

Workshop Summary: Controlling nematode endoparasites in organic animal husbandry

Opinion prevailed at the International Workshop: "Recent Research in Endoparasite Prevention in Organic Animal Husbandry", 5. - 6. October 2006, Institute of Organic Farming of the Federal Agricultural Research Centre, Trenthorst 32, 23847 Westerau/Germany

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Abstract

In organic farming grazing is essential for ruminants, while for pigs and fowl an outdoor-run has to be available. This provokes a higher infection risk for endoparasites. Endoparasite control has to consider the restrictions of the rules for organic production. Preventive treatment with antiparasitic drugs is prohibited, when therapeutically used the withdrawal time has to be doubled. Current preventive strategies for worm control in organic husbandry rely heavily on grazing management. Grazing strategies focus on reducing the infective risk of the pasture e.g. by repeated mowing and a late turnout. Repeated changes to clean pastures also offers an effective means for reducing the risk to susceptible animals. Utilizing e.g. tanniferous plants offers an additional option in organic feeding. Integrated control systems with a restrictive targeted drug-use are in development. A decision tree for the measures to determine optimal recommendations at farm level has been developed for cattle in the Netherlands. It must be adapted to other livestock species and other countries. The biological control of nematodes by nematophagous fungi is presently not available. The combination of methods could be recommended if the options of the farm are considered. In conclusion, the control of endoparasites in organic livestock farming systems is more demanding than in conventional industry, requiring a larger agricultural area and working hours if the farmer is to adopt the no-drugs-option.

Keywords: cattle, pigs, small ruminants, grazing management, integrated worm control, organic animal husbandry

Zusammenfassung

Die Kontrolle der nematodischen Endoparasiten in der ökologischen Tierhaltung

Im ökologischen Landbau ist der Weidegang ein wesentliches Merkmal in der Wiederkäuerhaltung. Für Schweine und Geflügel muss ein Auslauf angeboten werden. Mit dieser Tierhaltung ist ein erhöhtes Risiko für Endoparasiteninfektionen verbunden. Bei der Endoparasitenbekämpfung müssen Einschränkungen aus den gesetzlichen Regelungen zum Öko-Landbau beachtet werden. Präventive Behandlungen sind verboten, bei therapeutischer Verwendung ist die Wartezeit zu verdoppeln.

Die gängigen Strategien zur Prophylaxe von Wurmbefall beruhen hauptsächlich auf einem dem Klima und den betrieblichen Möglichkeiten angepassten Weidemanagement. Dies beinhaltet auch die Verringerung der Anzahl der infektiösen Larven auf der Weide z.B. durch wiederholtes Mähen und durch einen späten Austrieb. Wiederholte Wechsel auf ausschließlich saubere Weiden sind nachweislich wirksam. Die Verwendung von speziellen Futterpflanzen, z.B. solchen mit erhöhtem Tanningehalt bietet eine weitere Möglichkeit im Öko-Landbau. Integrierte Kontrollsysteme mit eingeschränktem, gezieltem Medikamenteneinsatz sind in der Entwicklung. Ein Entscheidungsbaum für die Maßnahmen auf Betriebsebene ist als unterstützendes Werkzeug für Rinderbetriebe in den Niederlanden entwickelt worden. Er könnte für andere Tierarten und andere Länder angepasst werden. Die Methode der biologische Kontrolle mit nematophagen Mikropilzen ist bis auf Weiteres nicht verfügbar. Die kombinierte Anwendung der Methoden kann unter Beachtung der betriebsindividuellen Gegebenheiten empfohlen werden.

Abschließend ist festzustellen, dass die Kontrolle der Endoparasiten im ökologischen Landbau anspruchsvoller als im konventionellen Landbau ist, eine größere Fläche und viele zusätzliche Arbeitsstunden benötigt, wenn keine Medikamente eingesetzt werden sollen.

Schlüsselwörter: Rinder, Schweine, kleine Wiederkäuer, Weidemanagement, integrierte Endoparasiten Kontrolle, ökologische Tierhaltung

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A Facts

1. The regulations:

An increasing part of the animal husbandry is subjected to special regulations (national and international) for organic farming. Today in Sweden i.e. about 7 % of the animal production is certified as „organic“. There is the political ambition to increase this to 20 % within the next 5 years. In NZ* expanding organic livestock production for the export is a big challenge.

The organic regulations restrict the routine use of veterinary drugs like anthelmintics. Preventive treatment is forbidden. Therapeutic treatment is obligatory to assure animal welfare if the animal is sick. The legal withdrawal time has to be doubled. Homeopathics are forbidden in Sweden.

Apart from regulations about stocking rates, feed composition and feed quality, all organic ruminants should have access to pasture, if that is not possible at least an outdoor-run must be available (EC No1804/1999). Many countries prescribe pasturing, i.e. in DK and NL a minimum of 150 days grazing period per year is obligatory. In NZ sheep and cattle graze the whole year. Organic pigs need at least an outdoor-run; in DK pasturing during pregnancy and farrowing is common in organic pig farming.

These husbandry systems cause an increased risk of infectious diseases and zoonotic problems. Mainly the organic pig-farms are in danger to get the food safety state of “high risk herds” in the future.

2. The problems:

The main nematode parasitic problems are caused by *Ostertagia ostertagi*, *Cooperia oncophora* and *Dictyocaulus viviparus* in cattle, *Haemonchus contortus*, *Teladorsagia circumcincta*, *Trichostrongylus vitrinus/colubriformis* and *Nematodirus battus* in small ruminants and *Ascaris suum* and *Oesophagostomum* spp in pigs. In addition coccidiosis is a potential problem in all host species, though problems tend to be less in organic systems, except perhaps for *Eimeria alabamensis* in calves during the first weeks after turnout.

As well an increased risk for zoonotic species (*Trichinella* spp and *Toxoplasma gondii*) has to be taken in account. In example, a study on pig farms found that 39 % of the

samples (33 pig farms with free-range system) and 2,9 % of their animals were *Toxoplasma* positive, in comparison to conventional farms which were all negative. This workshop covered only nematode parasites.

The worldwide increasing spread and prevalence of Anthelmintic Resistance (AR) is another problem. The growing problem of drug resistance places the welfare of animals at risk. Without a preventive treatment, livestock may harbour high worm counts and grow ill. So, particularly in organic farming systems, it is necessary to have effective anthelmintic drugs to guarantee the welfare of animals that need a salvage treatment.

B Methods of control, experiences, problems

There are three major approaches to minimize the detrimental effects of endoparasites. Farmers often practice a combination of different strategies, depending on farm options and epidemiology. Those combinations are more common in organic than in conventional farming (SE). Most farmers are aware of the increased risk for parasitical infections in organic farming (SE).

1. Strategies to minimize the risk of infection with eggs or infective strongylid third larvae (L3). Specially in fattening these systems are used with success (NZ). Eight methods are mentioned.

- a) “**Clean¹-pasture-system**” implies turnout or move to a pasture without infectious risk. The big question is: “When is a pasture clean?” ‘Safe paddocks’ are defined as those in which a worm infection is likely to be low, in example areas previously grazed by healthy adults. Experiences indicate that after 2 cuts the number of herbal L3 decreases on ruminant pastures and after the 4th cut it diminishes to less than 3 %. This effect may be as well due to the resting time and the influence of sun and weather. Mowing cattle pastures in spring seems to be useful, while no clear effect has been seen in the rest of the season (NL). Pig-paddocks in DK were still contaminated with infective *Ascaris/Trichuris* eggs after 4 years of ploughing and seeding. Under moderate climate, the estimation of infectious risk is left difficult and remains the corner stone of this method. Another key issue is also how long a safe pasture remains safe when it is grazed by infected animals (NL).
- b) Let the most susceptible First Season Grazing (FSG) lambs “**creep**” and graze before the ewes are allowed to enter the pasture (NZ).
- c) “**Rotational grazing**” or the “frequent-change-to-clean-pasture-system” proved to be very effective in FSG calves in SE. But often there is not enough clean pasture

* The abbreviations for the countries are used in the following text to demonstrate a specific national feature or the statement of the referent, respectively.

area and problems result from weeds. *Eimeria* spp. can add further problems.

- d) A “**late turnout**” let the overwintering L3 die timely and the defence mechanism of the elder FSG animals is better. This concept mainly implies that initial infection will be lower the later FSG animals are turned out. Thus, later in the grazing season the reinfection will be less and very little has to be done in addition to control parasitic gastroenteritis. (NL, DE).
- e) “**Mixed grazing**” or “**alternate grazing**” means the reduction of L3 by inclusion of less susceptible animals onto the pasture. Implementation of elder animals of the same species (exception goats, which as adults remain very susceptible) or of resistant or less susceptible livestock species is possible (CH). Problems come up with endoparasites, which live in both hosts, i.e. liver flukes. Cross-infections are possible (SE).
- f) “**Browsing**” shrubs and bushes could reduce the intake of L3, which only live in grass and herbage.
- g) “**Biological control**” has been tested with variable results. *Duddingtonia flagrans* is a nematophagous microfungi, which reduces the number of L3 in faeces when the spores are added to the feed. After a dry summer, a huge number of autumn L3 will overwinter and big problems will arise the following year. Research in field studies with ruminants resulted in bad experiences (NL), limited efficacy (NZ) and moderate to agreeable efficacy (DE, CH, SE). Since missing EC-registration this biological control method has been abandoned, waiting for better options.
- h) Effective “**cleaning and disinfection**” of stables and outdoor-runs is necessary. It should be noted, that cresol - containing disinfectants are forbidden in organic farming.

2. Coping strategies support the host in his efforts to regulate the parasite burden and to cope with the parasite induced damage.

- a) “**Additional nutrition**“ of high protein components or “**Immunonutrition**” to assist the parasitized animal is one strategy for sustaining the productivity of young animals in organic systems. This could be made available as a special forage (e.g. Legume) or added to the animals diet, as a supplement. In DK Inulin (i.e. from chicory-roots) fed to pigs reduced the parasitic burden in the large intestine (but no efficacy at *Ascaris*). About 80 % of farmers in Europe use supplementary feeding in raising animals, an effect of feeding more is questionable (DK). Supplementary feeding with concentrate and roughage to FSG calves as a parasite control option has failed in Sweden. Negative effect could be a rise of infection with *Eimeria* spp.(SE).

- b) The ability to cope well with a given parasitological burden is called resilience. A considerable amount of research has been conducted in NZ examining the potential and merit for selecting and breeding sheep for “**resilience and resistance**” of the host to endoparasite challenge. Considerable progress has been made by the sheep industry in providing rams with a breeding worth for these traits. Finding the right alleles is very attractive for the industry. For cattle there has been little work. In pigs on pasture there is a wide variation in worm burdens and some of the farrowing sows never seem to get rid of their worms, the search for the genetic marks of resistance may be reasonable (DK).
- c) “**Late weaning**” improves the defence system; so young animals can cope better with subsequent infections. Delaying the weaning of calves in beef cattle in NZ has shown benefits in liveweight gain and resilience to parasite challenge once weaned.

3. Strategies including treatments will control the parasites by the additional support of natural or chemical drugs.

- a) The “**Targeted Selective Treatment**” (TST) of subpopulations results a large reduction in the use of anthelmintic drug. Not the whole herd is drenched but rather those animals that are in need to get treated or are most at risk of disease. The distribution of worms in a population is well known to be uneven, but skewed to a minority of hosts. The parameters of selection these hosts are an open question. Surely the reduction of the individual liveweight gain may be a feasible indicator. A second impact of TST is the postponing of the development of Anthelmintic Resistance (AR). The treatment of only 20 % of the animals of the herd probably reduces the contamination of the pasture and leaves an adequate refuge for susceptible isolates. Treating more than 20 % will possibly jeopardize the refuge (DE). AR doesn't remain a problem of minor species, an actual research in Northern Germany found less than the 90 %-reduction in Faecal Egg Count (FEC) after Ivermectin treatment in dairy replacement calves (DE).
- b) “**Phytotherapy drugs**” have to pass the same registration procedures as chemical drugs before they could get the licences for food animals. Today there is not a strong stimulus for further research in this item in Europe (CH).
- c) The 40 years lasting research in “**Vaccination**” is going on, but vaccines are not likely to become available soon.
- d) “**Copper wire**“ particles or boluses are only mentioned. The efficacy in cattle is not proved (SE). This method may be reasonable only for stomach worms. Because of low to moderate FEC reduction in sheep and high cop-

per values in the liver: no recommendation.

- e) Feeding crops which ingredients are detrimental on worms, i.e. the “**Condensed Tannins**”(CT), showed a reduction of FEC (CH). Promising plants grow in Mediterranean (i.e. Sulla) and can be fed as silage or hay (CH). That the needed amount of CT is sometimes near the toxic limit is a problem, as well the great diversity of CT’s, the varying proportion of CT in the plants and sometimes a bad acceptance by the animals. The different endoparasitic species respond variably to the application of CT (CH). In NZ the use of tannin containing forage plants have been examined in some detail, including the use of browse willow and poplar and the use of these species as silage. Further research is needed.
- f) The “**decision tree**” (NL) achieves safety for first season grazing animals. However, it does not guarantee sufficient exposure to nematode larvae and infections for immunity build up. Therefore, it should preferably be combined with monitoring. FEC approximately two months after turnout is an excellent indicator for pasture contamination. Which accessory parameters are suitable for a monitoring? Liveweight gain reduction is a big reason, but only apparent in September and it is secondarily affected by different influences. Pepsinogen-value in blood samples is a good indicator, mainly at housing. It decreases quickly after housing (NL). The farmers should plan the pasture management in winter and later revise it depending on weather conditions. A program like that is only accepted if this evokes no competition to other farm operations (CH). Metaphylactic treatment creates less Anthelmintic Resistance as with the early deworming and saves drugs, but farm options are often more important (NL).

C Conclusions

a) “The preservation of the efficacy of established drugs has the highest priority. What can be done to avoid or postpone the development of AR? **Targeted Selective Treatment** (TST) is a possible approach.”(DE) Key points for TST should be found. Is TST practicable? (DK)

For a proper use of the TST approach, we need to find indicators for measuring endoparasite burdens. That means the selection after

1. Parasitological parameters as:

- Antibody-ELISA of *Ostertagia* in milk samples is promising.
- Antibody-ELISA of Gastro Intestinal Strongyles in serum: This is a promising method in development, it shows a good correlation to liveweight gain, but need more specification and standardization. The ELISA

with a recombinant *Cooperia oncophora* protein is of little practical value because it is only useful for FSG calves at the end of the season (NL). Farmers could take a pooled blood sample of perhaps 5 animals (SE). Until now there is no commercially available serological test for *Haemonchus contortus*.

- Faecal Egg Counts are very useful and not too expensive (NL). The testing has best to be done at strategic moments, following the expected seasonal patterns of pasture infectivity, which depends on the farmer’s individual management of animals and areas. For example on intensive sheep farms approximately every 4 weeks beginning at the first week in July (if the ewes were clean at turnout) monitoring of lambs is recommended (NL). Even as individual samples yield a lot of false-negative results, pooled samples are of high diagnostic value. In Switzerland they had good experiences of pooled samples taken by farmers (CH). Testing of at least 20 calves for monitoring may be too expensive (DK). Sampling of about 10 calves will be sufficient as well and the samples should be examined as pooled samples to diminish costs (NL). In Europe we have a lack of experts, in NZ the farmers do the faecal egg counts on their own.
- Faecal Larval Counts: Pooled samples of FSG calves have always 80 - 90 % *Cooperia*, therefore no differentiation is necessary (NL).

2. Pathophysiological parameters as:

- Pepsinogen-value in blood samples, taken by farmers, is robust and has a good predictive value, mainly at housing (SE). But the value is only meaningful in stomach worms and it decreases quickly after housing (NL).

3. Performance parameters as:

- Body Condition Score
- Lack of liveweight gain of hosts in relation to the mean of the herd or a fixed value. This should be the first of criteria, with the parasitological data only secondarily (SE).
- Level of resilience and resistance. But limiting selection to resilience, with high FEC, results in contamination of pasture.

We need an indicator as well for the contamination level of a pasture; the most reliable is probably the FEC (DE). The pasture larval count is unhandy.

We need as well the research concerning the best proportion of untreated animals in a herd. Rather than a fixed value (i.e. 90 % proportion of untreated sheep) farmer’s drenching probably should be practiced more carefully.

Any confirmation that TST will reduce the further development and spread of AR-alleles in cattle is missing.

b) The **decision tree** (NL) as a learning tool for farmers should get modified to

- climate conditions (where necessary)
- livestock species
- main detrimental parasite species
- farm options
- economics
- implementation in herd health management programs.

c) **Control approaches based on Anthelmintics** (if the efficacy stays at about 70 %): Even in organic farming the implementation of a strategic prophylactic approach for the gastro intestinal worms and a metaphylactic, diagnostic treatment approach for lungworm problems could be reasonable (SE). The discussion runs between the organic rules (“no prophylactics”) and the “bloody nonsense” to wait until all the calves are ill.

New drugs (Emodepside) will come in about 5 - 10 years. They are very expensive to produce and the persistence in faeces and environment is still questionable. (DE)

Natural products for deworming were desirable. (DK)

d) **Control of parasites without any treatment** should deal with the finding of genetic markers for resistance of the host and the refinement of the nutritional manipulation. (DK)

D Recommendations

Advices to farmers should include:

- Avoid “Dose and Move”.
- Avoid treatment of all ewes at turnout.
- Dose only the FSG calves.
- Avoid underdosage.
- The 90-days-bolus in sheep accelerates on the development of AR.
- The efficacy of the combination of different classes of compounds has not been proved, but the full dosage of both drugs is helpful.
- Anthelmintic use only when necessary.
- Try to drench only 10 % of the herd.
- Quarantine treatment, so that resistant strains are not imported to a farm.
- No effect of additional feeding.
- Best System: turnout of FSG calves on clean pasture (i.e. pasture of healthy second year grazers in the previous year) and change to aftermath at midsummer.
- Rotate pasture grazing as frequent as possible and all

new pasture should be clean. There should be a differentiation here between cattle and sheep. For cattle pastures it takes at least one month before larval populations build up to dangerous levels, but on sheep pastures the ‘safe’ period does not exceed two weeks in summer and sometimes (high temperature and rain) can be less than that, in particular for *Haemonchus contortus*). In SE and DK only one change per season is feasible for cattle.

- Control for a correct rotation.
- Late turnout, but awareness to weed control is necessary.
- Turnout on aftermath, the FEC will rise from mid of June.

E Summary

Opinion prevailed at the workshop:

- That conventional and organic farming often deal with the same problems and that the answers point at the same direction = less drugs.
- That new approaches of worm control are time and cost intensive and that these methods need ongoing efforts in research and development.
- That the preservation of the efficacy of anthelmintic drugs is one of the main tasks in the near future.
- That the problem of Anthelmintic Resistance amongst nematode parasites is on the increase in the temperate-climate cattle farming. Organic and conventional husbandry may be concerned in the same extent.
- That a new mode of handling the drugs is needed, most urgently for small ruminants and in cattle, to ensure productivity.

As most of the problems are supranational, international cooperation and integrated research activities with concerted applications on research programs will support the advancement in controlling endoparasitic problems.

