The productivity of pasture-based dairy farms in New Zealand with different levels of extra feed input

D. SILVA-VILLACORTA, C.W. HOLMES, N. M. SHADBOLT[1], N. LOPEZ-VILLALOBOS, W. PREWER[2], C.B. GLASSEY[2] and M. BLACKWELL[2]

Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Private Bag 11-222, Palmerston North, New Zealand

ABSTRACT

The objective of this research was to study the physical and financial performance of commercial dairy farms in New Zealand that differed in the amount of extra feed used. Data from Dexcel's ProfitWatch corresponding to 626 owner-operated dairy farms between 1998/1999 and 2001/2002 were analysed. The data were classified according to each of the four dairy seasons and the extra feed used per cow. Extra feed comprised supplements imported (hay, pasture silage, maize silage, concentrates and other feeds), winter grazing and maize silage grown on the farm. The statistical analyses were done in SAS and comprised analyses of variance and regression analyses. High feed input farms (H farms, 740-940 kg extra DM /cow/year) had higher stocking rates (2.7-2.8 vs 2.4-2.5 cows/ha), lower comparative stocking rate (83-86 vs 83-92 kg live weight/t DM), and higher milksolids (MS) production per cow (293-341 vs 249-295 kg MS/cow) and per hectare (826-921 vs 616-744 kg/ha) than low feed input farms (L farms, 20 kg DM extra feed/cow/year). The use of nitrogen fertiliser was also higher in the H farms than in L farms (85-116 vs 53-67 kg N/ha/year). There were no significant differences in farm size, herd breeding worth, reproductive characteristics of the herds and estimated pasture consumed per hectare. On average, extra feed was significantly associated with extra cows (0.17 extra cows/ha for 1 t extra DM) and extra milk solids (50 g extra MS/cow for 1 kg extra DM/cow and 96 g extra MS/ha for 1 kg extra DM/ha), but the wide variability is shown by the low values for R^2 (0.13 to 0.16 for the three relations above). The H farms produced higher gross farm incomes per hectare (by \$0.47 to \$0.49/kg extra DM offered) but had higher farm working expenses per hectare (by \$0.36 to \$0.37/kg extra DM offered), so that Economic Farm Surplus per hectare was not higher for these farms in any year. High management skills and control of costs are necessary for profit to be increased by the use of extra feeds.

Keywords: low-input; high-input; extra feed.

INTRODUCTION

New Zealand dairy farms are characterised by their low feed input, low costs of production and seasonal milk production. However, these low feed input systems can also limit milksolids (MS) production per cow and per hectare, and farm profitability (Roche & Reid, 2002). A high gross farm income per hectare is the first step to achieve high Economic Farm Surplus per hectare (EFS/ha) (Leslie, 2001). Since Gross Farm Income per hectare is mainly determined by MS production per hectare (Howse & Leslie, 1997) the use of extra feed to increase MS production, per cow and per hectare, can potentially increase farm profitability.

In recent years, dairy farmers increased the amount of feed supplied to their herds, by the use of extra feed (supplements), with the aim of increasing MS production per cow and per hectare (MAF, 2001). Similarly, in recent years there have been considerable debates over the profitability of the use of extra feed in New Zealand dairy farms. Some reports have shown that low feed input farms can be highly profitable (Penno *et al*., 1996; McGrath, 1997; Armer, 2000; Kuriger, 2002). Other reports have showed that high feed input farms can also be highly profitable if managed effectively (Van der Poel, 1996; Moore, 2000; Roche & Reid, 2002). The 1.75 t MS/ha trial at Dexcel studied the characteristics of farmlets that used different amounts of extra feed (Macdonald, 1999). In this trial, low input farms had lower MS production per cow and per hectare than high input farms; but their EFS/ha was higher than those of high input farms due to their lower farm working expenses per hectare (Macdonald, 1999). However, there is little information about the physical and financial characteristics of commercial dairy farms with different levels of extra feed input. The objective of this research was to describe and compare the physical and financial performance of dairy farms in New Zealand according to their level of extra feed used per cow.

MATERIALS AND METHODS

This study comprised the analysis of Dexcel's Profitwatch database of physical and financial data from dairy farms. The data analysed corresponded to 915 surveys, from 626 owner-operated dairy farms and four dairy seasons (1998/1999, 1999/2000, 2000/2001; 2001/2002). Some dairy farms were surveyed in more than one year. Three groups of farms were formed according to the amount of extra feed used per cow. Low feed input farms (L farms) comprised farms that

[1] Institute of Food, Nutrition and Human Health, Massey University, Private Bag 11-222, Palmerston North, New Zealand

[2] Dexcel Limited, Private Bag 3221, Hamilton, New Zealand

used less than 50 kg DM of extra feed per cow. Intermediate feed input farms (I farms) comprised farms that used between 50 and 500 kg DM of extra feed per cow. High feed input farms (H farms) comprised farms that used more than 500 kg DM of extra feed per cow. The definition of 'extra feed', for the purpose of classification of the data, comprised supplements imported (pasture hay, pasture silage, maize silage, meals, grains, other feeds), pasture imported as winter grazing and maize grown on farm. The statistical analyses of the data were done in SAS (2001) and comprised one-way and two-way analyses of variance, and regression analyses.

RESULTS

The physical and financial differences between the three groups of farms are shown in Table 1.

In all four years, H farms had significantly higher MS production, per cow and per hectare, than L or I farms (Table 1). For data from all four years, MS production per cow and per hectare were positively related to the amounts of extra feed used per cow (kg MS/cow = 284.0 + 0.050 (kg DM extra feed/cow), $R^2 = 0.14$; $P < 0.0001$) and to the amount of extra feed used per hectare (kg MS/ha = 701 + 0.096 (kg DM extra feed/ha), $R^2 = 0.16$; $P < 0.0001$), respectively. The slopes of the regression equations show that an extra 50 g MS/cow, or an extra 96 g MS/ha, were produced in association with 1 kg DM of extra feed fed per cow or per hectare, respectively.

H farms had higher stocking rates than I and L farms (Table 1). For data from all 4 years, there was a positive association between the amount of extra feed used and the farm stocking rate (stocking rate = 2.45 + 0.00017 (kg DM extra feed/ha), $R^2 = 0.13$, $P < 0.0001$). When the effect of extra feed on stocking rate is removed, the MS response per hectare to extra feed fed per hectare is similar to the MS response per cow to extra feed fed per cow (kg MS/ha = 26.7 + 274.7 (cows/ha) + 0.047 (kg DM extra feed/ha), $R^2 = 0.69$; $P < 0.0001$).

With the exception of 2001/2002, H farms had lower comparative stocking rates than I and L farms (Table 1). In all four years, H farms used more nitrogen fertiliser per hectare than I or L farms. Within each year there were no significant differences in herd breeding worth between the three groups of farms.

In all 4 years, H farms had higher gross farm income per hectare (GFI/ha) than I and L farms (Table 1). This was due to their higher incomes from the sale of MS, and higher net stock incomes. In all four years, H farms had significantly higher farm working expenses per hectare (FWE/ha) than L farms. There were no significant differences between the three groups of farms in labour costs per cow, but animal costs per hectare (excluding labour), feed costs per hectare, fertiliser costs per hectare and overhead costs per hectare were higher in H farms than in I and L farms.

In all 4 years, there were positive relationships between the amount of extra feed used per hectare, GFI per hectare and FWE per hectare (Figures 1 and 2). In 1998/1999 (MS payout = $3.58/kg) the increase in cash operating surplus associated with the use of extra feed was $0.07/kg DM extra feed (Figure 1). In 2001/2002 (MS payout = $5.30/kg) the increase in cash operating surplus associated with the use of extra feed was $0.12/kg DM extra feed (Figure 2).

However, in all four years, there were no significant differences in EFS/ha between L, I and H farms (Figure 3), nor significant associations between extra feed input per hectare and EFS/ha.

DISCUSSION

The higher stocking rate in H farms indicates that dairy farmers associated the use of extra feed with more cows per hectare (1 extra cow per 5.9 t DM extra/ha). This is consistent with the recommendations from the 1.75t MS/ha trial, in which the three systems with extra feeds fed an extra 6.1 t DM/ha and carried an extra 1.08 cows/ha (Macdonald, 1999). The lower comparative stocking rates in H farms suggest that the total feed input per cow in this group of farms was higher than in the other two groups, and this agrees with the fact that MS yield per cow was also higher in this group of farms.

In this study, the use of 1 t DM/ha was associated with 0.17 cows extra/ha and 95 kg extra MS/ha. In the study by Macdonald (1999) the use of 1 t DM/ha was associated with 0.18 extra cows/ha and 85 kg extra MS/ha. In the present study the use of extra dry matter per hectare was also associated with the application of extra nitrogen.

H farms used 32 – 49 kg N/ha more than L farms. Higher use of nitrogen fertiliser in high input farms were also reported by Van der Poel (1996) and Jamieson (1996). The extra pasture that may have been grown with the extra N was not included as extra feed input in the H and I farms. However, the low determination coefficients (R^2) of the linear models explaining the relationships between extra feed input and MS production per cow and per hectare also show that there is a wide variation in the data. This can probably be explained in terms of quality of feed and variation between farms in the efficiency with which the total feed available was utilised in the I and H.

The higher MS production per cow and per hectare in H farms in this study agrees with reports of high MS production in farms that use supplements (Van der Poel, 1997; Reid, 1997; Macdonald, 1999; Leslie, 2001).

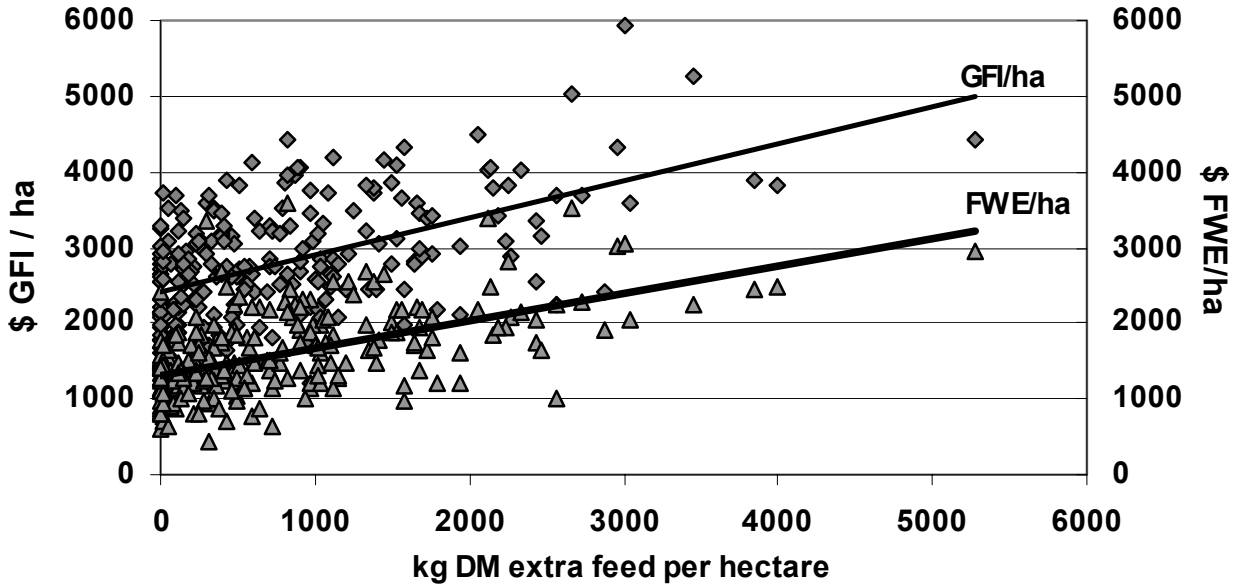
Since H farms had higher MS production per hectare, their GFI/ha were higher than intermediate and low feed-input farms. The higher FWE/ha in high feed-input farms were mainly associated to their higher stocking rates and their higher feed, fertiliser and overhead costs. Van der Poel (1997) and Macdonald (1999) also reported increases in GFI/ha and FWE/ha with the use of extra feed.

TABLE 1: Physical and financial characteristics of low (L), intermediate (I) and high (H) feed input owner operated dairy farms in New Zealand, between 1998/1999 and 2001/2002.

Farm parameters	1998/1999 ($3.58/kg MS) [1]			1999/2000 ($3.78/kg MS) [1]			2000/2021 ($5.00/kg MS) [1]			2001/2002 ($5.30/kg MS) [1]		
	L	I	H	L	I	H	L	I	H	L	I	H
Number of farms	58	128	51	58	128	51	45	126	78	46	76	73
Physical Data												
Herd breeding worth ($)	38 [a]	38 [a]	36 [a]	48 [a]	49 [a]	44 [a]	62 [a]	59 [a]	59 [a]	77 [a]	79 [a]	74 [a]
Stocking rate (cows/ha)	2.5 [a]	2.6 [ab]	2.8 [b]	2.4 [a]	2.6 [ab]	2.7 [b]	2.4 [a]	2.6 [ab]	2.7 [b]	2.5 [a]	2.6 [a]	2.7 [a]
CSR (kg live weight/t DM)	92 [a]	88 [ab]	86 [b]	86 [a]	85 [a]	83 [a]	89 [a]	84 [b]	84 [b]	83 [a]	83 [a]	83 [a]
Extra feed input (kg DM/cow)	22	229	737	19	249	849	21	249	844	20	250	943
Extra feed input (kg DM/ha)	55	595	2064	46	647	2292	50	647	2279	50	650	2546
Milksolids (kg MS/cow)	249 [a]	274 [b]	293 [c]	249 [a]	292 [b]	298 [b]	293 [a]	311 [a]	329 [b]	295 [a]	310 [a]	341 [b]
Milksolids (kg MS/ha)	616 [a]	720 [b]	826 [c]	706 [a]	767 [a]	868 [b]	716 [a]	793 [a]	900 [b]	744 [a]	808 [a]	921 [b]
Nitrogen (kg N/ha/year)	53 [a]	71 [ab]	85 [b]	54 [a]	72 [ab]	86 [b]	63 [a]	87 [ab]	108 [b]	67 [a]	84 [a]	116 [b]
Financial data												
Milksolids income ($/ha)	2183 [a]	2585 [b]	3004 [c]	2567 [a]	2801 [b]	3210 [c]	3500 [a]	3925 [b]	4502 [c]	3941 [a]	4251 [a]	4888 [b]
Stock income ($/ha) [2]	201 [a]	235 [ab]	280 [b]	233 [a]	280 [b]	349 [c]	411 [a]	417 [a]	508 [b]	471 [a]	540 [ab]	594 [b]
Gross farm income ($/ha)	2374 [a]	2821 [b]	3287 [c]	2787 [a]	3080 [ab]	3498 [b]	3854 [a]	4276 [a]	4859 [b]	4362 [a]	4679 [a]	5377 [b]
Labour costs ($/cow) [3]	227 [a]	230 [a]	244 [a]	263 [a]	251 [a]	262 [a]	299 [a]	285 [a]	278 [a]	307 [a]	314 [a]	316 [a]
Other animal costs ($/ha) [4]	315 [a]	338 [a]	398 [b]	319 [a]	356 [ab]	388 [b]	346 [a]	371 [a]	416 [b]	348 [a]	380 [a]	462 [b]
Fertiliser costs ($/ha)	240 [a]	280 [b]	322 [c]	249 [a]	291 [b]	293 [b]	324 [a]	354 [a]	423 [b]	330 [a]	378 [b]	428 [c]
Total feed costs ($/ha) [5]	143 [a]	304 [b]	437 [c]	178 [a]	320 [b]	478 [c]	185 [a]	364 [b]	567 [c]	263 [a]	398 [b]	716 [c]
Overhead costs ($/ha) [6]	689 [a]	772 [a]	955 [b]	734 [a]	793 [a]	968 [b]	785 [a]	860 [b]	1151 [c]	893 [a]	898 [b]	1202 [c]
Farm working expenses ($/ha) [7]	1265 [a]	1601 [ab]	1945 [b]	1374 [a]	1625 [ab]	1994 [b]	1588 [a]	1851 [a]	2447 [b]	1735 [a]	2063 [a]	2675 [b]
Economic farm surplus ($/ha)	474 [a]	594 [a]	550 [a]	815 [a]	836 [a]	880 [a]	1711 [a]	1790 [a]	1760 [a]	1849 [a]	1926 [a]	1902 [a]

[1] Values with different superscript letters are statistically different (within year and row) ($P < 0.05$)
[2] Stock income = net stock income + stock adjustment used for the estimation of EFS/ha
[3] Labour costs = wages + labour adjustment used for the estimation of EFS/ha
[4] Animal health, herd improvement, farm dairy and electricity
[5] Total feed costs ($/ha) = costs of supplements made on farm (crop and re-grassing), supplements purchased, winter grazing-off and young stock grazing
[6] Overhead costs = freight, weed and pest control, administration, standing charges, run-off lease and other expenses
[7] Farm working expenses includes wages but not the labour adjustment

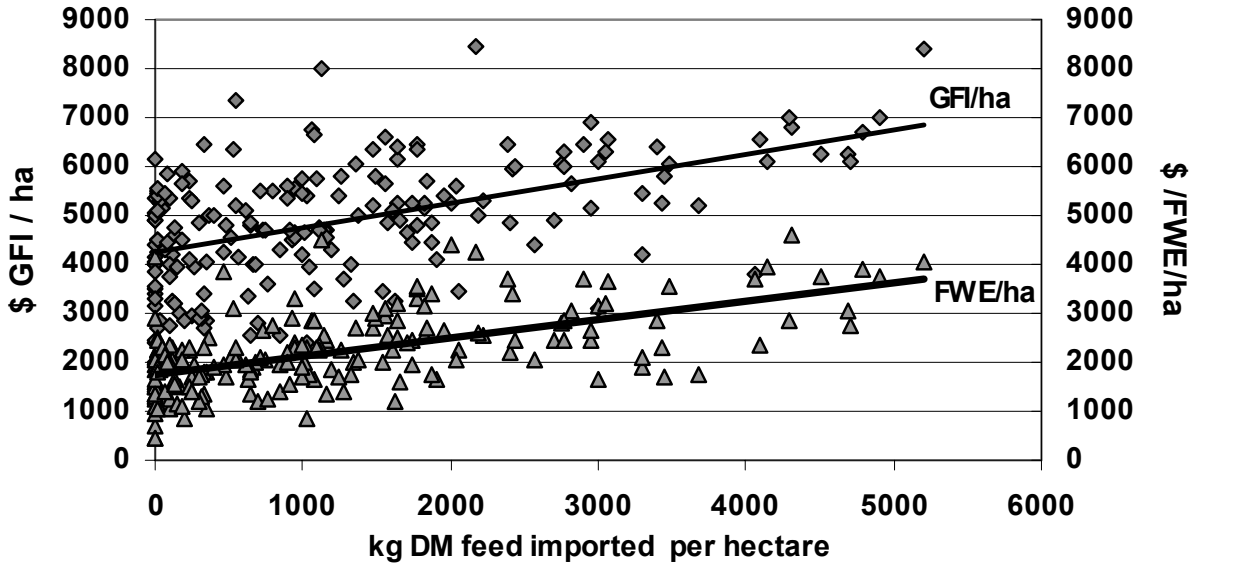
FIGURE 1: Relationship of extra feed input with Gross Farm Income per hectare (GFI/ha) and Farm Working Expenses per hectare (FWE/ha) in owner-operated dairy farms in 1998/1999 (n = 237)



◇ $GFI/ha = 2525 + 0.43 (kg DM extra feed/ha) R^2= 0.2107 (P<.0001)

△ $FWE/ha = 1344 + 0.36 (kg DM extra feed/ha) R^2= 0.2852 (P<.0001)

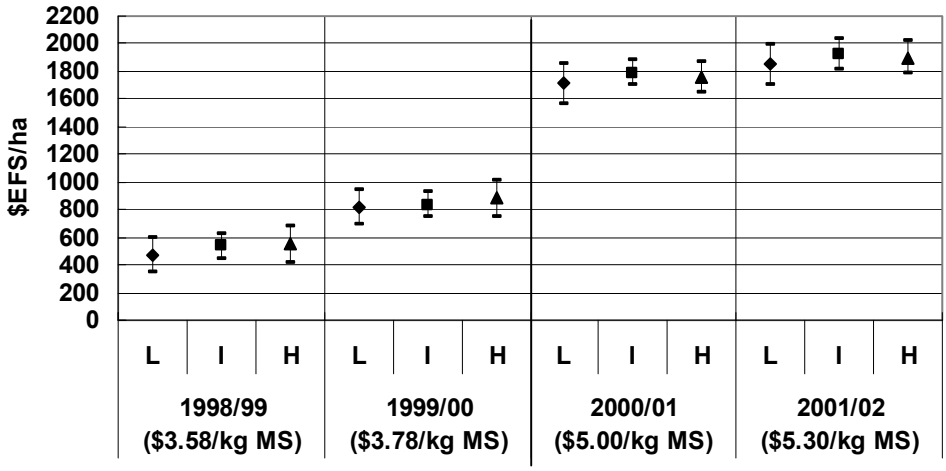
FIGURE 2: Relationship of extra feed input with Gross Farm Income per hectare (GFI/ha) and Farm Working Expenses per hectare (FWE/ha) in owner-operated dairy farms in 2001/2002 (n = 192)



◇ $GFI/ha = 4327 + 0.49 (kg DM extra feed/ha) R^2= 0.2593 (P<.0001)

△ $FWE/ha = 1777 + 0.37 (kg DM extra feed/ha) R^2= 0.3520 (P<.0001)

FIGURE 3: Average EFS/ha in low (L), intermediate (I) and high (H) feed-input farms between 1998/1999 and 2001/2002



The results of this study suggest that the input of extra feed (plus other associated inputs such as extra cows and nitrogen fertiliser), increased per cow and per hectare MS production but did not consistently result in higher $EFS/ha because the efficiency with which farmers converted income to profit varied. Individual skills, motivation and management can influence the ability with which farmers generate income, and control costs, to increase profit by the use of extra feed (Penno, 2003). There are probably farmers following best-practice management who are using extra feeds profitably (Van der Poel, 1997; Miller, 2005).

CONCLUSIONS

Between 1998/1999 and 2001/2002, dairy farmers who used high levels of feed input also had higher stocking rates, used more nitrogen fertiliser per hectare (kg N/ha), and produced more MS per cow and per hectare, than intermediate and low input farms. H farms had higher GFI/ha and higher FWE/ha than I and L farms. However, additional feed did not automatically result in a higher EFS/ha. Management skills are required at all levels to generate profit.

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