Effects of anthelmintics use in nature conservation areas

Joost Lahr (Alterra, Wageningen UR, The Netherlands)

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Background

- Large herbivores are increasingly used for vegetation management purposes in The Netherlands (and elsewhere):
  - Keep landscapes open and patchy
  - Cheaper than mowing
  - Esthetical value
- Herbivores become infected with various internal parasites:
  - Gastrointestinal nematodes
  - Lungworms
  - Liver flukes
- Treatments with anti-worm parasiticides (anthelmintics)

A problem?

- 80% of active ingredients excreted in the dung
- Many publications on toxic side-effects on invertebrate dung fauna
- No research in The Netherlands
- Aim:
  - Objective investigation
  - Survey among area managers
  - Residue analysis

Het gevecht tegen de ver-factoren en dode koeienflatsen

sing tegengaan. 'De gebruikte ontwormingsmiddelen zijn een heel groot probleem. De koeieflatsen in natuurgebieden zijn volkomen dood. Er zit zelfs geen strontvlieg op. We raken de hele mestfauna kwijt.'

drs. Hans Esselink

'Bij verstandig natuurbeheerder ontstaan geen dode koeienflatsen'

3. de bewering is volstrekte onzin.

Maarten Eysker
Afdeling Parasitologie en Tropische Diergeneeskunde, Utrecht

Hap, slik, weg met de Grote Grazers!
Die brengen de biodiversiteit in gevaar

tuurgebied loopt of in een weiland, bevat allerlei veterinaire stoffen die via dierlijke mest in de natuur terechtkomen en die zeer veel schade berokkenen aan mestkevers en allerlei andere mestverwerkende insecten, die mede daardoor letterlijk uit de natuur verdwijnen. Ook voor de flora heeft dit gevolgen: uitwerpselen blijven langer liggen, en dat trekt weer allerlei mest minnende planten aan.

Ruud van der Meijden
en Laura Kooistra

Slechts beperkte informatie beschikbaar

Milieuschade door diergeneesmiddelen geen indianenverhaal

Alterra-onderzoeker dr. Joost Lahr

Grote grazers brengen biodiversiteit niet in gevaar

maart). Ik heb me gestoord aan de opmerkingen over „allerlei veterinaire stoffen die via dierlijke mest in de natuur terechtkomen en die zeer veel schade berokkenen aan mestkevers en allerlei mest verwerkende insecten". Dit vooral omdat dit een indianenverhaal is dat steeds weer terugkeert.

MAARTEN EYSKER,
Afd. Parasitologie en Tropische Diergeneeskunde, Universiteit Utrecht

Oproep voor meer onderzoek

Wormengif bedreigt mestfauna

G.A.J.M. Jagers op Akkerhuis
& H. Siepel

uitgedroogde mest, zonder larven. Veldwaarnemingen doen vermoeden dat ontwormingsmiddelen een selectieve "Silent Spring" veroorzaken.

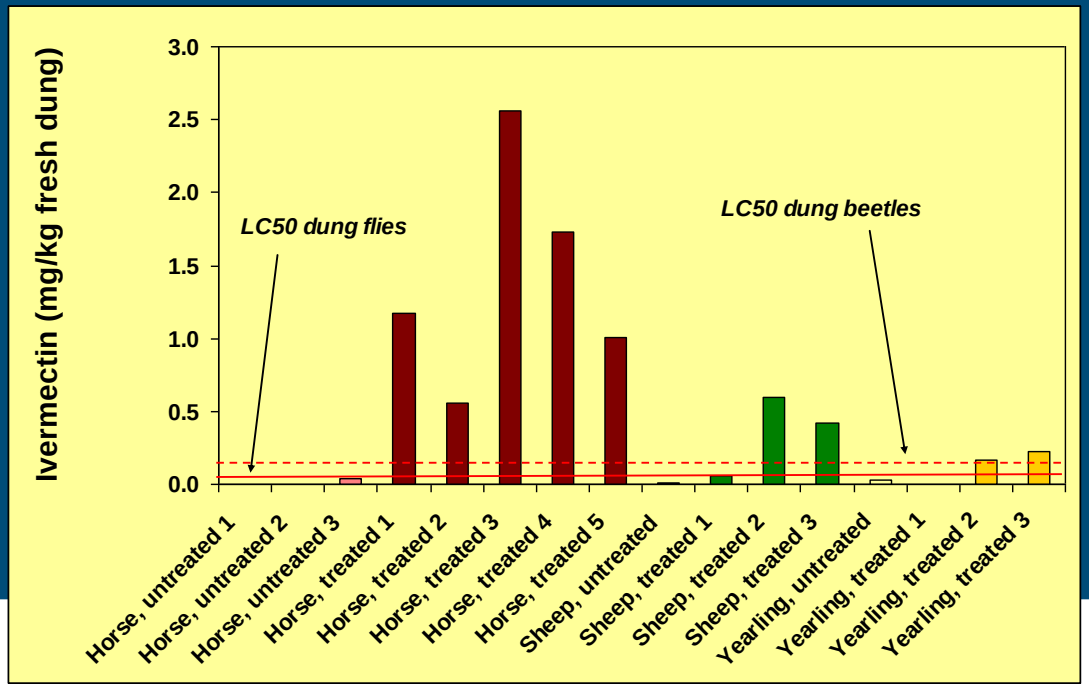
Survey

- Survey in 2006:
  - Anthelmintics used in 80% of investigsted nature conservation areas (horses, sheep, cattle)
  - Ivermectin used routinely in 75% of the areas
  - Oral applications most used, boluses (oxfendazole) only very rarely

Survey

- Short investigation in 2007
  - Levels of ivermectin in dung of horses, sheep and heifers shortly after dosing exceed toxicity thresholds from the literature.

Solid line: 48h-LC50 of 0.036 mg/kg wet wt for larvae of the yellow dung fly *Scatophaga stercoraria* (Strong & James, 1993, Vet. Parasitol. 48: 181-191). Dotted line: 3wk-LC50 of c. 0.19 mg/kg wet wt for larvae of the dung beetle *Aphodius constans* (Hempel et al., 2006, Environ. Toxicol. Chem. 25: 3155–3163).



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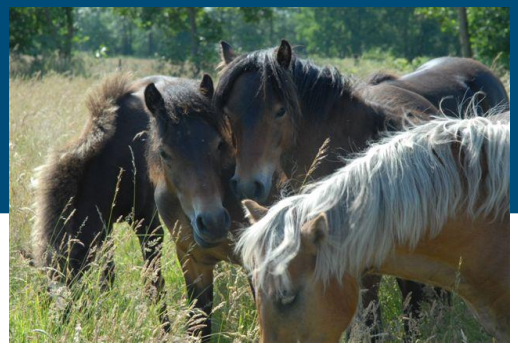
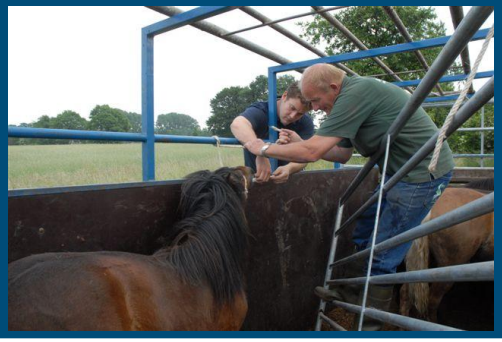
Experiment

- Objectives:
  - To investigate the effects of ivermectin on the degradation rate of horse (pony) dung
  - To asses the impact of earthworms on dung degradation simultaneously (also in response to outcome York study)
- Study area:
  - Semi natural pastureland (Unifarm, experimental biological farm of Wageningen UR)
  - Darmoor ponies, outside all year round



Methods

- Each day the 5 ponies were put into a new enclosed part of the field
- Each morning 20 fresh dung pats collected and laid in another field in cages (agains birds)
- Half of the pats on 30x30 cm ‘root cloth’ with very fine meshing, the rest on plastic grids with a 5 mm mesh
- Routine treatments by vet in early June 2008 (Eraquell oral paste; 40 g active substance per pony).

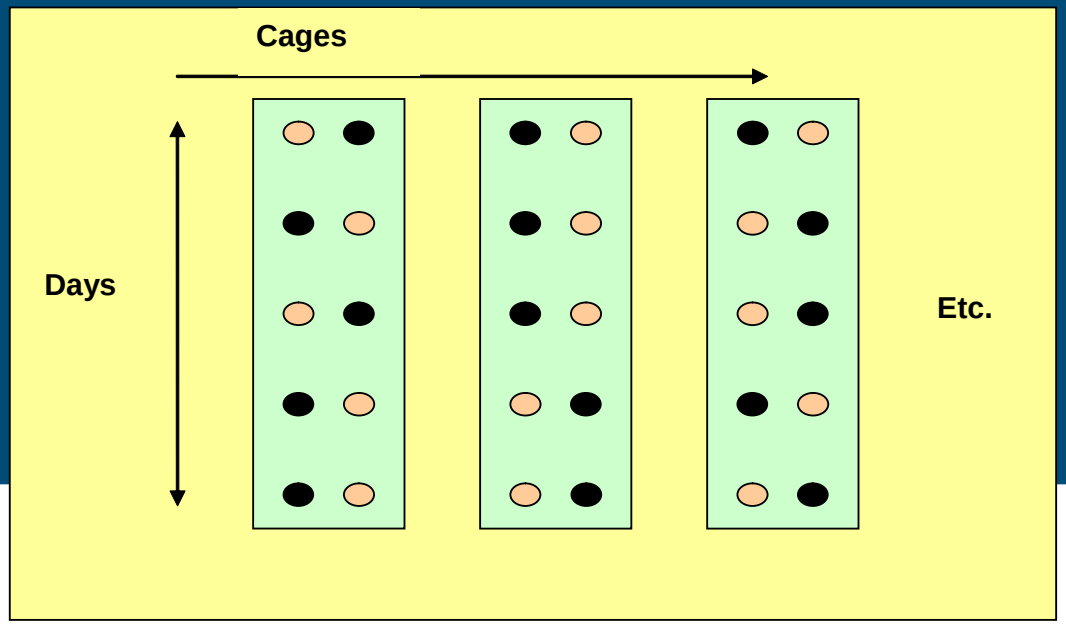


Methods

- Dung collected on 2 consecutive days prior to treatment and during 3 days afterwards
- Weight monitored during 58 weeks:
  - Dry weight (16h at 105 °C), corrected for susampling
  - Organic matter (3h at 550 °C), idem
- Ivermectin residue analysis
  (Åsbakk et al. (J. Agric. Food Chem. 1999, 47, 999-1003)

Methods

- Randomnised block structure
- ANOVA:
  - DW, OM, fitted first order degradation rate constant *k* or DT_{50} per individual dung pat
  - Factors ‘day’ (no.) and ‘worms’ + interaction



Results

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Results

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Results

Week 0

Week 10

Week 15

Week 20

Week 25

Week 34

Week 43

Week 50

Week 58

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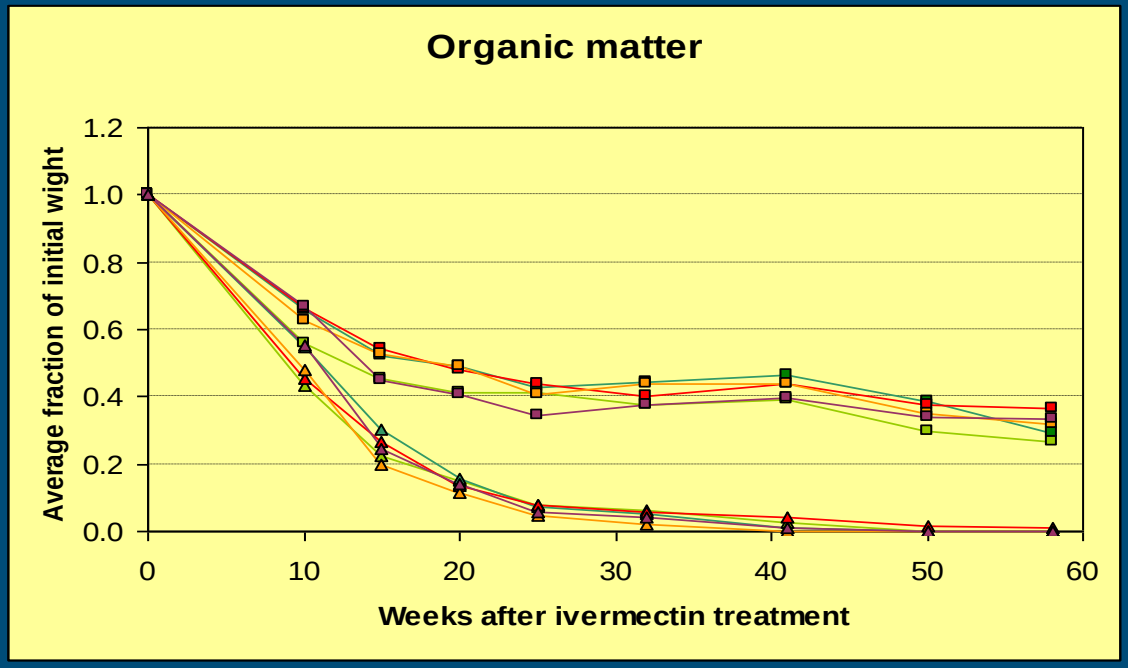
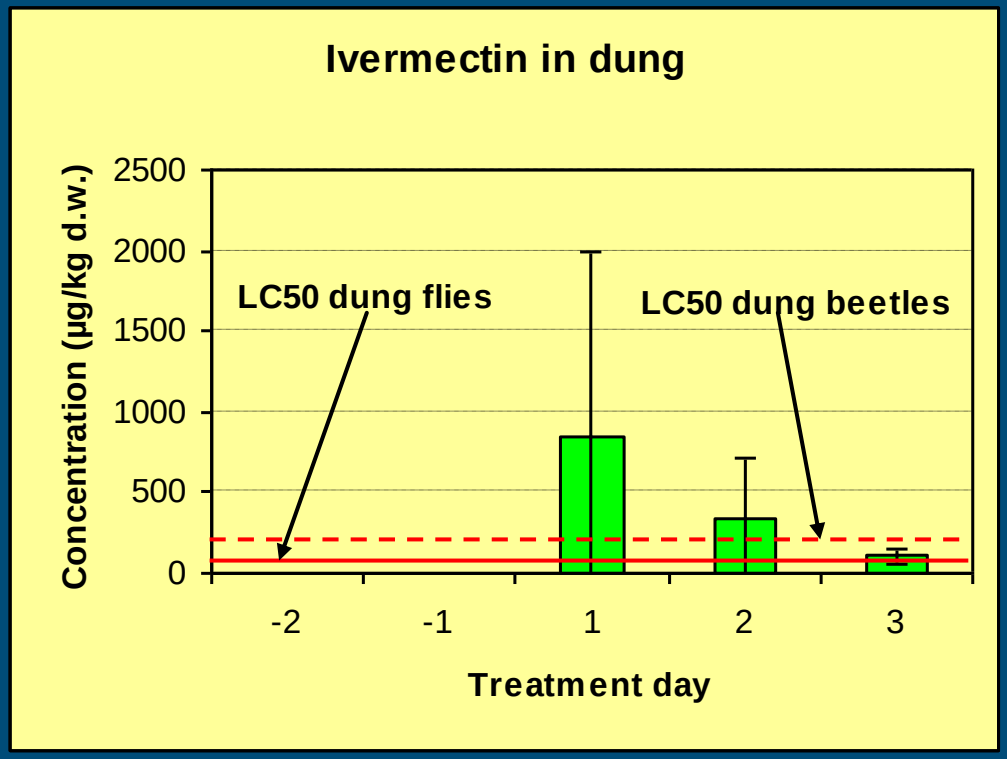
Results

- No significant relevant effects of treatment ('day') on DW, OM, *k* and/or DT_{50}
- Strong and highly significant effect of the presence of earthworms on dung degradation (DT50 for DW and OM c. 4x shorter)



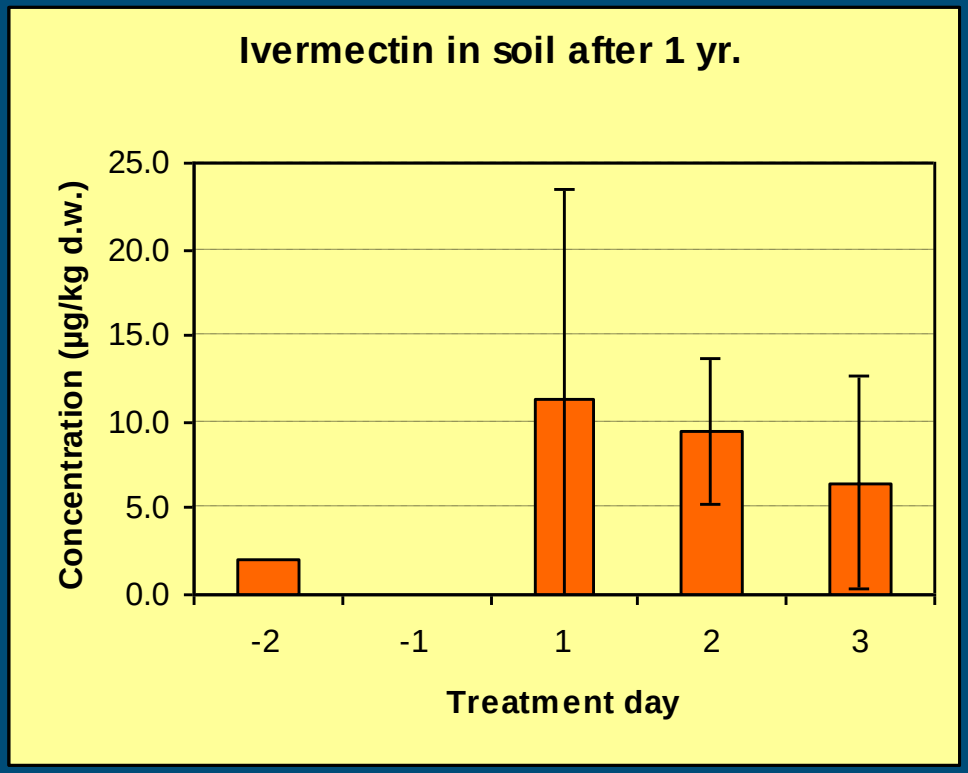
Results

- But levels are higher than LC50 values from literature



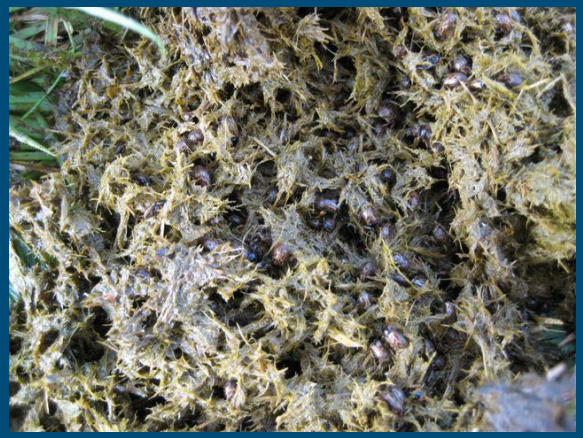
Results

- Ivermectin still found after 58 weeks in upper 5 cm of the soil under dung pats placed on 5mm mesh grids!



Discussion

- Toxic ivermectin levels, but no effect.
  - Lower availability? Pony's ruminants, lots of raw OM.
  - Effect on dung insect biodeversity and/or community structure not translated in effects on degradation (when the species do not fragment)
  - Wrong study area or wrong time of the year?



Discussion

- Importance of worms to horse (pony) dung degradation in temperate pasture areas
  - Earthworms less sensitive to ivermectin?
  - So, effects on dung insects in temperate areas less important from the functional perspective?

- Ivermectin very persistent in soil (and probably in dung if dung would not disappear)
  - Ivermectin in soil by earthworm action?
  - From percolation by rain water?
  - From dust/soil particles remaining after the dung disappears?

What now?

- Lots of remaining research questions
  - Effects on structure and or biodiversity local dung fauna?
  - Effects in other times of the year?
  - Persistence in dung?
  - Persistence in soil?
  - Effects on soil fauna?
  - Effects on dung fauna and dung degradation of other grazers (sheep, cattle)?

Test organisms DOTTS group

Yellow dung fly (*Scatophaga stercoraria*)

Face fly
(*Musca autumnalis*)

Dung beetle
Aphodius constans

Predators of invertebrate dung fauna

Black-tailed godwit (*Limosa limosa*)

Red-backed shrike (*Lanius collurio*)

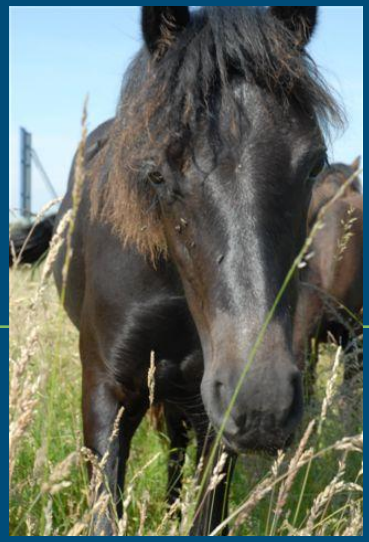
Horseshoe bats (*Rhinolophus* spp.)

Skylark (*Alauda arvensis*)

Awareness raising

- Awareness in 2005:
  - 20% familiar with brochure
  - 15% familiar with decision key for anthelmintics use
- New survey & notice by Natuurmonumenten in 2009 → compare results?
- Decision scheme:
  - Modify existing scheme for animal husbandry (cattle) for nature conservation areas?
  - Specify for different herbivores?

Thanks!



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