Trends in monthly milkfat production of cows in seasonal dairy herds in New Zealand

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ABSTRACT

Records from cows in herds which were production tested by the Auckland and Taranaki Livestock Improvement Associations from 1960 to 1984 were used in regression analyses to estimate trends in milkfat (mfat) production each month from August to May. The average annual increase in production was 0.84 kg mfat/cow in Auckland compared to 0.75 in Taranaki. This meant that over the period from 1960 to 1984, the estimated increases in production were 20.2 and 18.0 kg mfat/cow in Auckland and Taranaki respectively. In Auckland 14.2 kg of this increase occurred in September, October and November. The increase in Taranaki in these 3 months was 10.6 kg mfat/cow.

Annual increases in production per cow would be greater if the rate of decline in daily production during summer (from December to February) could be reduced. No consistent increases in production have occurred during the autumn because of highly variable seasonal factors.

Keywords Seasonal trends; milk volume; milkfat; milkfat test.

INTRODUCTION

A single seasonally concentrated calving pattern is a feature of dairy herd management in New Zealand. On average, 50% of cows in a herd will have calved by a date 18 d after the planned or expected start of calving (Macmillan *et al.*, 1984b). The concentration of calving within a herd has also increased due to increased conception rates, increased submission rates and to the widespread use of induced premature calving (Macmillan *et al.*, 1984a). It has been suggested that these changes in calving pattern have contributed to a disproportionate increase in milk production during October and November. Capital expenditure to process this extra peak production is not profitably invested unless production increases are spread throughout the season (Paul, 1982).

Reducing the seasonal peak in milk supplied for processing may allow for more efficient use of processing plant, but recent studies have shown that a herd's daily production performance in terms of milk fat(mfat)/cow/d during the peak October-November period is strongly correlated with that herd's relative seasonal production performance (Macmillan *et al.*, 1985). During this period when increasingly higher peaks in October-November production have been creating processing problems, the genetic merit of the National herd has also been increasing. The National production increase calculated as being due to the use of artificial breeding has risen from 1.4 kg mfat/cow/lactation in 1960 to 28 kg mfat/cow/lactation in 1984 (New Zealand Dairy Board, 1985). This predicted increase in production agrees with results obtained in trials comparing Jersey cows with a high (126) or low (101) breeding index (Bryant, 1985).

It has not been determined whether the predicted production increases in mfat production have also been obtained in commercial herds, nor whether any increases have tended to occur during the period of peak production. This study examined both of these aspects using the records from production tested cows processed by the centralised service operated by the Livestock Improvement Division of the New Zealand Dairy Board.

MATERIALS AND METHODS

Averages for production tested cows which were sampled at monthly (30 d) or alternate monthly intervals and which were in herds serviced by the Auckland or Taranaki Livestock Improvement Associations (LIA) for the 1960-61 to 1984-85 seasons (25 years) were analysed to compare annual trends with *month-within-season* trends. The unit of mfat production was calculated as kg mfat/cow/30-day period taking into acount the total mfat produced in a period divided by the average number of cows production tested in a herd in November and December. This parameter is useful to describe changes in milk supply patterns in seasonal herds where most cows calve in August and September. These patterns can be related to average mfat/cow/lactation (season). Linear regression analyses were used to compare trends over the 25 seasons from 1960-61 to 1984-85.

Similar analyses were also made to annual trends in milk volume/cow, mfat production/cow, seasonal average mfat test and average herd size (cows in milk for at least 100 d).

TABLE 1 Average milk production, milkfat production, milkfat test and herd size, and average annual changes in each parameter in herds production tested by Auckland (A) and Taranaki (T) Livestock Improvement Associations (LIA) from 1960 to 1984.

Parameter	LIA	Mean	± RSD[1]	Slope ± SE[2]	1984 Estimate
Milk production (kg/cow/year)	A	2938	151	32 ± 4	3357
	T	2820	187	21 ± 5	3096
Milkfat (kg/cow/year	A	145.1	8.4	0.84 ± 0.23	155.2
	T	147.5	10.6	0.75 ± 0.29	156.5
Milkfat test (%)	A	4.83	0.05	−0.015 ± 0.001	4.63
	T	5.12	0.06	−0.03 ± 0.002	5.09
Herd size (cows/herd)	A	111.7	3.5	3.2 ± 0.1	153.9
	T	106.3	2.8	2.8 ± 0.1	142.4

[1] Residual standard deviation
[2] Change/year (± standard error)

TABLE 2 Average annual change (slope ± standard error) in monthly milkfat production (kg/cow) and residual standard deviation (RSD) among cows in production tested herds in the Auckland (A) and Taranaki (T) Livestock Improvement Associations (LIA) from 1960 to 1984.

Month	Slope		RSD	
	A	T	A	T
August	−0.04 ± 0.02	−0.01 ± 0.03	0.81	1.30
September	0.17 ± 0.02	0.09 ± 0.03	0.77	1.17
October	0.25 ± 0.03	0.20 ± 0.04	0.93	1.33
November	0.18 ± 0.02	0.15 ± 0.02	0.89	0.81
December	0.09 ± 0.02	0.10 ± 0.02	0.77	0.77
January	0.11 ± 0.03	0.13 ± 0.03	0.96	1.17
February	0.06 ± 0.05	0.11 ± 0.06	1.89	2.22
March	0.07 ± 0.06	0.08 ± 0.06	2.10	2.28
April	0.02 ± 0.08	0.03 ± 0.06	2.76	2.32
May	−0.03 ± 0.05	−0.04 ± 0.04	1.88	1.55

RESULTS AND DISCUSSION

The Auckland and Taranaki LIA's are the 2 largest Associations in New Zealand with 52% of the 1 million cows in the former and 63% of the 400,000 cows in the latter being production tested in 1984. This meant that 40% of the 1.3 million cows production tested in New Zealand in 1984 were in the Auckland LIA, and another 19% were in the Taranaki LIA. Although fewer cows were production tested in both associations in other seasons, the minimum number was 67,000 cows (New Zealand Dairy Board, 1985).

The annual average mfat production per cow and the annual average increase in mfat production were similar in both LIA's (Table 1). While the latter figures were significantly different from zero, the estimated increase in production from 1960 to 1984 would be only 20.2 kg and 18.0 kg mfat/cow in Auckland and Taranaki LIA's respectively.

On a monthly basis, the greatest annual increases in mfat production have occurred during September, October and November in the Auckland LIA when increments exceeded 0.17 kg mfat/cow (Table 2). Although the annual monthly increases were less in the Taranaki LIA, the 2 months with the highest increments were October and November (Table 2).

Seasonal factors, particularly drought, have their greatest impact during autumn. These factors produced greater variation in monthly averages as reflected by high residual standard deviations from February to April in both LIA's. None of the annual monthly increases in mfat production from February onwards were significantly different from zero in either LIA (Table 2).

When the figures for annual monthly increments in mfat production were converted to estimated increases between 1960 and 1984 in each LIA, it showed that the largest increases in mfat production per cow have occurred in October in both LIA's (Table 3). Over 70% of the 1960 to 1984 increase in mfat production of 20.2 kg by cows in Auckland LIA was estimated to be obtained in September (20%), October (30%) and November (21%). While the pattern of increases in Taranaki LIA was similar, it was less pronounced (Table 3).

The annual trends in mfat production from 1960 to 1984 were less pronounced than for some other herd and production characteristics. There were significant annual increases in milk production per cow in both LIA's, but particularly in the Auckland LIA where it was 32.2 kg/cow/year (Table 1). It was estimated that in 1984, cows in the Auckland LIA produced 8.4% more milk than cows in the Taranaki LIA (3356 kg *v* 3096 kg). Because mfat yields were similar (Table 1), the mfat test in Taranaki LIA had to be higher than in Auckland LIA (5.09% *v* 4.63%; Table 1). However, there has been a significant decline ($P<0.01$) in mfat test in Auckland LIA of 0.015%/year, whereas it has not changed in Taranaki LIA. This difference will be the result of a greater proportional increase in the use of semen from Friesian sires in the Auckland LIA. Herd size is also increasing at a significantly faster rate in the Auckland LIA (3.2 *v* 2.8 cows/herd/year), with both LIA's showing highly significant annual trends (Table 1). These annual increases in herd size will

TABLE 3 Estimated monthly milkfat production (kg/cow) and production change between 1960 and 1984 among cows in herds production tested by the Auckland (A) and Taranaki (T) Livestock Improvement Associations.

Season	Month	1984 production (kg mfat/cow)		Production change (1960-1984) (kg mfat/cow)	
		A	T	A	T
Winter	Aug	9.5	6.5	−1.0	−1.2
Season total		**9.5**	**6.5**	**−1.0**	**−1.2**
Spring	Sep	18.8	17.0	4.0	2.2
	Oct	23.2	23.0	5.9	4.8
	Nov	22.8	23.0	4.3	3.6
Season total		**64.8**	**63.0**	**14.2**	**10.6**
Summer	Dec	19.9	20.8	2.1	2.3
	Jan	18.7	19.1	2.7	3.0
	Feb	15.5	17.0	1.4	2.5
Season total		**54.1**	**56.9**	**6.2**	**7.8**
Autumn	Mar	13.0	14.2	1.7	1.9
	Apr	9.4	11.0	0.4	0.9
	May	4.9	5.6	−0.7	−1.0
Season total		**27.3**	**30.8**	**1.4**	**1.8**
Lactation Total	Aug-May	155.7	157.2	20.8	19.0

compound the need for increased milk processing capacity during October unless there is either a proportionately similar or greater reduction in the total number of herds or cows.

The estimated increases in annual production from 1960 to 1984 of 20 kg and 18 kg in the 2 LIA's are less than those predicted from sire-use statistics (New Zealand Dairy Board, 1985) or by predicting seasonal production figures from *flush period* production figures (Macmillan *et al.*, 1985). If production increases which have occurred in October were also obtained in most other months, then the annual increase would be over twice the figures shown in Tables 1 and 2. It may be difficult to achieve annual monthly production increases of 0.2 kg mfat/cow in late autumn when seasonal factors are so variable. This should be less of a problem from December to February; yet monthly production figures have changed by less than half of those which occurred in the preceding 3 months in the Auckland LIA.

The concern expressed by dairy companies has been in terms of disproportionately higher increases in milk and mfat production during October. The results of these analyses suggest that the increased rate of decline from October peaks of daily production during the months from December to January are of equal importance to the dairy companies, and of greater importance to herd owners if they are to fully utilise the ability of cows of increasing genetic merit to produce milk and mfat.

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