"Feed less Food"
Low input strategy results in better milk quality in organic dairy goats

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Abstract

More than a third of the world's grain harvest is used to feed animals. According to the environmental agency of the UN, losses of calories by bad conversion factor of grain into animal food could theoretically feed 3.5 billion people. This shows that the production of animal protein is very energy consuming, especially when concentrates are fed to ruminants. Until today, feeding of ruminants even in organic dairy farming is based on concentrates, accepting overexploitation of resources and negative effects on animal health. In contrast to the received opinion of "a lot helps lot", organic dairy production in Western Europe is trying to do the very reverse: Feeding less concentrates. This is in line with the evolution of ruminants to an excellent roughage converter, especially dairy goats are destined to produce high quality milk at a minimum amount of concentrates in their ration. In our study we wanted to evaluate effects of a low concentrate diet of maximum 10 % of the total annual dry matter intake per dairy goat (KF10) compared to a 40 % diet (KF40). As was expected, milk yield of KF10-group was lower, but fatty acid composition was more valuable using less concentrates. Omega-3 fatty acid and conjugated linoleic acid (CLA) were found to be significantly higher in the milk of the KF10 dairy goat group throughout the whole lactation. Thus, less can be more in terms of quality and taste.

Key words: dairy goats, world population, feeding concentrates, milk yield, animal welfare

Introduction

To provide the rising world population with sufficient and high quality food in the future, we must ensure that food production can be increased gradually (Rahmann and Oppermann 2010). According to the FAO, an increase in food production of only 20 % can be achieved through an expansion of agricultural land. The remaining 80 % of food production must be met by increasing yields of agricultural livestock production systems (Rahmann and Oppermann 2010).

Currently 11 % of the global land is arable land. That is a total of 1.4 billion hectares, of which annually about one billion tons of concentrates or one third of the world's grain harvest respectively, are used in animal production (Rahmann and Oppermann, 2010; Notz 2010). According to Steinfeld (2006), this quantity is sufficient to feed about 15 billion chickens, 1.7 billion sheep and goats, 1.4 billion cattle and 0.9 billion pigs. The increasing demand of producing bio-energy on farm land is another deficiency area regarding global food supply. For example, the use of grain and corn for food and feed increased since 2000 by 4 % and 7 %. In contrast, industrial use of cereals for bio-energy production increased at the same time by 25% (Brockmeyer and Klepper, 2008). In the U.S., 30 % of the corn harvest is used for the production of bioethanol (Brockmeyer and Klepper 2008).

Ruminants can be divided into three feeding types: concentrate selector (CS), grass and roughage eaters (GR) and intermediate types (IM) (Hofmann 1989). CS-types include deer and elk, whereas cattle and sheep are all grazers (GR). Goats together with chamois, red deer, fallow deer belong to the IM types. IM-types are able to browse bushes and even trees besides consuming traditional ruminant diets. The additional source of food ingredients also widens up the goat diet by tannins, which cannot be utilized by GR-types. Goats are generally very selective in choosing food with ingredients of the highest quality, thereby optimizing their roughage ration. Due to their anatomical advantages and excellent roughage conversion, goats are destined to produce high quality milk at a minimum amount of concentrates in their ration. Thus, our major goal in this study was to measure effects of a low concentrate diet on fatty acid composition and milk yield of organic dairy goats.

Material and Methods

In 2011, 50 dairy goats of our experimental herd were divided into two homogenous groups of 25 goats each, considering parity, milk yield and body weight of individuals. One group (KF10) was fed according to the Bio Suisse guidelines with a 10% concentrate proportion of annual ration and the other group (KF40) in accordance with the requirements of the EC regulation on organic farming with a 40% concentrate portion of the annual ration fed. The concentrate consisted of 100 % wheat grist. Mineral licks were made available. Part-time grazing was offered to both groups during the growing season. During the entire lactation there was extensive monitoring of the herd. According to the standards, monthly milk recordings and bodyweight controls were made. Every two weeks, feed samples were taken (concentrate, hay and fresh grass) and analyzed. Milk samples were taken weekly and monthly to assess milk composition. Data recordings were statistically analysed using SAS 9.3 (SAS Institute Inc.). Test of normality was done by calculating Shapiro-Wilk-test (proc univariate). Where appropriate, t-test or non-parametric test procedures were used to compare group means, box-whisker plots were created to illustrate data distributions.

Results

Figure 1 shows the annual performance regarding milk yield, fat and protein content. The fatty acid compositions are of monthly samples. Milk yield of KF10 was 68.8 kg, and fat and protein contents were respectively 4.1 and 2.4 kg lower compared to KF40. The annual amount of concentrates for KF10 was 66 kg/goat, whereas it was 259 kg/goat for KF40.

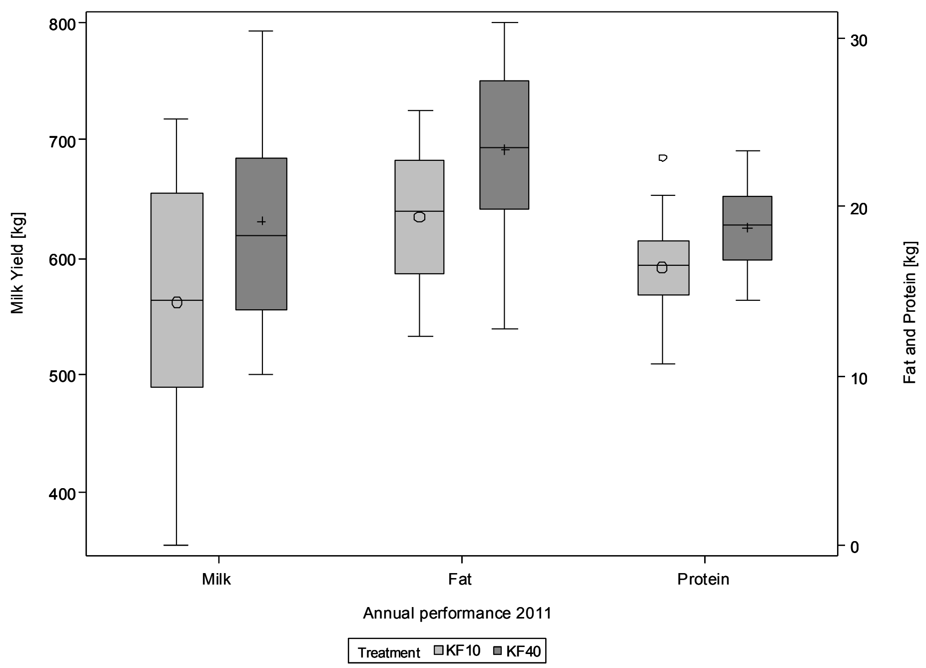

Figure 1. Annual milk, fat and protein yield of goats fed according to Bio Suisse guidelines (KF10) and EC regulation on organic farming (KF40).

The content of Omega-3 fatty acid as described in Figure 2 shows higher Omega-3 values of KF10 at every sampling date. The difference of omega-3 content between KF10 and KF40 was highly significant during the whole lactation period.

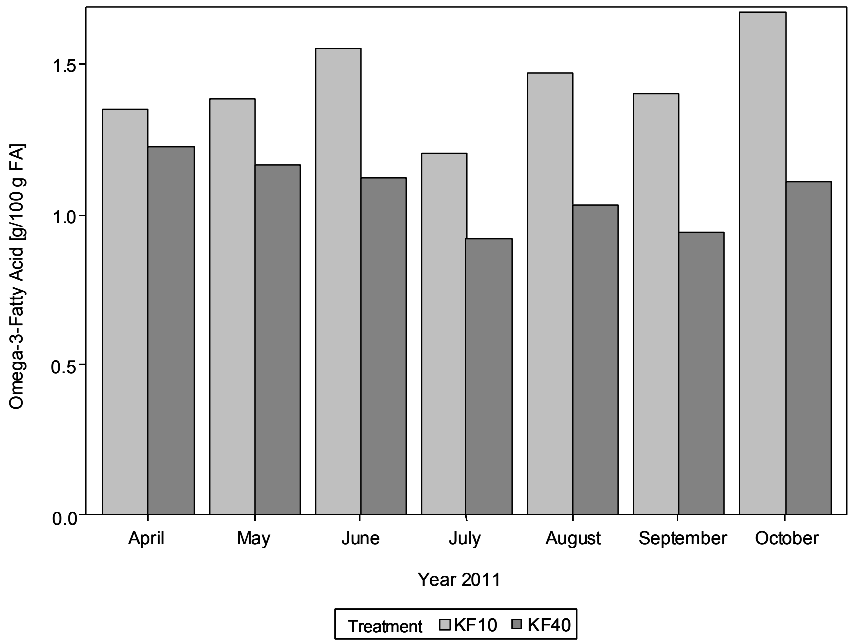

Figure 2. Omega-3 fatty acid content in milk of organic dairy goats fed according to Bio Suisse guidelines (KF10) and EC regulation on organic farming (KF40).

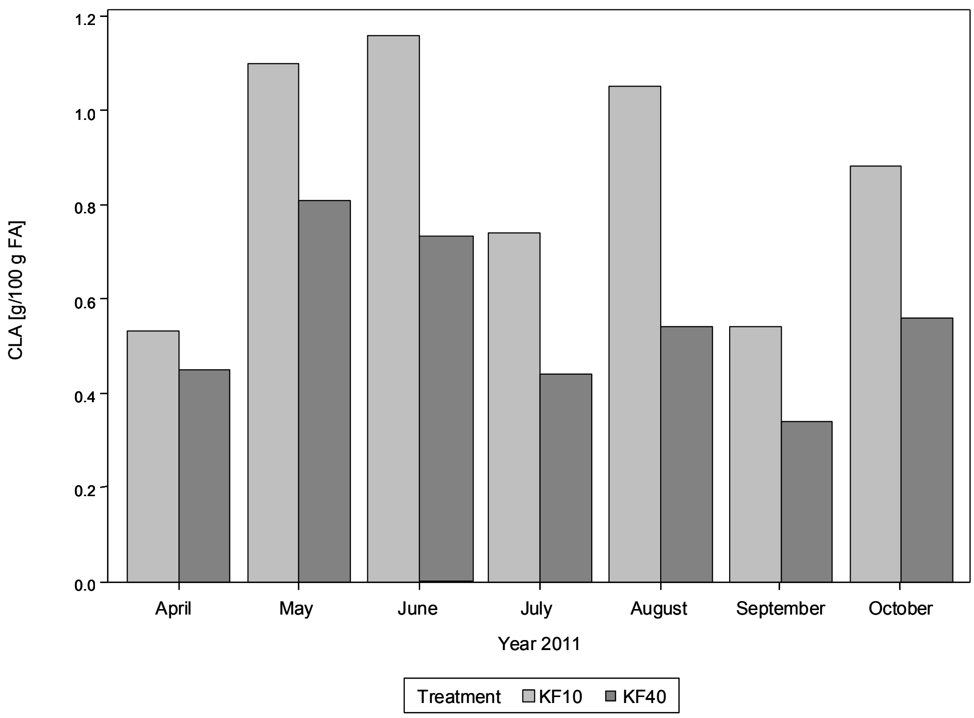

Figure 3. Conjugated linoleic acid content in milk of organic dairy goats fed according to Bio Suisse guidelines (KF10) and EC regulation on organic farming (KF40).

Conjugated linoleic acid content (CLA, C18:2 c9t11), as an example of fatty acids analyzed in this study, was higher in KF10 throughout the whole lactation period (Figure 2). The slight depression for both groups in September was due to indoor housing and hay feeding. Body weight of goats was significantly lower for KF10 during the last three months of lactation. Health status was checked regularly for both groups and did not show any difference.

Conclusions

The results indicate that less concentrate feeding is feasible. Feeding less concentrates results in a better quality of the final product milk regarding favourable Omega-3- and CLA-content.

Suggestions to tackle the future challenges of organic animal husbandry

Future studies should quantify selective abilities of goats as a base of breeding selection. Breeding strategy regarding low concentrate should consider roughage conversion ability of dairy goats, in order to select the best roughage converting goats, not concentrate adopted goats.

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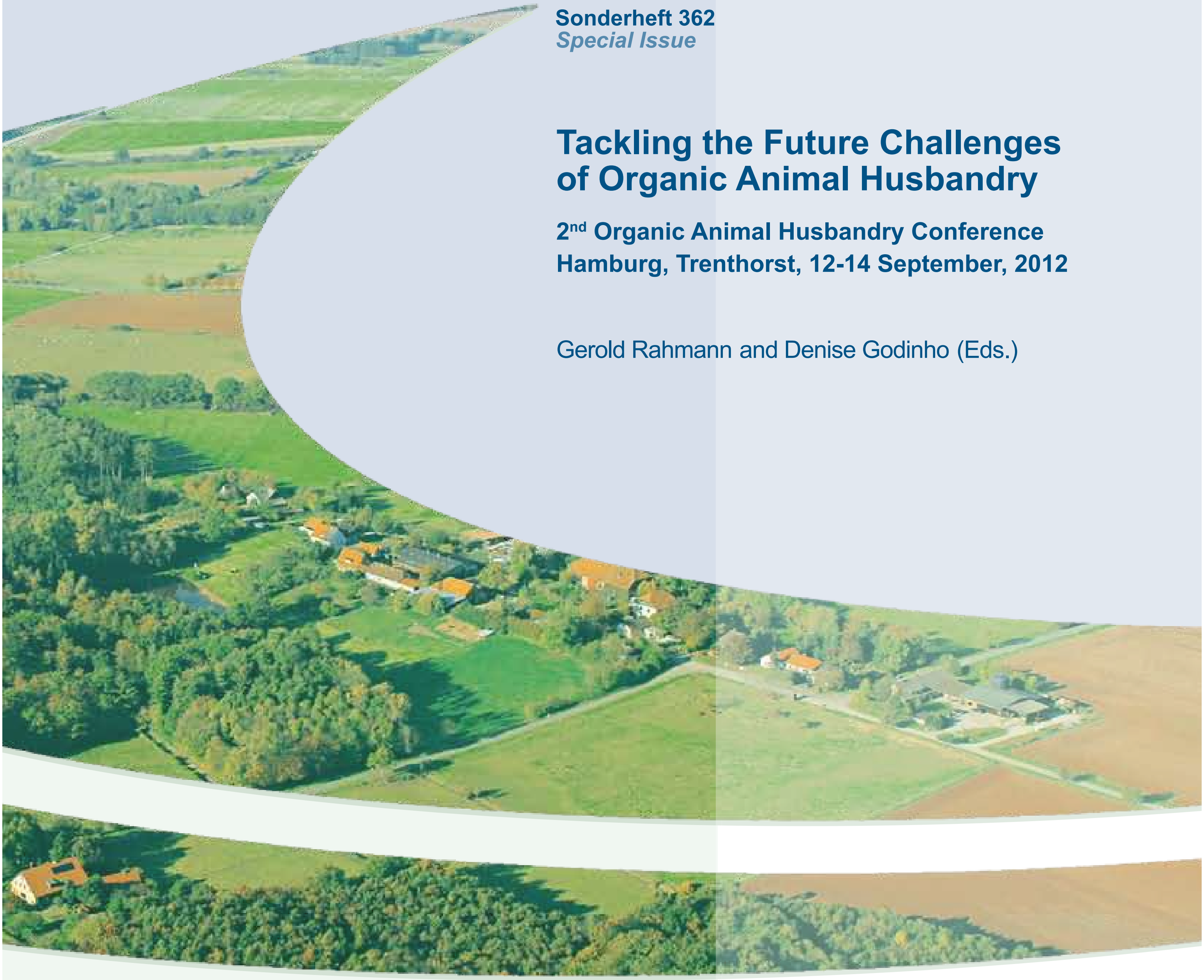

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