Systems development: quality and safety of organic livestock products

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WORMCOPS - Worm control in organic production systems for small ruminants in Europe: Towards the implementation of non-chemical sustainable approaches
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Introduction
Organic agricultural production has grown rapidly in recent years in most EU countries. It is, however, clear from several investigations that organic production of livestock will have implications for animal welfare and health, based on e.g. the requirements regarding outdoor access and certain limitations on the preventive use of medicines. The project was, therefore, formulated in recognition of the difficulties that organic small ruminant farmers in the EU face when they wish to control parasitic infections without resorting to preventive use of parasiticides, in accordance with the principles and official standards of organic farming. In conventional (i.e. non-organic) farms, non-chemical control is also an attractive alternative to heavy reliance on parasiticides due to, amongst others, increasing problems with parasiticidal resistance, e.g. as observed in nematodes infections in sheep and goats and in liver flukes in sheep in NW-Europe in the last decade. Coping with the problems caused by parasitic nematodes on organic farms currently and in the future will only be possible through implementation of integrated, sustainable parasite control. This goal can most likely be achieved by using combinations of both existing non-chemical options (i.e. grazing management), as well as novel approaches such as biological control and bioactive forages. It was, therefore, the general objective of the project to develop and analyse such options for an integrated strategy for control of gastrointestinal parasitic nematodes in organic small ruminant production systems across Europe.

Objectives of the project
The specific objectives were as follows:
- Evaluation of the potential benefits of bioactive plants and forages in mitigating the effects of parasitic nematodes in economically important small ruminant livestock (sheep and goats).
- Evaluation of the potential of biological control of the free-living stages of nematode parasites of sheep and goats by means of the nematode-destroying fungus Duddingtonia flagrans, including evaluation of the environmental impact of field application of the fungus.
- Assessment of various grazing management strategies for the control of parasitic nematodes in sheep and goats.
- Pilot field testing of integrated control strategies involving two or more of the three options mentioned above.
- Provision of recommendations for sustainable parasite control in organic production of sheep and goats in Europe that comply with organic standards for sustainable, non-chemical parasite control at farm level.

Results

Bioactive forages
Repeated studies within the project focusing on the bioactive forages have revealed that plants with high levels of condensed tannins (e.g. sainfoin and sulla) and other plants with secondary metabolites (e.g. chicory) possess anti-parasitic activity against common gastrointestinal nematodes of small ruminants, i.e. nematodes of the genera Teladorsagia (s. Ostertagia), Haemonchus and Trichostrongylus. Effects found in vivo in both goats and sheep with natural mixed infections or mono-specific experimental infections have been confirmed in vitro using different assays on nematode larvae. However, it is also clear that the effects depend on species and stage of parasite and the specific crop. These assays have enabled us to identify certain fractions of forage extracts which are responsible for the observed effects, e.g. certain sesquiterpenlactones in chicory seem to possess substantial anti-parasitic activity. Chicory is the main candidate for an anti-parasitic forage in the Northern Europe context but it is evident that the effect of chicory in vivo is solely directed against the abomasal genus Teladorsagia. Haemonchus, another abomasal nematode, is not affected. Variations in the contents of active compounds may explain the differences observed between years and places. The results with sainfoin in goats in France have been very promising, and most studies are already published.

Biological control and evasive grazing
Plot studies and in vitro testing of the nematophagous fungus Duddingtonia flagrans have shown marked reductions in worm burdens of goats but, in summary, grazing trials with ewes and suckling lambs under close-to-normal farming conditions showed no or inconsistent effect on any of the parasitological parameters examined. This lack of effect when the nematophagous fungus is applied to ewes in early lactation at turn-out is puzzling and the project has only briefly researched the background. Obviously, the situation is very different from the turn-out of calves where excellent results have been obtained, also in the early grazing season. However, studies in Sweden and Denmark have indicated a clear production benefit of applying this novel approach. I should be emphasized that a product for biological control is not at present marketed commercially. The backbone in all non-chemical parasite control strategies is evasive grazing i.e. repeated moves to clean pasture during the season. Although sufficient control of Haemonchus contortus may not be achieved with 3 weekly moves in trials conducted in the Netherlands with heavy challenge, it must be emphasized that other infections are well controlled by this procedure. An interesting feature in several studies is the unexpected persistence of some of the infections in the lambs e.g. for more than 2 months during a period of rapid moves to clean pasture whereby re-infection was eliminated. This has been observed for H. contortus but probably also holds true for Trichostrongylus spp.

Other novel approaches to control, e.g. selection of resistant/resilient animals and development of sub-unit vaccines (compliance with organic standards depend on manufacturing specifications), which may in the future play a role in worm control on organic farms, have not been considered within the project.
General guidelines arising from the project
In conclusion, diseases caused by internal parasites pose a major threat to the health and welfare of sheep and goats within organic production systems. Basically, organic farmers need to enhance and exploit the animal’s own immune status and resilience to parasitic infection, in so doing they need to recognise and take account of differences in host immunity due to age, genotype, nutritional status and level of productivity. The losses associated with infection by roundworms are known to be challenge density dependent with high levels of challenge being associated with mortality and less severe challenge with morbidity and reduced productivity. For these reasons organic producers need to moderate exposure to parasitic infection to allow the development of acquired resistance in susceptible stock, without succumbing to clinical disease or heavy production losses.

Within organic production systems, the development of host resistance/resilience together with other non-chemical means of moderating the challenge from pasture are the two fundamental prerequisites for good worm control. Effective worm control also relies upon utilising our understanding of the epidemiology of the key species of gastrointestinal nematodes implicated in these diseases such as Teladorsagia, Haemonchus, Trichostrongylus and Nematodirus. Farmers should take and develop an evidence-based approach to targeting anthelmintic inputs, taking account of individual farm circumstances, which safeguards animal health and welfare. This approach will lead to the identification of key system limiting parasites, which pose a particular challenge to animal health and productivity, and may require substantial changes to the farming system (i.e. housing periods, reduced stocking density) or the limited use of anthelmintics.