Introduction

The production capability of dairy cows is, at present, one of the main characteristics on which their selection is based. In determining this they are generally given rations high in concentrates. The question that arises is whether the selection decision would remain the same if the cows were fed on rations with a high roughage content. Conrad et al. (1964) have suggested that the mechanisms regulating the intake of the feed may vary according to its digestibility.

Although the knowledge of the interaction between genotype and nutrition in dairy cattle is limited (Korver, 1982), its importance was studied in some experiments within a breed (e.g. Richardson et al. (1971), Lamb et al. (1977)). The exchange of semen of dairy and/or dual purpose breeds between countries in Western Europe has greatly increased during the recent years. These breeds were selected in different environmental circumstances (e.g. different feeding regimes).

Korver (1982) has studied the importance of the interaction between genotype and ration on feed intake, milk production and live weight change during the lactation. The results will be described in part in this paper. Dutch Friesians (DF) and the Holstein- and Dutch Friesian (HF) crosses were used as genotype groups in this experiment. These cows were kept on either a high or a low concentrate ration (Concentrate and Roughage group).

Material and method

The DF (n=45) and the HF (n=46) groups formed a part of the comparison trial between Dutch Friesians and the crosses between Friesian subpopulations (Politek et al., 1982). The animals were in their second or later lactation and were allocated to two rationing systems within a genotype group on the basis of calving date, milk production and live weight in their first lactation, and on the number of lactation.

All cows were fed roughage (hay) ad libitum but one half of their number received a low concentrate ration (570 kg concentrates over the total lactation) (Roughage group) and the other half was fed a high concentrate ration (2300 kg concentrates over the total lactation) (Concentrate group). The concentrates were offered independently of the level of milk production but were divided over
the lactation in three fixed steps within a treatment. The variation in milk production within a genotype-ration group was dependent on the variation in roughage intake, live weight change and/or utilization of nutrients. One kg concentrates contained 940 VEM (1 VEM = 6.908 kJ Net Energy) and 120 grams digestible protein. The roughage offered was analysed weekly for in-vitro digestibility and composition.

The concentrate steps generally corresponded with three physiological stages of lactation (e.g. Bines, 1976) and these periods were analysed separately. The energy intake per period was based on the concentrate intake and the average dry matter roughage intake. This roughage intake was recorded for individual cows over a period of one week every 3 or 4 weeks. The milk yield and composition were determined once a week and was presented as the milk energy equivalence (FPCM) (FPCM = (0.349 + 0.107 * Milk Fat percentage + 0.067 * Milk Protein percentage) * Milk Yield - Korver, 1982). The weight change was taken as the difference in live weight between the beginning and end of the period.

These characteristics were analysed by the method of least squares (Harvey, 1977) for each stage of lactation using a linear model with the following effects: genotype, ration, number of lactation, days open and the interaction between genotype and ration.

Results and discussion

Energy intake. The effect of ration was significant (P < 0.05) and the mean contrasts in VEM per day for the three stages of lactation were 3583, 3469 and 3016 respectively (table 1, fig. 1) in favour of the concentrate groups. Over the whole lactation the energy intake of the roughage groups was approximately 21% lower than that of the concentrate groups. In contrast to this the roughage groups had a dry matter roughage intake about 22% higher than the concentrate groups. This shows that the rations produced different nutritional environments. The genotype-ration interaction was not significant and this agrees with the reported results of Lamb et al. (1977) for Holstein Friesian progeny groups in the first lactation.

The genotype effect was significant (P < 0.05) only during weeks 29-40 of the lactation, the mean contrasts between both DF and both HF groups in the three periods being 348, 424 and 451 VEM per day respectively in favour of the HF groups. These differences were caused by a 5% difference in roughage dry matter intake.

Table 1. Least squares means of the energy intake (VEM d⁻¹), fat protein corrected milk (FPCM) (kg) and live weight change during the lactation (kg) per genotype-ration group per period of the lactation (I = week 1-12, II = week 13-28, III = week 29-40)

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Table 1 includes the VEM value (1 VEM = 6.908 kJ Net Energy)
Milk energy equivalence (FPCM). The interaction between genotype and ration on FPCM yield was not significant (P > 0.05) in the three stages of lactation. Richardson et al. (1971) reported an interaction term on FPCM yield which approached significance (0.10 < P < 0.05) and Lamb et al. (1977) observed a significant interaction in one trial. The interactions were probably caused by the amount of concentrates in the high concentrate groups, these varying per individual with the level of milk production.

The ration effect was significant in all three periods of the lactations. FPCM production by the concentrate groups exceeded that of the roughage groups by 398, 529 and 321 kg in periods 1, 2 and 3 respectively (table 1). The contrast increased from 15.7 to 26.8% over the course of the lactation possibly because of the differing changes in weight between ration groups related to the stage of lactation. Contrasts (Roughage-Concentrate ration) over the whole lactation for milk yield, FPCM yield, milk fat and milk protein were -1259 kg, -1249 kg, +0.04 10^-g kg^-1 d^-1 and -0.05 10^-g kg^-1 d^-1 respectively.

The genotype effect was significant and the contrasts (kg) between DF and HF in the three stages of the lactation were -110, -207 and -118 respectively. The greatest daily effects were found in the middle of the lactation suggesting a difference in persistency between these two groups of genotypes in these feeding circumstances. Over the whole lactation the contrasts (DF-HF) in milk yield, FPCM yield, milk fat and milk protein were -594 kg, -345 kg, +0.21 10^-g kg^-1 d^-1 and +0.08 10^-g kg^-1 d^-1 respectively.

Live weight change. No significant genotype-ration interaction was observed on the live weight change during the lactation. However, figure 1 shows a tendency for an interaction (P = 0.11) in the first stage of the lactation. The DF-genotype had possibly more body reserves at the beginning of the lactation which may be useful on the roughage ration. The effect of the genotype was not significant during the lactation and the ration effect was only significant in week 1-12 (contrast: 29 kg).
SUMMARY

Two subpopulations of dairy cows (total n = 91), characterized as Dutch Friesians and the crossbreds between Holstein- and Dutch Friesian, were used to estimate the effect of genotype, ration and interaction between these two components on feed intake, milk production (milk energy equivalence) and weight change during the lactation. All cows were fed roughage ad libitum but one half of the cows received a high roughage ration (570 kg concentrates total lactation) and the other half was fed a high concentrate ration (2300 kg concentrates total lactation). For the mentioned traits interactions between genotype and ration were not significant (P < 0.05) during three periods of the lactation (week 1-12, 13-28 and 29-40). The contrasts between genotypes for milk energy equivalence increased with the stage of lactation (total lactation 7.6%). The ration contrast for the total lactation was 20.3%. The observed contrasts between rations and genotypes for net energy intake were for the total lactation about 21 and 3 percent respectively. The effects on weight change were mainly expressed in the first part of the lactation.

RESUMEN

Dos grupos de vacas lecheras (en total n = 91), caracterizados como Dutch Friesian y las cruzas entre Holstein y Dutch Friesian, fueron usados para estimar el efecto del genotipo, ración e interacción entre estos dos componentes sobre consumo de alimento, producción de leche (expresada en energía equivalente de la leche) y cambio de peso durante la lactancia. Todas las vacas fueron alimentadas con forraje grosero ad libitum, pero una mitad recibió una ración con alta proporción de forraje (570 kg de concentrado en toda la lactancia) y la otra mitad recibió una ración baja en forraje (2300 kg de concentrado en toda la lactancia). Para las características mencionadas, las interacciones entre genotipo y ración no fueron significativas (P < 0.05) durante tres etapas de la lactancia (semanas 1-12, 13-28 y 29-40). Los contrastes entre genotipos para leche, en energía equivalente, aumentaron con la etapa de lactancia (7.6% para la lactancia completa). El contraste de las raciones para la lactancia total fue 20.3%. Los contrastes observados entre raciones y genotipos para el consumo de energía neta fueron alrededor de 21 y 3 por ciento respectivamente, para toda la lactancia. Los efectos sobre el cambio de peso se expresaron principalmente en la primera parte de la lactancia.

RÉSUMÉ

Deux subpopulations de vaches laitières, caractérisé comme Néerlandais Frisons et des croisés Holstein Frisons et Néerlandais Frisons, étaient utilisés pour estimer l'effet du génotype, de la ration et l'interaction de ces deux facteurs sur la consommation alimentaire, la production de lait (en équivalents d'énergie) et le changement de poids au cours de la lactation. Les vaches avaient accès à des fourrages ad libitum, la moitié de chaque groupe recevant une quantité totale de 570 kg de concentrés par vache pour la durée de la lactation, l'autre moitié une quantité de 2300 kg. Les interactions génotype-ration pour les paramètres mentionnés n'étaient pas significatives pendant les trois périodes.
de lactation (1\textsuperscript{e} - 12\textsuperscript{e}, 13\textsuperscript{e} - 28\textsuperscript{e} et 29\textsuperscript{e} - 40\textsuperscript{e} semaine). La différence entre les génotypes pour l' équivalent énergétique de lait augmentait avec la stade de lactation (7.6\% pour le total de la lactation). La différence due à la ration était de 20.3\% pour le total de la lactation. Les différences observées entre rations et génotypes étaient respectivement 21 et 3\% pour la quantité de consommation d' énergie nette durant la lactation. Les effets sur le changement de poids (corporel) étaient surtout prononcés pendant la première partie de la lactation.

References


