Characteristics of seasonal dairy farms achieving high per cow production in the lower North Island of New Zealand

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ABSTRACT

The ability of New Zealand cows to achieve high milksolids production has been well documented, but less than 1% of New Zealand dairy herds consistently achieve more than 350 kgs milksolids (MS) per cow per season. A survey was undertaken to characterise seasonal dairy farms in the lower North Island that had achieved an average production of at least 348 kg MS per cow over three seasons (n = 31 farms from 1162 suppliers). Thirty of these farmers were interviewed.

The farmers averaged 51 ± 11 years of age and had 31 ± 10 years of dairy farming experience. The average herd size of 164 (range 52 - 515) cows was milked on 66.5 hectares (2.48 cows/ha). Milksolids production of 386 ± 28 kg per cow was achieved from an average lactation length of 274 ± 10 days. Peak MS production ranged from 1.16 to 2.09 kg/day. Production equated to 881 kg MS/ha and 56,800 kg MS/farm. Friesian and Friesian x Jersey cross cows predominated (87% of herds). Hay, silage, nitrogen, and grazing young stock off the milking area were used to increase the feed available to the milking herd. In pasture equivalent terms this equated to 315 kg DM/cow as hay, 342 kg DM/ cow as silage and 198 kg DM/cow from nitrogen-boosted pasture. Concentrates and summer crops were each used by nine farmers to provide additional feed to their herds. There was a significant correlation between total feed inputs and days in milk ($r = 0.49$, $P<0.01$). Per cow production was associated with soil fertility ($r = 0.48$, $P<0.01$), and peak milk production ($r = 0.68$, $P<0.001$). A wide range of management systems were used to achieve high per cow production, but a common aim was to feed cows as well as possible.

Keywords: per cow production, dairy systems, farm management.

INTRODUCTION

The genetic ability of the New Zealand dairy cow to achieve high milksolids production has been well documented (Jaisiorowski *et al.*, 1987; Graham, 1991). However, under New Zealand pasture-based dairy systems less than 1% of seasonal dairy herds consistently average more than 350 kg MS per cow per season (LIC, 1991). Little is known about the management systems that are employed on farms that consistently achieve high per cow production. This paper presents the results of a survey of farmers with herds achieving high per cow production and discusses the characteristics of the farm, herd, farm inputs, and the farmer.

METHOD

The annual supply records from Tui Milk Products Ltd (Tui) were used to identify seasonal supply dairy farms in the lower North Island that achieved high per cow production in each of the three seasons from 1990/91. Farms achieving high per cow production were defined as having a three year average production of at least 348 kg MS per cow and a minimum of 331 kg MS per cow in any one season. Thirty one farms, from a total of 1162 suppliers, met these criteria.

A telephone questionnaire, to obtain data on the characteristics of the farm, herd, and the farmer, was developed and pretested on two local Manawatu farmers. The questionnaire was administered in May 1994, and 30 of the eligible farmers responded. Of these, 18 farmed on the eastern side of the Ruahine / Tararua ranges, within an area from South Wairarapa to Dannevirke, and 12 farmed on the western side, within an area from Foxton to Kimbolton.

Supplementary feed data was converted to pasture DM equivalents assuming that dairy cows grazed-off the farm consumed 6 kg DM/ head/ day, each bale of hay contained 15 kg pasture DM, and grass silage comprised 27% pasture DM equivalent. Other assumptions included, a response rate of 10 : 1 for applications of nitrogen fertiliser, crop yields of 10,000 kg DM/ha equivalent, and an energy density of 10.8 MJ ME/ kg DM in concentrates fed to dairy cows. Lactation length was calculated from the median calving date until the last day of milking. The effective milking area of the farm was adjusted for the period when young stock (rising 2 year heifers) were grazed on the farm assuming that a rising 2 year heifer consumed 2,083 kg DM/ year and annual pasture growth of 10,000 kg DM/ha.

Data were subjected to simple descriptive statistical procedures (frequencies and correlations) to determine relationships between input variables and per cow production using the SPSS/PC programme (SPSS, 1986). The deliberate selection of farms with high per cow producing herds and the relatively small size limited the inferences that could be made about the general supplier population.

RESULTS

Farmer and farm profile

The average age of the respondent farmers was 51 ± 11 years (Table 1). They had 31± 10 years dairy farming experience. The average farm size of 81 ± 40 ha, included an adjusted milking area of 66.5 ± 38 ha. Half of the farmers owned or leased a runoff. The mean herd size of 164 cows (range 52 -

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515) was farmed at a stocking rate of 2.48 ± 0.43 cows per ha. Stocking rate was significantly (P<0.001) associated with per hectare production (r = .75), but not with per cow production (r = -0.35). Herds were milked by an average of 1.5 labour units (including the principle partner). Farm production was 56,787 ± 27,415 kg MS or 881 ± 220 kg MS per ha.

TABLE 1: Characteristics of farmers and farms achieving high per cow production in the lower North Island and corresponding data for all suppliers to Tui Milk Products Ltd.

Characteristics	N[1]	Mean	SD	Range	All Suppliers
Farmer					
Age (male) (years)	33[2]	51	11	33 - 84	
Age (female) (years)	25[3]	46	7	33 - 61	
Farming experience (years)	30	31.3	10	13 - 60	
Labour units[4]	30	1.5	.73	1 - 4	
Cows per labour unit	30	113	43	54 - 230	
Farm size (ha)	30	81	40	30 - 230	
Effective area (ha)	30	66.5	38	27 - 203	75
Runoff area (ha)	15	71	77	3 - 320	
Herd size 1992-93	30	164	87	52-515	172
Stocking rate (cows/ha)	30	2.48	.43	1.7 - 3.6	2.38
Production (kg MS)					
Total (000)	30	56.8	27.4	19.6 - 163.6	46.7
Per hectare	30	881	220	715 - 1545	651
Per cow	30	386	28	348 - 479	274
Peak production per cow[6]	29[5]	1.72	0.2	1.46 - 2.09	
Lactation length (days)	30	274	10	250 - 299	
Soil fertility					
Olsen P value	20	28.4	6.9	16 - 38	
pH levels	25	5.9	.1	5.5 - 6.2	

[1] Number of farm responses.
[2] The number of males includes the second male partner where family partnerships consisted of other members of the family.
[3] One of the farms owned by a family trust was operated by a husband and wife team.
[4] Includes principle partner's labour.
[5] Data for one farm system altered in 1993/94 was not included in these calculations.
[6] Peak production per cow was calculated from the average daily production supplied to Tui Milk Products Ltd during October and November divided by the number of cows peak milked.

Herd and herd management

Friesian or Friesian x Jersey cows were present in 26 herds (87%). Eleven herds had registered pedigree animals and four of these had only registered animals. The average herd breeding index (BI) was 126 ± 6 (n = 26) and only two of these herds had a BI below 120. Herd testing was carried out on 25 of the 30 farms. Eight weekly testing was the most common option (16 farmers) followed by monthly testing (6), and six weekly testing (2). One farmer tested his herd twice a year.

Average milk production per cow was 386 ± 28 kg MS and was attained from a lactation length of 274 days. Peak milk production was 1.72 ± 0.16 kg MS per cow per day (Table 1). Correlations between per cow production and herd size (r = 0.22), lactation length (r = 0.22) and herd BI (r = -0.24) were not significant.

The mean date for planned start of calving (PSC) was 29 July. Calving spread was 72 ± 25 days, with the mean calving date (MCD) being 3 September. The PSC for farms on the western side of the ranges was 25 July compared to 1 August for farms in the eastern districts. Artificial insemination (AI) was used by all farmers over an average period of 6 ± 3 weeks. The total mating period was 13 ± 3 weeks. The average BI of the bulls used for AI service was given as 145.

Overall annual herd wastage was 20.3 ± 6.5% and 4.03 ± 6.5% of the herd were culled for low production. The values for replacement rate and number of low production culls were distorted because 10 farmers had increased cow numbers during the study period. Three farmers involved with sales of pedigree livestock had difficulty estimating the number of cows sold for low production. Care therefore needs to be taken when interpreting the herd replacement data.

Use of fertiliser and feed inputs

Average soil fertility measured by phosphate levels (Olsen P) was 28.4 (range 16-38) (Table 1). The mean soil acidity level (pH) was 5.9. Nutrients applied annually to each hectare of the milking area, irrespective of the type of fertiliser, were: 48 ± 33 kg of nitrogen; 47 ± 21 kg of phosphate, 56 ± 34 kg of potassium; and 45 ± 26 kg sulphur. Phosphate was the only nutrient applied by all farmers (range 19 to 95 kg P/ha/yr). Nitrogen inputs also varied (9 to 109 kg/ha/yr) widely between the 25 farmers who applied this fertiliser. Fertiliser was more commonly applied in the spring and autumn, than the summer or winter. Per cow production was positively associated with soil fertility (r=.48, P<0.01), but not with the annual application rate of phosphate fertiliser (r = 0.10).

All farmers fed some hay to their cows and 17 farmers used grass silage in addition to hay (Table 2). An average of 20 bales of hay per cow (315 kgs DM) and 0.972 tonnes of silage per cow (342 kgs DM) were fed as supplements. In addition, extra pasture was grown due to applications of nitrogen on 25 farms. Crops were grown by nine farmers (maize, kale, turnips or brassica), however, crop yields were unavailable except in one instance. The average area planted by these nine farmers was 3.4 ha. Concentrates such as meal and barley were fed to nine herds for all or part of the year. The average amount of concentrates fed per farm equated to an average of 90 kg pasture DM per cow, but this was reduced by 54 kg pasture DM per cow when one outlying farm, where concentrates were fed all year round, was removed (Table 2). Additional feed inputs were not significantly correlated to per cow production (r = .13), lactation length (r = 0.50), or stocking rate (r = 0.22).

All except six of the farmers grazed stock off the farm during the year. Milking cows were grazed off for an average of seven weeks by 18 farmers, and young stock were grazed off for an average of 44 weeks by 23 farmers (Table 2). Only 15 of the 23 farmers grazed their young stock off the property for the full year.

Paddocks were topped regularly by 24 of the respondents to achieve pasture control and maintain pasture quality. Minerals and trace elements were used by 27 farmers. Selenium was the most common element added (n = 22 farmers) followed by magnesium (19), and copper third (11). Other minerals and trace element supplements used were: Aloe Vera (2), molasses (1), zinc (1), cobalt (3), salts (4). A multi-mineral supplement was used by eight farmers which may have contained all or some of the aforementioned minerals.

TABLE 2: Levels of annual feed inputs including supplements, concentrates, crops and grazing-off on farms achieving high per cow production in the lower North Island.

Feed type per year	N[1]	Mean	SD	Range
Hay (bales)	29	3182	N/A	1,000 - 10,000
Hay (kg DM/cow)	29	315	178	43.9 - 886.9
Silage (tonnes)	18	296	N/A	35 - 1,760
Silage (kg DM/cow)	18	342	243	51.1 - 801.9
Crops (ha)	9	3.4	3	1 - 10
Nitrogen response (kg DM/cow)	25	198	134	39.4 - 435.4
Concentrates (tonnes)	9	62	N/A	1.5 - 500
Grazing off (weeks)		(6.7)[2]	(1.5 - 15)[2]	
Cows	18	7	4	3 - 10
Young stock	23	44	13	8 - 52

[1] Number of respondents replying to the question.
[2] The figures in brackets are the values when one outlying farm was removed.

Farmer comments On-Farm Production and goals

Climate, either through the variability or lack of summer or autumn rain, was considered to be an important constraint to milk solids production by 11 of the farmers. Two farmers used irrigation to mitigate summer dryness. Soil constraints, such as fertility level or drainage/soil type, were mentioned by 10 farmers. Pasture constraints were mentioned by eight farmers, with pasture species being the most common limiting factor. Four of the respondents believed that they did not have complete or up to date technical knowledge about some aspects of management, and that this may have limited production on their farm.

In response to the question, "What is or are your goals in relation to milk production?", the answer of most farmers (n=25) related to per cow production, and included: "achieve over 200 kg milkfat per cow; keep per cow production as high as possible; and aim for total production with high per cow production as the base." High per cow production was a goal of 21 farmers because of the satisfaction its achievement provided when healthy dairy cows (high genetic merit) were well fed. Twelve farmers saw high per cow production as a means to achieve high profits and better utilisation of pasture for milk production. Five farmers adopted the goal of high per cow production because of resource constraints such as the size of the farm, the age of the shed or the ability to employ labour.

DISCUSSION

In contrast with the average dairy farm supplying Tui Milk Products Ltd, those with high per cow production had less effective milking area, fewer cows and a slightly higher stocking rate (Table 1). The survey farmers were 6 years older on average than owner-operator suppliers located in the eastern districts of the Tui catchment area (Hughes, *et al.*, 1989) and approximately one third of them were involved with pedigree animals. The latter factor may explain the relatively low useage of induction (43% of herds vs 87% in a Waikato study (MacMillan, 1990)). Calving spread was also wider for the study herds than those in the Waikato.

The positive relationship between effective milking area and per cow production on the high per cow production farms contrasts with the annual statistics for Tui suppliers which indicated that larger farms have lower per cow production (TMPL, 1993). On the survey farms, increases in stocking rate were associated with decreased production per cow, suggesting that stocking rate was near the critical level on these properties. Peak milk production and per cow production was strongly related for the survey herds, but this relationship may reflect confounding between these two variables. Nevertheless, other reports of a positive association were reviewed by Holmes and Wilson (1987) and also applied to the production per cow and lactation length data for all Tui suppliers.

The negative relationship between herd BI and per cow production is not consistent with published data (Bryant 1982; Grainger *et al.*, 1985). The reason for this is not known, however some farmers suggested that their herd BI did not reflect their herd's overall performance.

Supplementary feeding significantly affected lactation length by allowing farmers to milk their herds for longer and maintain stocking rates slightly above the Tui supplier average, and was more likely to occur on farms with larger effective milking areas. This suggests that economies of scale may be a factor in supplement use (i.e. larger quantities reduced the average fixed cost of supplements).

The positive association between by Olsen P (soil fertility), and per cow production indicates that farms with higher phosphate levels will achieve greater milk output than those with lower phosphate levels, other things being equal. The data suggest that the base soil fertility level is more important than the amount of fertiliser applied and this is in agreement with results for Taranaki soil types (Roberts *et al.*, 1991).

In summary, herds supplying Tui that consistently achieved high per cow production were smaller and run at a higher stocking rate than the average supplier, achieved high peak milksolids production, had a high average BI, were fed reasonable quantities of supplements and were located on farms with a good base level of soil fertility. The farmers were about 10% older than the average supplier, and used a range of management systems for their herds, but in general had a common goal to achieve high per cow production and feed cows well.

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REFERENCES

Bryant, A. M. 1982. Developments in dairy cow feeding and pasture management. *Ruakura Farmers Conference*. 75 – 81.

Graham, N. J.; Mumside, E. B.; Gibson, J. P.; Rapitta, A. E.; McBride, B, W. 1991. Comparison of daughters of Canadian and New Zealand Holstein sires for first lactation efficiency of production in relation to body size and condition. *Canadian Journal of Animal Science* **71:** 293–300.

Grainger, C.; Davey, A.W.F.; Holmes, C.W. 1985. Performance of Friesian cows with high and low breeding indexes. *Animal Production* **40:** 379 - 388.

Holmes, C. W.; Wilson, G. F. (Eds.) 1987. Milk production from pasture. Butterworths. Wellington, New Zealand.

Hughes, A.H.; Parker, W.J.; Anderson, F.M. 1989. May 1988 Survey of MCDC suppliers. Research Report to the Manawatu Cooperative Dairy Company. Department of Agricultural and Horticultural Systems Management, Massey University.

Jasiorowski, H. A.; Stolzman, M.; Reklewski, Z. 1987. International FAO black and white cattle strain comparison (1974–1984). *World Animal Review* **62:** 2 –15.

LIC. 1991. *Dairy Statistics 1990 / 91*. Livestock Improvement Corporation, Hamilton.

MacMillan, K. L.; Henry, R. I.; Taufa, V. K.; Phillips, P. 1990. Calving patterns in seasonal herds. *New Zealand Veterinary Journal* **38:** 151 - 155.

Roberts, A. H. C.; Edmeades, D. C.; O'Connor, M. B.; Thomson, N. A. 1991. The importance of fertiliser for milk production. *Ruakura Farmers Conference* 60 - 65.

SPSS. 1986. SPSS/PC for IBM PC/XT/AT and PS/2. SPSS Inc, Chicago.

TMPL 1993. Annual production statistics. Tui Milk Products Limited, Longburn.