Control of gastrointestinal nematodes in organic beef cattle through grazing management

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Introduction

Gastrointestinal nematodes (GIN) are a major health and economic risk factor in ruminant production in organic and conventional farms (Thamsborg *et al.,* 1999). Fattening of organic beef cattle (OBC) on pasture is an emerging area for organic farmers in Switzerland, which partly compensates the declining development in dairy production. So far, there are no data available about the parasitic status of beef cattle kept in organic farms between weaning (4-6 month) and slaughter (24-26 month).

The aim of the present study was to assess the parasitological status of organic beef cattle in the pre-alpine and alpine region of Switzerland and to analyse the benefits of different grazing strategies for GIN control.

Materials and methods

At the end of 2001, a questionnaire was sent to 148 OBC producers who kept more that 10 animals annually. In addition to basic farm data, the questionnaire included detailed information on pasture management and on previous parasitic problems.

Regarding their possible risk of infections with GIN, the farms were classified in five categories (A-E). The classification was based on relevant epidemiological factors, such as stocking rate, separate grazing of first and second season cattle, altitude of pastures, overnight housing and others.

After specific instruction, the farmers were advised to send two pooled faecal samples (early summer, autumn), separated by age group, (i.e. animals older and younger than 12 month). The samples were examined qualitatively and quantitatively for helminth eggs and larvae (Schmidt, 1971).

Farms belonging to the higher risk categories and/or that were facing problems with GIN in 2002 were offered advise on implementation of protective grazing strategies in spring 2003. Strategies that had proved successful in the other farms were used. These included alternate grazing of older and young cattle and/or inclusion of cow pastures, mixed herds with first and second season cattle and to a lesser extent, alternate grazing with other animal species. The consequences of the proposed grazing management on the GIN infection level in the first season grazing cattle of these farms were assessed by three series of pooled faecal samples, that were investigated

quantitatively at the end of May, first half of August, and second half of September 2003 (Schmidt**,** 1971).

Results

Questionnaire

Thirty-nine percent of the farmers returned the questionnaire and showed interest in participating in the study. Thirty-six questionnaires could be used for the analysis. Two thirds of the farms were situated between 500 and 1,000 m above sea level. The majority of the farms had been producing for more than five years according to the BIO SUISSE organic guidelines.

The grazing season lasted 23 to 35 weeks (mean: 28 weeks) for the participating farms. On 16 farms (44%), some or all cattle were kept on alpine pastures during the summer. The season on these pastures varied between 75 and 150 days (mean: 112 days). In almost all cases, the cattle on alpine pastures were grazed together with animals from other farms. Most farmers (28) separated their OBC herds on the pasture in age groups. In approximately half of those farms, the first and second season cattle were grazed alternately on the same pastures. In the other farms, the younger cattle were grazed almost exclusively on their own pastures. Most of the farms practised a rotational grazing system, whereas, on 6 farms, the animals were set-stocked. On 14 farms, the animals had free access to the stables. On 23 farms, the animals were housed during the day or the night.

Anthelmintic treatments prior to the study were normally performed without a faecal examination (as should be required by the organic guidelines). In total, less than 30% of the anthelmintic applications were based on coprological results. Only 13% of the farmers mentioned clinical disease in the questionnaire caused by gastrointestinal worms or lungworms prior to the study. In most of the cases where newly purchased calves were affected, the cause of the problem was not identified on the investigated farms.

The overall mean daily weight gain was reported by the farmers to be 771 gram during the whole fattening period.

Parasitic infections

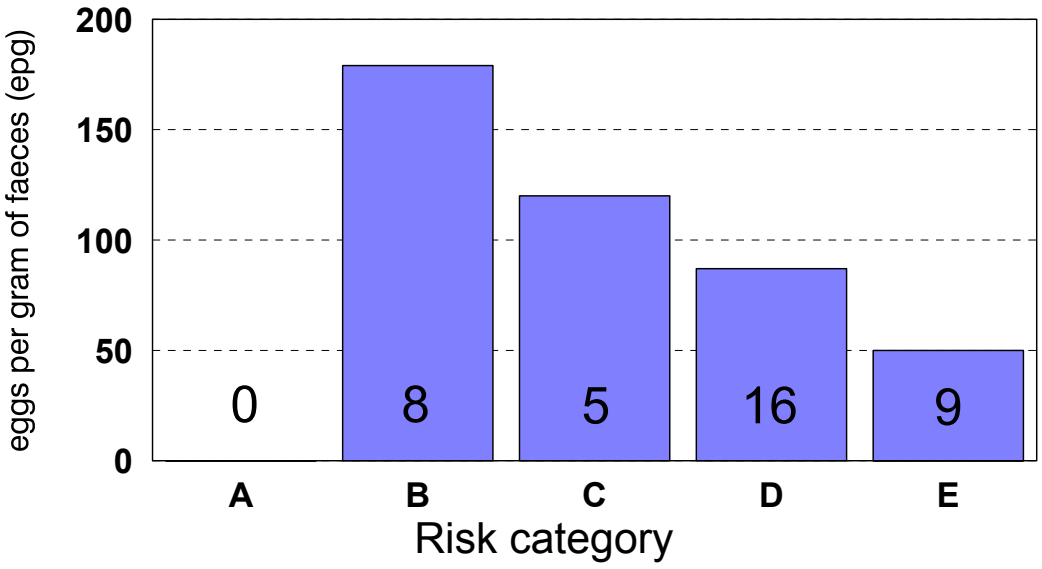
During the first year of the experiment, 165 faecal samples from 36 farms and from animals of different age groups were analysed coprologically for parasite stages. As expected, gastrointestinal strongyles were the most frequent helminths (Table 1).

Table 1: Frequency of important parasites on examined beef cattle farms

	Positive farms (%)
Gastrointestinal strongyles	97
Dictyocaulus viviparus	39
Trichuris sp.	8
Moniezia sp.	8
Fasciola hepatica	19
Dicrocoelium dendriticum	61
Eimeria sp.	100

The use of a risk profile for GIN-infections, based on the epidemiological data, revealed that two thirds of the farms were categorized into the low risk classes D and E. The classification based on the questionnaires was supported by quantitative analysis of the faecal samples in late summer, i.e. farms with the highest risk potential showed the highest parasite egg excretion in the susceptible young stock (Figure 1). *Cooperia* and *Ostertagia* were the dominant genera among the cultivated trichostrongyle larvae. Only on 7 farms, a GIN-infection above tolerable level was diagnosed. This was associated with bad general condition of some of the animals. In those cases, an anthelmintic treatment was proposed to the responsible veterinarian. The majority of those farms used herd management based on the separation of age groups with exclusive pastures for the susceptible cattle. GIN egg counts in the older animals (> 12 months) ranged around 50 e.p.g. during the entire observation period in all farms.

Figure 1: Mean excretion of GIN-eggs in susceptible beef cattle (up to 12 month age) in relation to the determined risk group of the farms (calculated on the base of epidemiological data). Numbers in the columns represent the amount of classified farms.



About half of the farmers mentioned problems with lungworms *(Dictyocaulus viviparous)* in their animals in previous years. Based on the faecal samples lungworms were found in 39% of the farms (Table 1). There was one farm with a fatal *Dictyocaulus*-infection shortly before the second routine examination in August. In this case, the infection had been misdiagnosed by the responsible veterinarian.

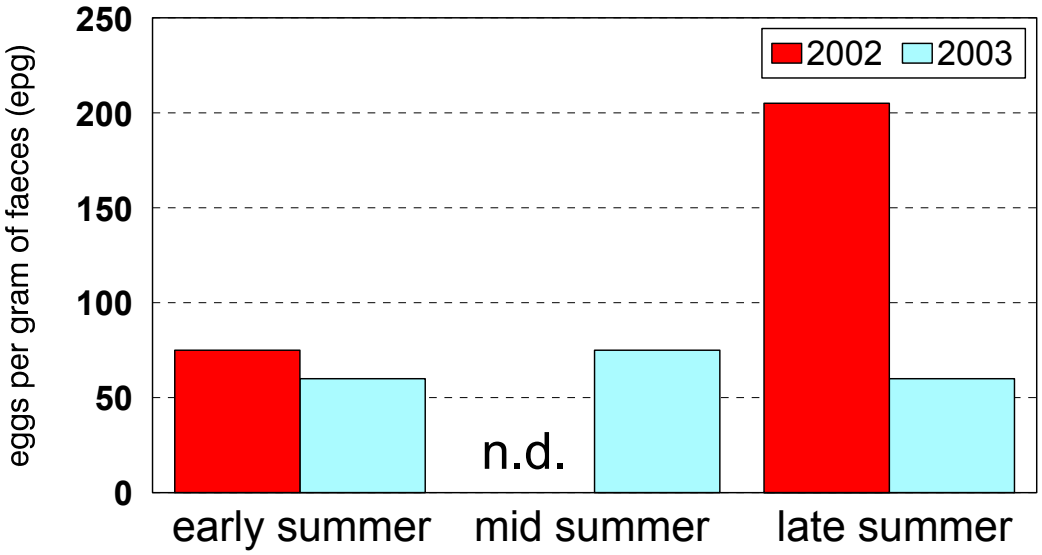
Of the 12 farms which belonged to a higher risk category and/or showed excessive shedding of GIN-eggs, 10 were interested in a continuation of the study in 2003. Eight of these farms could realise the recommended control strategies based on grazing management. Two farms could only follow the recommendations to a limited extent. In one case, this was caused by temporarily dry pasture conditions that forced the farmer to stable the older stock for several weeks. In another case, steep pastures that could only be grazed by younger cattle had to be used too intensively.

Oral vaccination, to prevent lungworm infection, was carried out by all concerned farms. Juveniles born in winter obtained the vaccination in spring before the first turnout, while newly purchased calves were vaccinated before they were integrated into the herd.

Coprological results in risk farms after implementation of control strategies

The mean excretion of GIN-eggs remained below 150 e.p.g (Figure 2) during the entire grazing season in the 8 farms that were able to adequately adopt the proposed grazing management. In the second half of the season, some animals on the two farms with restricted implementation of the measures showed an unsatisfying development and diarrhoea. The mean faecal egg excretion was about 300 e.p.g on both farms. In these cases, the use of anthelminthics (albendazole) was necessary and led to clear improvement of the animal's condition on both farms. The treatments were still reflected by the mean e.p.g. values of these farms measured in late summer. Figure 2 compares the mean egg excretion of the young cattle in the two years of the study.

Figure 2: Mean excretion of GIN-eggs in susceptible beef cattle (up to 12 month) from 10 farms before (2002) and after implementation of control strategies based on grazing management



During the last examination in late summer *Dictyocaulus*-larvae were found in small numbers in faecal samples of vaccinated animals of 3 farms. No clinical symptoms were present in these animals.

Discussion

On only one third of the examined farms, the risk analysis and/or faecal results revealed a higher risk potential for substantial infections with GIN. The main reason for the low infection level on the majority of the farms is most likely based on the grazing management practised on the farms. Thus, the general high risk for severe infections with GIN in the Swiss midland region (Hertzberg et al., 1996) is clearly reduced by these measures. The underlying effect is a substantial reduction of the stocking rate of the susceptible calves, resulting in a dilution of the pasture contamination with infective larvae. The stocking rate is regarded as one of the major factors influencing the magnitude of GIN infections in young calves (Nansen *et al.,* 1988; Eckert and Hertzberg, 1994; Hertzberg and Eckert, 1996). The faecal examinations confirmed that the older animals, that had already been in contact with pasture for at least one season, had developed a protective immunity and thus were excreting only very few GIN eggs. This did not result in harmful herbage infectivity for the younger animals.

A number of farms already practised a beneficial grazing management before entering the study, but the farmers were not aware about the parasitological background. Out of the two most effective and practical grazing strategies, especially the alternate or mixed grazing of different age groups was used, whereas the integration of other animal species was not possible in the majority of the farms, as these animals (i.e. sheep) were not available in sufficient numbers.

In addition to the prophylactic measures performed on the OBC-farms, the infection level of the newly purchased calves, deriving from dairy or cow-calf farms at the age of 4 to 6 month, plays an important role. In contrast to what could be expected, the vast majority of the animals examined on 15 farms in summer 2002 only showed a low level of GIN egg excretion (data not shown). The fact that the calf pastures were rarely exclusively used for these age groups is a probable explanation for this observation.

The implementation of the suggested grazing management on the farms, with a higher level of GIN infections in the second year of the experiment, resulted in a substantial decrease of the mean faecal egg counts. Eight of 10 farmers were able to adopt the proposed measures without reporting difficulties with this system. On those farms, the excretion of GIN eggs in summer averaged only about one third of the values of the previous year and remained clearly below the achieved threshold level of 150 e.p.g. Clinical parasitic gastroenteritis was absent on these farms. The use of anthelmintics was restricted to the animals of the two farms that were not able to establish the proposed grazing management. First season grazing cattle in these farms developed higher infections than on the remaining farms, indicating that relevant GIN infections could successfully establish under the temporary dry conditions of the season 2003. The absence of such infections on the other farms supports the view that the observed effects were mainly related to the grazing management.

The results of this study confirm the efficiency of grazing strategies for the prophylaxis of GIN infections in susceptible calves leading to a significant reduction of anthelmintic usage in these animals. This option is especially attractive for organic farmers, but is also relevant for conventional farms with respect to minimizing the use of anthelmintic drugs and thus delaying the development of anthelmintic resistance. So far the potential of GIN control by grazing managment has been highly underestimated.

As a two-year-study only allows a limited view on the problem, it is necessary to continue the observations over a prolonged period to ensure that all relevant factors with possible influence on the observed system will be covered.

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References

Eckert, J. & Hertzberg, H. (1994): Parasite control in transhumant situations. *Vet. Parasitol.*, 54, 103-125.

Hertzberg, H., Durgiai, B., Schnieder, T., Kohler, L., & Eckert, J. 1996 Prophylaxis of bovine trichostrongylidosis and dictyocaulosis in the alpine region: Comparison of an early and late administration of the oxfendazole pulse release bolus to first year grazing calves. *Vet. Parasitol.* 66, 181-192.

Hertzberg H. & Eckert J. (1996) Epidemiology and prophylaxis of infections with trichostrongyles and lungworms in calves raised under extensive grazing conditions in the alpine region. *Wien. Tierarztl. Monatsschr.* 83, 202-209.

Nansen P., Foldager J., Hansen J.W., Henriksen S.A. & Jorgensen R.J. (1988) Grazing pressure and acquisition of Ostertagia ostertagi in calves. *Vet. Parasitol.* 27, 325-335.

Thamsborg S.M., Roepstorff A. & Larsen, M. (1999) Integrated an biological control of parasites in organic and conventional production systems. *Vet. Parasitol.* 84, 169-186.

Schmidt U. (1971) Parasitologische Kotuntersuchung durch ein neues Verdünnungsverfahren. *Tierärztl. Umsch.* 26, 229-230.