Epidémiol. santé anim., 1997, 31-32

INCOME OVER FEED COST AND SEASONAL VARIATION IN MILK PRODUCTION IN DAIRY HERDS IN PRINCE EDWARD ISLAND, CANADA

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La relation entre le coût annuel de l'alimentation par vache et les variations saisonnières de production de lait en 1994 a été étudiée pour 72 fermes laitières dans l'île de Prince Edward au Canada. La variation de production a été exprimée à l'aide du niveau de production du cheptel en calculant un paramètre qui exprime la moyenne de lait produit par jour et par vache en automne par rapport au pourcentage de cette moyenne lors du dernier printemps et du dernier été.

En moyenne, la production de lait par jour et par vache a été de 25% plus basse en automne qu'aux printemps et été précédents, les mois présentant le maximum et le minimum d'écart ont été 101% et 45% respectivement.

Le détail des calculs est présenté pour déterminer la moyenne du coût de l'alimentation par vache pendant l'hiver et l'été. La mesure de tous les composants de la ration a été réalisée, la liste complète des techniques de pâturage a été collectée par une enquête en élevage comprenant deux visites d'élevages pendant l'année 1994.

Les moyennes des coûts quotidiens de l'alimentation par vache en hiver et en été ont été respectivement de 4,06$ et de 3,24$ (canadiens). Les recettes provenant de la vente du lait ont été déterminées à partir des niveaux de livraison actuels et des différentes formules de paiement.

Des associations positives ont été trouvées entre le rapport des coûts de nourriture par vache, la moyenne de lait produit par vache et la taille du cheptel. Les cheptels suivis par des tests adaptés sur la production de lait quotidienne tout au long de l'année montrent une diminution des coûts alimentaires par vache par rapport aux troupeaux ayant une variation saisonnière de leur production laitière.

En moyenne, la variation saisonnière dans la production a diminué de 1%, il y a eu une croissance des recettes à travers les coûts de l'alimentation de 21,53 $ par vache.

INTRODUCTION

It has been shown that many herds in Prince Edward Island (PEI) experience a significant decline in individual cow milk production during the summer and fall months of the year irrespective of herd size, genetic index, and level of milk production during the winter months, but that there were also herds that maintained very consistent levels of production throughout the year (E. Hovingh, *submitted for publication*).

Kelton (1995), in a study investigating the productivity and profitability of Ontario dairy herds, found that annual income over feed cost per cow (IOFC) was not related to the amount of seasonal variation in adjusted corrected milk production. Adkinson et al. (1993) found, however, that the 10 percent of herds in Louisiana with the highest IOFC had less seasonal variation in daily milk yield per cow than all herds.

The primary objective of this study was to explore the relationship between the amount of seasonal variation in daily milk production per cow in PEI during 1994 and the IOFC. In addition, the relationship between the daily summer and winter feeding costs and the seasonal variation in production was examined as was the relationship of herd factors with the IOFC.

MATERIALS AND METHODS

All dairy herds that had individual cow milk production information in the Animal Productivity and Health Information Network (APHIN) database (Dohoo 1992) for the calendar year 1992 were included in the initial sampling pool. Monthly figures for average test day milk production during 1992 were electronically downloaded along with a unique herd identification number. A parameter that represented the amount of decline in production during the summer and fall months was calculated for each herd. This variable, SLUMP, was calculated as the ratio of the minimum test day production during September, October and November to the maximum test day production during May, June and July.

The 45 herds that experienced the most significant decline in production and the 45 herds that experienced the least amount of decline were enrolled in the study.

Each farm selected for the study was visited twice in 1993 and twice in 1994, once near the end of the stabling period (April) and once during the latter part of August. Only the data collected in 1994 was used in this analysis. The daily quantity of each feed that was fed to the lactating cows was recorded on a per cow basis. This was recorded by production group (high, average, and low groups) if the amount fed was proportional to the milk production level. In these instances the farm specific cut points dividing the production groups were ascertained. Data from the APHIN database were used to determine the percentage of milk tests occurring

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within each range during February, March and April. A herd average amount fed per cow for each feedstuff was calculated using these group percentages as a weighting factor. The summer stored ration was recorded in a similar manner, and the milk production records for July, August and September were used to weight the group specific data.

Samples of all available forages, grains and concentrates were taken to determine the dry matter, protein and energy content, except where a commercially prepared product with a known composition was being fed. In this case, enough details about the product were recorded so that the dry matter, energy and protein levels could be ascertained from other sources at a later time. In almost all instances, the actual weight of the feedstuffs fed to the cows was also measured and recorded.

In the case of forages fed *ad libitum* or where total mixed rations were fed, the total dry matter intake was calculated based on the average dry matter intake expressed as a percent of body weight of cows of similar breed and size that were also included in the study and had complete feed data available.

Prices for hay and silage were obtained from the 1994 PEI Dairy Cost of Production Study (Harris & Parlee, 1995). These were used to determine the cost of stored forages fed to the cows. Prices for commercially prepared pelletized and mixed rations, and other supplements, were obtained from the suppliers of the products. Grain prices were available from the local grain elevator. Where rations had been prepared on farm, the price was calculated based on the protein concentration of the completed mix. Using barley grain as a base, the amount of a commercially available 38 percent protein concentrate needed to reach the measured protein level was determined and the price of the resulting ration calculated. Cull potato prices were obtained by surveying a number of producers who utilized this feed. Where total mixed rations or partially mixed rations were fed the cost per tonne was calculated strictly on the basis of the components included in the mix.

The winter daily feed cost per cow was calculated by adding all the costs from the winter ration components. The summer daily feeding costs included the costs of the stored feeds that were fed during the summer as well as the pasture costs per cow per day.

Information regarding pasture management was collected by means of a questionnaire that listed of all the pasture fields utilized on a farm. It included, among other things, information regarding the field size, the method of access to the fields and the details of any fertilizer, lime or reseeding utilized.

Total pasture costs were calculated based on the information collected and this was divided by the average number of cows being fed on pasture during the months of May to September. This figure was then divided by a constant 153 grazing days across all farms to arrive at the total pasture cost per cow per day.

Records of individual cow milk production were available from the APHIN database for all study herds. Herds, and animals within herds, were identified by unique identification numbers. These data were used to calculate monthly summary statistics for the average daily production and the number of animals milking. Total monthly milk shipments for each herd were available from the PEI Milk Marketing Board, as were the pricing formulas required to calculate the total milk revenue for each farm for each month during 1994.

Revenue from milk sales was calculated for each herd on a monthly basis from total milk shipments and the pricing formulas provided by the PEI Milk Marketing Board.

The total daily feed costs per cow were used to calculate the total monthly feeding cost for a lactating cow. Daily summer feed costs (pasture plus stored feed) were used in the calculation of costs for the months of May to September, and the remaining months were based on the daily winter feed costs (stored feed). The total monthly cost per cow was multiplied by the number of cows milking in each month as reported in the APHIN database. In the case of missing data in the event of a missed monthly test, the number of cows milking was calculated as the average of the number milking during the previous and following months. The total milk revenue in excess of feed costs for each month was then calculated. These monthly totals were summed to arrive at the IOFC.

Two-way scatter plots were used to examine the relationships in the data. Simple linear regression was used to determine the coefficient of the independent variable ( ), the percentage of the variation in the dependent variable accounted for by the independent variable (R^2) and the significance level of the relationship (P). Regression diagnostics included examination of the residual scatter plots for heteroscedasticity, and examination of the leverage values for points of high leverage. Formal statistical tests were used to determine the presence of heteroscedasticity (Cook-Weisberg test), missing variables (Ramsey test) and the impact of the individual values of the independent variable on the regression coefficient (DFBETA).

RESULTS

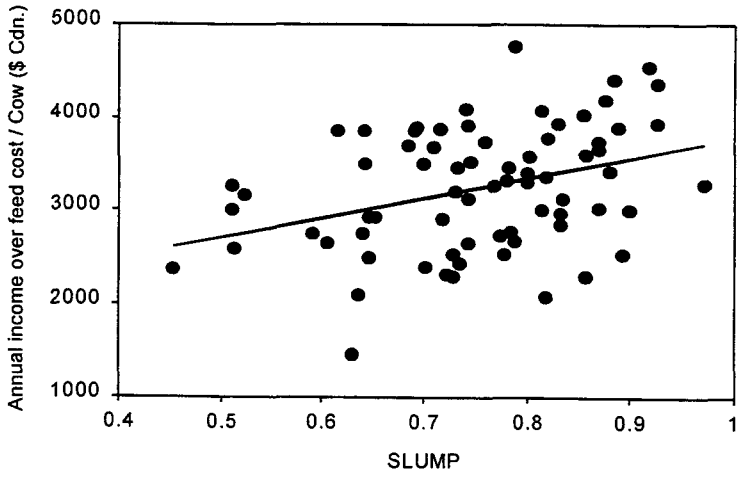
Seventy two herds of the ninety herds in the original study group contributed to the economic analysis. Six producers had ceased production during the study, three shipped only cream and were judged to have sufficiently different enterprise dynamics to warrant their exclusion, and two were removed from the study for other reasons. The remaining seven herds were not included in the economic analysis due to missing milk production data or an inability to accurately calculate daily feed costs.

The 1994 SLUMP parameter for the study herds was normally distributed with a mean of .75 and a standard deviation of .11. There was a wide range of daily feed costs, both during the summer (mean $ 3.24 CDN., SD .88) and during the winter (mean $ 4.06, SD .83). Of the 72 herds with complete economic data, only four did not utilize any pasture as a feed source. The IOFC was normally distributed with a range of $1453.57 to $4753.64, a mean of $3238.74 and a standard deviation of $664.12.

Figure 1 depicts the relationship between IOFC and SLUMP. There was a general upward trend in IOFC as the seasonal variability in production declined. On average, as the seasonal variability decreased by .01 there was an increase in annual income over feed costs of $21.53 (Cdn.) per cow.

As summer daily feed costs increased there was less decline in production during the summer and fall months (= .06, R^2 = .22, P < .01). There was no significant relationship between winter daily feed costs and SLUMP. Positive relationships were also found between the IOFC, average daily production per cow and herd size.
There was a very weak positive relationship between the average daily summer feed costs and the IOFC (= 144.63, R^2 = .03, P = .11), while there was no significant relationship between the average daily winter feed costs and the IOFC (= 14.34, R^2 = .00, P = .88).

Figure 1 : Scatter plot of Annual income over feed cost per milking cow ($ Cdn.) versus SLUMP parameter for 72Prince Edward Island dairy herds during 1994. β = 2153.20 R^2 = .13 P<.01.



DISCUSSION

The actual amount of stored feed used per lactating cow was measured on all farms in the present study. Farm specific feed costs were determined as accurately as possible, though calculating the farm specific costs of production for hay, silage and grain was beyond the scope of this study. The use of farm specific costs associated with pasture utilization allowed for an accurate estimate of the average daily cost per cow for the summer period. It would be expected that the method used to calculate feed costs should approximate very closely the actual overall cost, since the calculations account for farm-to-farm differences in feed quality, utilization efficiency and wastage.
The relationship between SLUMP and the IOFC (Figure 1) suggests that the IOFC was reduced in herds that experienced significant seasonal variation in milk production compared to herds that demonstrated consistent production throughout the summer and fall months. The positive association of average summer daily feed cost per cow and the SLUMP parameter implies that an increase in the average summer daily feed cost per cow should result in less seasonal variation in average test day milk production. Since there is a close association between monthly test day milk production and monthly total milk shipments from the farm (E. Hovingh, unpublished data), a decrease in the seasonal variation of individual cow milk production should result in more stable milk shipments. This is especially important in many quota based milk production systems (Dingwell, 1996).
Although there was a positive relationship between summer daily feed costs and SLUMP and between SLUMP and IOFC, it appears that there was enough variability in the data so that there was not a significant relationship between summer daily feeding costs and IOFC. Adkinson et al. (1993), in a model controlling for the amount of silage and hay fed, demonstrated a positive response in milk production and a negative response in IOFC when concentrate feeding was increased. However, when concentrate feeding was controlled for, there was a positive response in milk production and IOFC in response to an increased level of silage feeding. These opposing results could be part of the reason for not observing a more significant relationship between IOFC and the daily summer feeding costs per cow in the present study. Further investigation into these relationships is warranted. It must also be remembered that the IOFC as defined in the present study does not account for all of the variable costs of production, and as such, care must be taken in interpreting the results.

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