

# Effects of spring-calving compared to autumn-calving on the lactation curve and milk quality in Norwegian herds

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## ABSTRACT

The objective of this work was to study the effects of spring calving in comparison with autumn-calving on the trajectory of both milk yield and quality (percentages of protein, fat and lactose, and also somatic cell counts (SCC) and urea). On average, autumn-calvers had 0.8 and 1.2 kg higher daily milk yield and ECM (energy-corrected milk), respectively, than those calving in the spring, due to a higher yield in mid- and late lactation. Milk fat and lactose were also higher and SCC lower for those calving in autumn, and the reduction of protein and fat percentages in early lactation was lower. These results suggest that maintaining a high milk yield is a greater challenge for spring-calving cows on pasture feeding than for autumn-calving cows fed indoors.

KEY WORDS: lactation curve, autumn, spring, milk quality

## INTRODUCTION

In Norway, the frequency of cows calving in spring is significantly lower than the frequency of cows calving in autumn. This has led to an imbalance between the production and demand of milk, with a lack of milk supplied during the summer. For the farmers, increased milk production at pasture through a change of period of calving, may reduce feed costs and improve milk quality (Garcia and Holmes, 2001). The objective of the present work was to study the effects of spring-calving compared with autumn-calving on milk yield and contents of milk protein, fat, lactose, somatic cell count (SCC) and urea in Norwegian dairy herds.

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## MATERIAL AND METHODS

Individual test-day data for Norwegian Red, comprising two years (2002 to 2004) from the Norwegian Dairy Herd Recording system, were used. From these data, cows calving in April and in September were sampled to represent spring- and autumn calving, respectively. In the recording system, milk yield and concentrate supply are normally recorded for each cow monthly, whereas milk content traits (protein, fat, lactose, urea and SCC) are recorded every second month. For each group, cows with at least two observations in the period from calving until 40 weeks in milk (WIM) were kept. Protein, fat, lactose, urea and SCC were determined using an infrared milk analyser (MilkoScan, Foss Electric, Hillerød, Denmark). The dataset for milk and concentrate comprised a total of 284.544 records from 11.101 different herds and 31.121 individual lactations of which 40% calved in the spring and 60% in the autumn. The corresponding dataset for milk components contained 76.044 records. Data were analysed for fixed effects of spring- or autumn-calving, parity, WIM, interaction of region and year, and these factors interactions with calving-season by PROC GLM of the SAS software (SAS Institute Inc., Cary, USA). Analysis of SCC was based on log<sub>e</sub> transformed test-day observations (SCS).

## RESULTS

Least-square means of average daily milk yield, milk components, and concentrate supply, grouped according to calving period are presented in Table 1. The corresponding values during the lactation period, within lactation number, are shown in Figure 1. Cows calving in autumn were given on average 0.8 feed

Table 1. Least-square means of daily milk yield, ECM and milk components for spring- and autumn calving cows, respectively

	Spring		Autumn		Calving-season		Curvature <sup>1</sup>	
	mean	SEM	mean	SEM	F	P	F	P
Milk yield, kg	21.9	0.016	22.7	0.013	1651	***	84.1	***
ECM <sup>2</sup> , kg	22.1	0.039	23.3	0.030	528	***	17.6	***
Protein, %	3.35	0.002	3.33	0.002	33.5	***	33.9	***
Fat, %	4.12	0.006	4.17	0.005	31.1	***	12.5	***
Lactose, %	4.61	0.001	4.66	0.001	599	***	52.0	***
SCS <sup>3</sup> , 1000/mL	4.22 (147) <sup>4</sup>	0.009	4.05 (120)	0.007	244	***	4.5	***
Urea, mmol/L	5.1	0.010	5.0	0.008	71.2	***	60.0	***

<sup>1</sup> milk yield and ECM three way interactions of calving-season × lactation number × weeks in milk, otherwise two ways excluding lactation number; <sup>2</sup> ECM = energy corrected milk; <sup>3</sup> somatic cell score (log<sub>e</sub> transformed somatic cell count); <sup>4</sup> arithmetic means in brackets

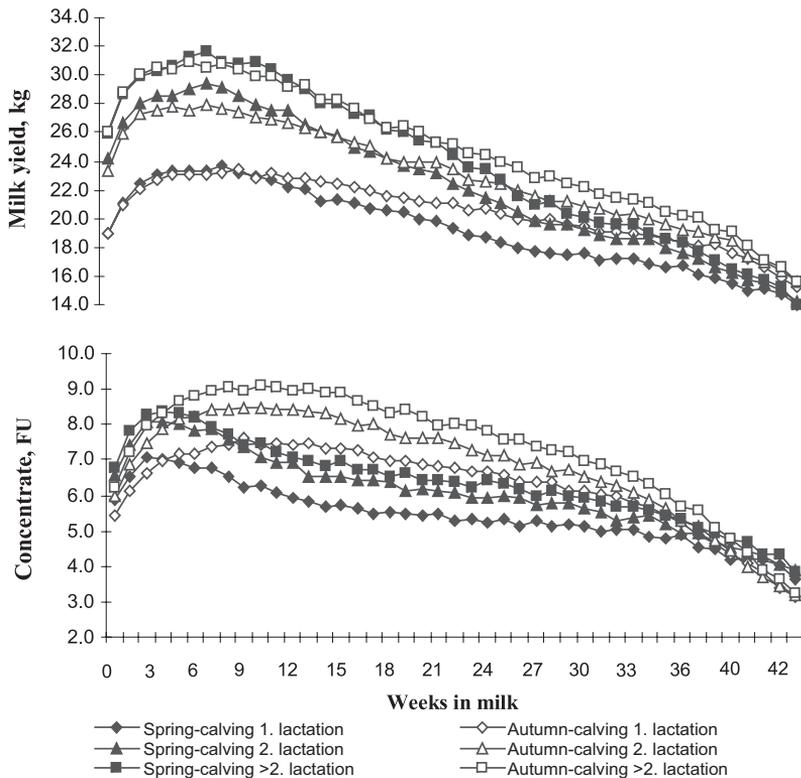


Figure 1. Least-square means of daily milk yield and concentrate supply, by calving season  $\times$  lactation number  $\times$  weeks in milk

units (FU) more concentrate and had a daily milk yield and ECM of 0.8 and 1.2 kg higher than the spring-calvers, respectively. Milk from autumn-calvers had also a significantly higher content of fat and lactose, and a significantly lower SCS. Calving period had no effect on the amount of concentrate offered, milk yield or milk quality during indoor feeding the first weeks of the lactation. Most of the spring-calvers turned to pasture at 4 to 6 WIM. In spite of lower concentrate supply during the first weeks at pasture, the spring-calvers maintained the milk yield at the same level as the autumn-calvers most of the period at pasture. Thus, it is during the last period at pasture and in the following indoor feeding period the spring-calvers produce less milk than the autumn-calvers. The autumn-calvers are at spring pasture in the corresponding stage of lactation. The drop in milk production of spring-calvers relative to autumn-calvers, occurred earlier for primiparous cows compared with multiparous cows (Figure 1). For milk components the interaction between calving season and lactation number were only of minor importance ( $1.36 < F < 3.39$ ). Hence, the trajectory of milk protein

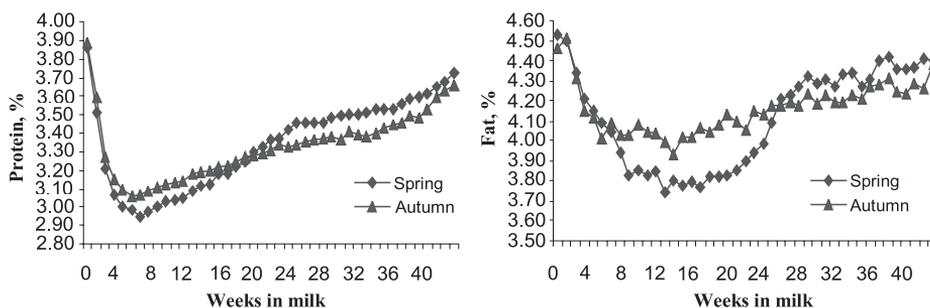


Figure 2. Least-square means of content of milk protein and fat by calving season x weeks in milk

and fat content are presented across lactation numbers (Figure 2). The milk of spring-calvers had lowest concentration of fat, but also protein in early lactation at pasture, but they were highest in late lactation. The curve for lactose had the same shape as that for milk yield (results not shown). Spring-calvers also had higher milk urea in mid lactation than did autumn-calvers (results not shown). It is also worth noting the higher SCS of spring-calving cows in mid lactation, but this will not be discussed further.

## DISCUSSION

In Norway, cows are normally at pasture from May to September, the length being somewhat dependent on region. Spring-calvers will therefore be in their peak lactation (4 to 6 WIM) at the start of the grazing season. For cows calving in the autumn, most of the milk production will be based on indoor feeding and only the late lactation will be at pasture. High yield in spite of reduced supply of concentrate to spring-calved cows was probably due to high quality pastures in spring and early summer, consistent with observations in an earlier Norwegian study (Olesen et al., 1999). Garcia and Holmes (2001) also found a more peaked lactation curve of spring-calving cows than that of autumn-calving cows, the difference being due to a higher yield in peak lactation and a lower yield in mid and late lactation. However, autumn-calving cows may have a “second” peak during the following spring associated with a greater availability and quality of pasture in spring (Garcia and Holmes, 1999). The variable access and quality of pasture strongly affect the shape of the lactation curve and might also result in that milk production will in some periods rely on body condition loss (Garcia and Holmes, 1999). Poor quality pasture at the end of the grazing season will probably be the main reason for the reduced milk yield for spring-calving cows in mid and late lactation. The high content of milk urea by spring-calving cows in mid lactation

may be due to a high level of non-protein nitrogen in late summer pasture, but may also indicate a lack of energy for the rumen microbes and thus, a lower utilization of the protein in the rumen. The lower milk protein content of spring-calvers in early lactation is likely attributed to deficiency of energy, and probably also of aminogenic- and glucogenic substrates, while the low milk fat content may be due to low fibre content in spring and early summer pasture.

## CONCLUSIONS

In Norway, the lactation curve is more peaked for cows calving in spring than for those calving in autumn. This is due to a lower milk yield for spring-calving cows than for autumn-calving cows in late lactation. In early lactation, especially fat, but also milk protein content were lowest for spring-calvers. The results may be explained by the reduced concentrate supply and the variable access and quality of the pasture during late summer. These results suggest that it is a greater challenge to keep a high milk production in spring-calving cows on pasture, compared with indoor-fed autumn-calving cows.

## REFERENCES

- Garcia S.C., Holmes C.W., 1999. Effects of time of calving on the productivity of pasture-based dairy systems: A review. *N. Z. J. Agr. Res.* 42, 347-362
- Garcia S.C., Holmes C.W., 2001. Lactation curves of autumn- and spring-calved cows in pasture based systems. *Livest. Prod. Sci.* 68, 189-203
- Olesen I., Lindhardt E., Ebbesvik M., 1999. Effects of calving season and sire's breeding value in dairy herd during conversion to ecological milk production. *Livest. Prod. Sci.* 61, 201-211