N., Mudford, C.R. and Holmes, C.W. (1997). Milksolids response in early lactation to condition score at calving and concentrate feeding. *Proceedings of the New Zealand Society of Animal Production* **57:** 157-159.

Van der Poel, J. (1996). Going for high production. *Proceedings of the Ruakura Farmers' Conference* **47:**5-10.