# Diagnosis of *Fasciola hepatica* in livestock

## Chasing the fluke or it's impact?

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# Contents of presentation

- Available diagnostics and their evaluation
- Correlation with fluke burden and productivity
- From parasitic to economic diagnosis

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# Diagnostics available

- Coprology
- Serology
- Copro-antigens
- DNA-based

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# Coprology (1)

- Microscopic detection of eggs
- Numerous methods described (Sedimentation-(flotation))

| PRO'S | CON'S |
| --- | --- |
| ▪ Specificity<br>▪ Current infections | ▪ Sensitivity |

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# Coprology (2)

| Method | Se | Sp | Reference |
|---|---|---|---|
| S 10 g | 33% | - | Conceiçao et al., 2004 |
| S 30 g | 83% | - | |
| | | | |
| S 10 g | 69% | 98% | Rapsch et al., 2008 |
| S 10 g – 2 times | 86% | 98% | Rapsch et al., 2008 |
| S 10 g – 3 times | 90% | 98% | Rapsch et al., 2008 |
| | | | |
| S-F 4 g | 43% | 100% | Charlier et al., 2008 |
| S-F 10 g | 64% | 93% | Charlier et al., 2008 |

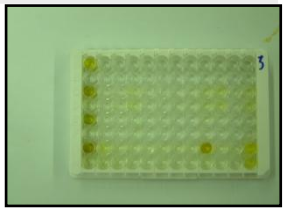
# Serology (1)

- Detection of *F. hepatica*-specific antibodies in serum or milk
- Many elisa's have been described based on complete or subfraction of excretory-secretory (ES) products of *F. hepatica*

| PRO'S | CON'S |
| --- | --- |
| ▪ Higher Se<br>▪ High-throughput<br>▪ User-friendly matrix: milk | ▪ Active infection? |

# Serology (2)

| | ES | "f2" | MM3 |
|---|---|---|---|
| Se | 86-100 % | 88-98 % | 99 % |
| Sp | 83-96 % | 84-98 % | 100 % |
| Commercial format | Svanova | IDEXX | Bio-X |
| References | Anderson et al., 1999<br>Cornelissen et al., 1999<br>Salimi-Bejestani, 2005<br>Charlier et al., 2008<br>Kuerpick et al.,2013 | Reichel, 2002<br>Molloy et al., 2005<br>Rapsch et al., 2006<br>Charlier et al., 2008<br>Kuerpick et al.,2013 | Mezo et al., 2010 |



# Copro-antigen

- MM3-copro-ELISA (Mezo et al., 2004):
  - Detection of active infection with high Se and Sp. (> 95%)
- Commercial version available (Bio-X Diagnostics, Jemelle)
  - Field evaluations report rather low sensitivity (Düscher et al., 2011; Salem et al., 2011, …)
  - Succesfully applied in copro-antigen reduction test (CRT)

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# DNA-based methods

- PCR (Martinez-Perez, 2012):
  - Highly Se/Sp
  - Detection 2 weeks pi vs. 4 weeks pi for copro-antigen
- LAMP (Ai et al., 2010):
  - Amplification in ca. 60 min under 61 °C.
  - Reaction visible by naked eye
  - Potential of pen-side diagnostic?

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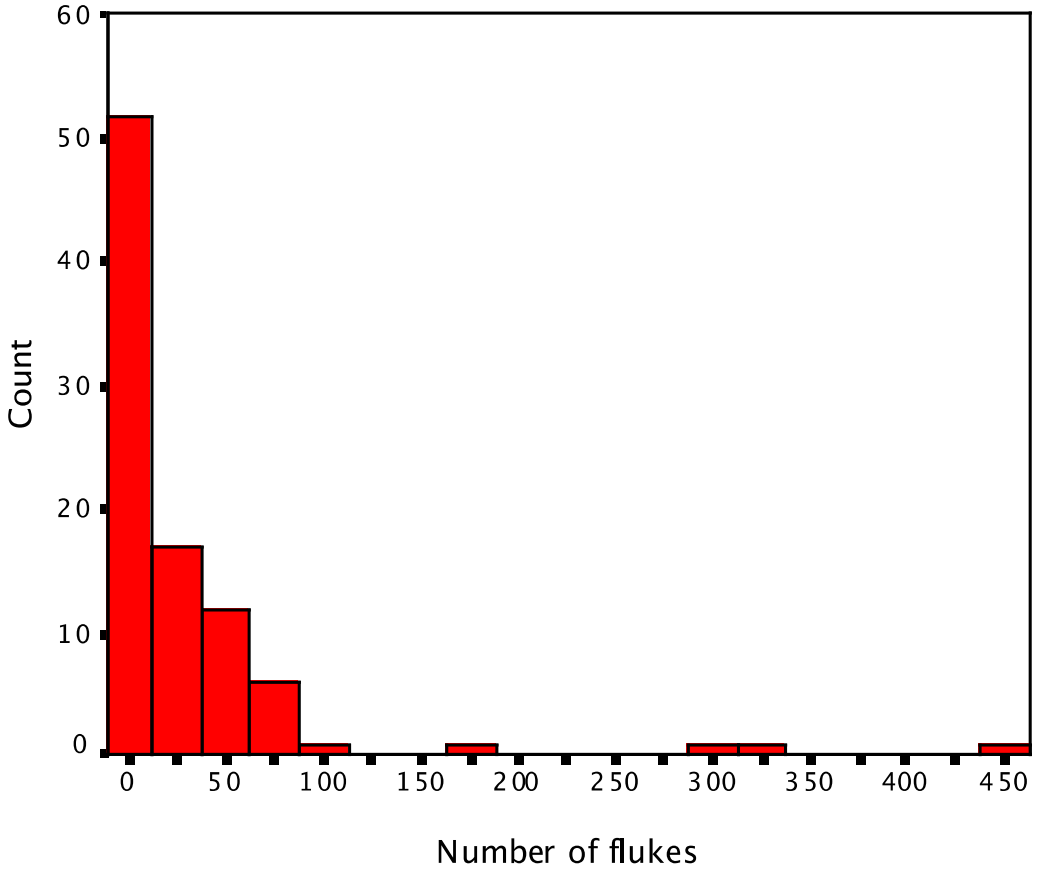
# The problem with current approach

**What is the message?**

# Closer look at the fluke burden (1)




- Geomean: 9(1-446)
- 60% < 10 flukes
- 28% > 30 flukes

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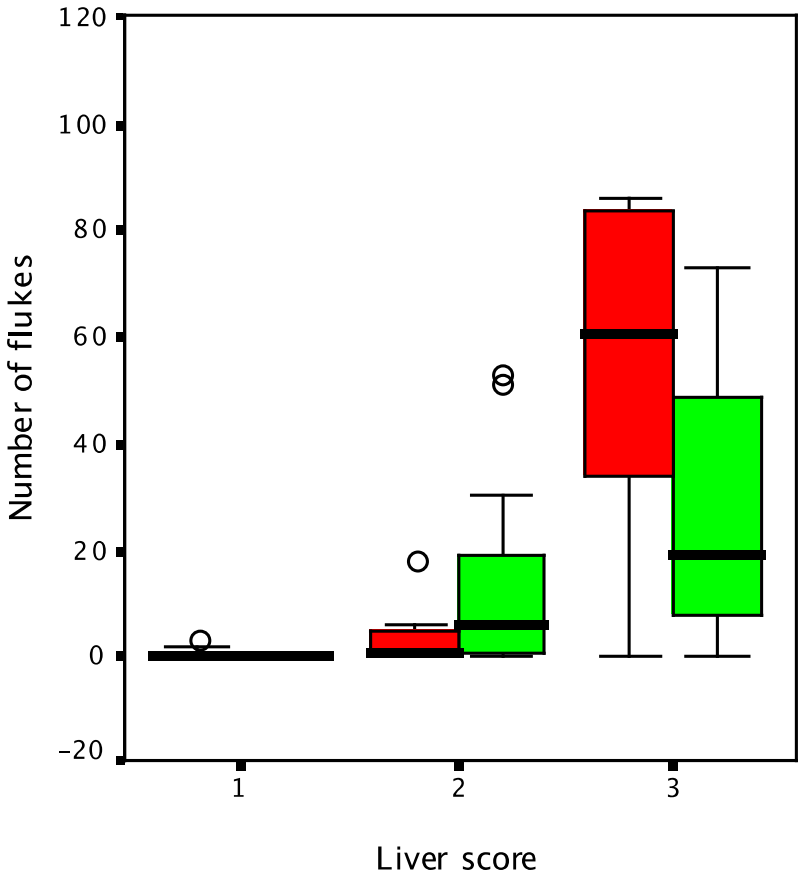
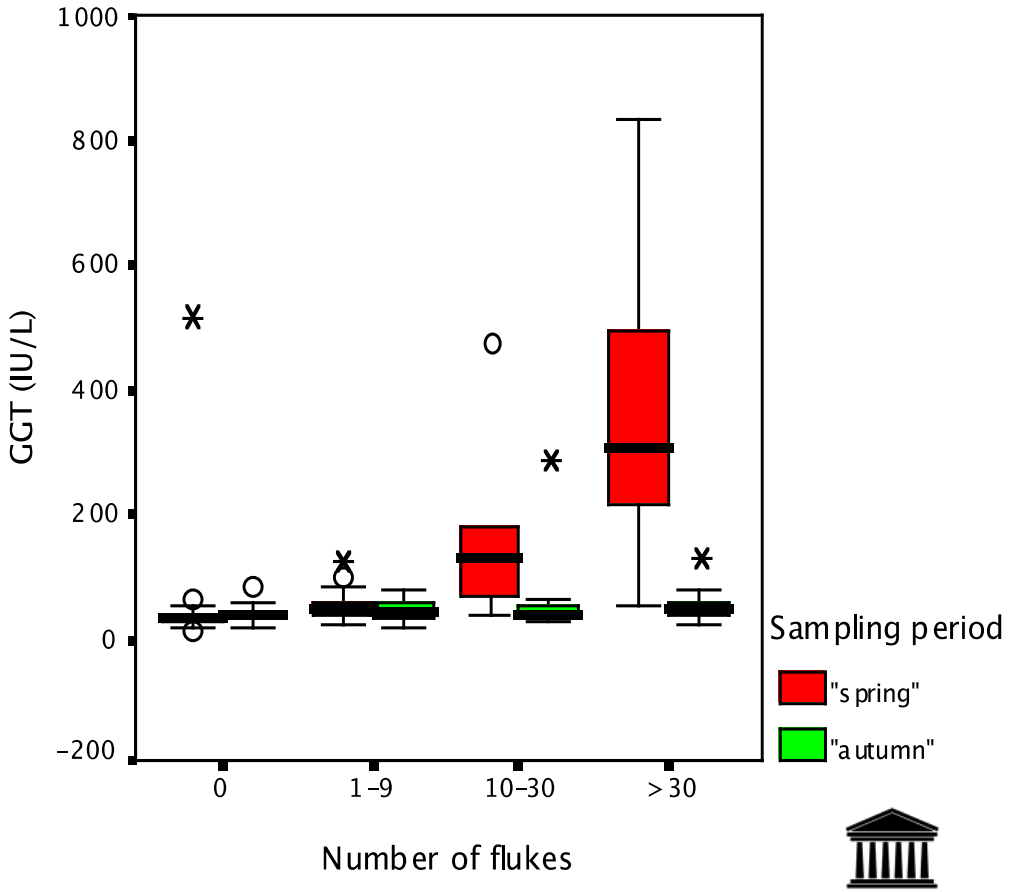
# Closer look at the fluke burden (2)

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# Correlation of diagnostics with fluke burden

- Coprology to detect infections with > 10 flukes
  - SF on 4 g: PPV 87%
  - SF on 10 g: PPV 48%.
- Copro-antigens: R ≈ 0.6
- Serology ES ELISA: R ≈ 0.3

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# Correlation of diagnostics with production parameters (1)

- ES ELISA (Charlier et al., 2007; 2009; Kuerpick et al., 2012)
  - Herd average milk yield (3%)
  - Herd mean carcass weight (0.7%)
  - Intercalving interval (+ 5 days)

- MM3 ELISA (Mezo et al., 2011)
  - "Light infection": no effect
  - "Heavy infection": -2 kg milk/cow/day

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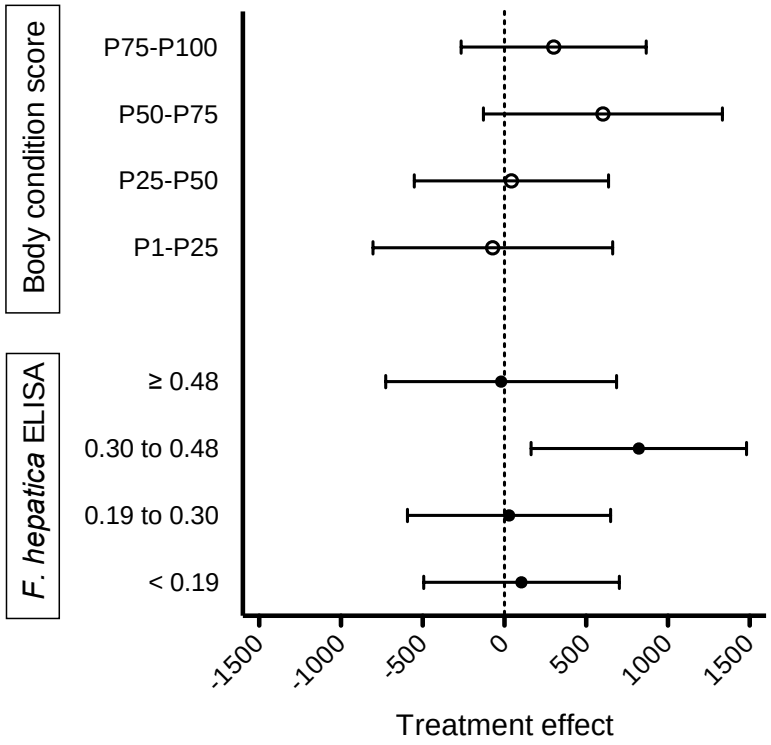
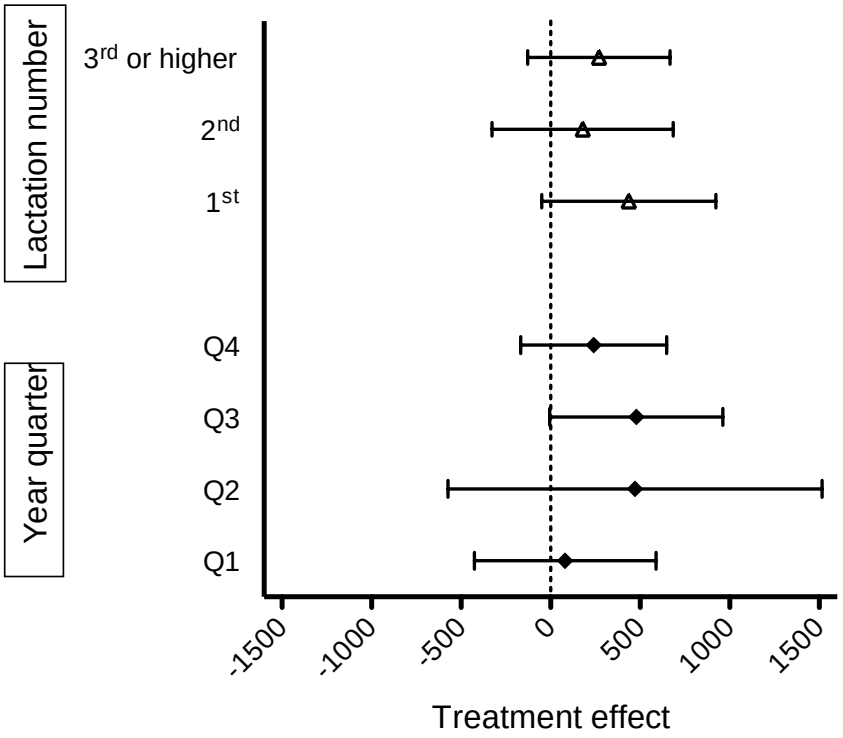
# Prediction of production responses




(Charlier et al., 2012)

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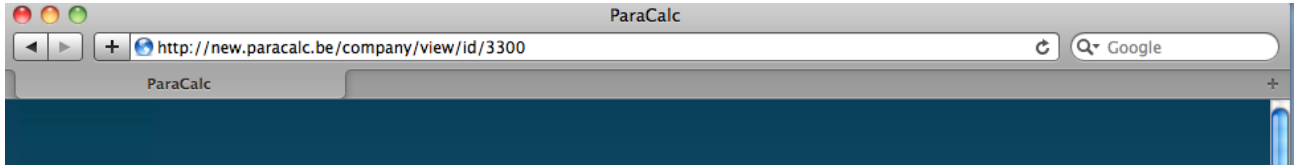
# Estimating herd-specific cost of disease

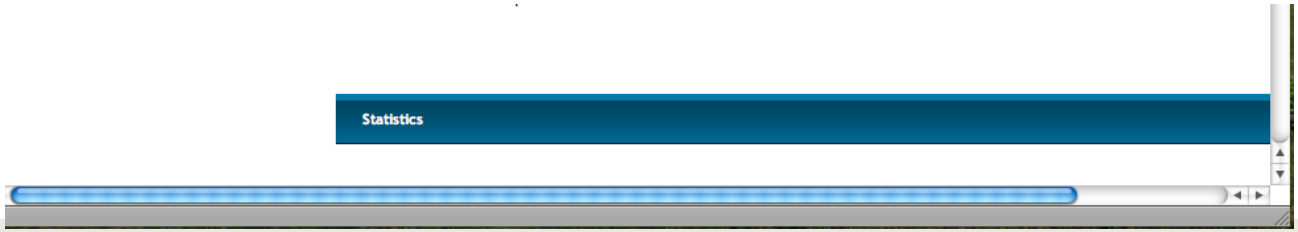



**Estimated costs of worm infections on your herd**

| | Gastrointestinal worms | | Liver fluke | |
|---|---|---|---|---|
| | Young stock | Dairy cows | Young stock | Dairy cows |
| Production losses | NA | £ 4,272.00 | NA | £ 241.00 |
| Cost of anthelmintics | £ 0.00 | £ 0.00 | £ 0.00 | £ 400.00 |
| Total | NA | £ 4,272.00 | NA | £ 641.00 |

| | |
|---|---|
| **Total costs gastrointestinal worms per year:** | £ 4,272.00 |
| **Total costs gastrointestinal worms per cow:** | £ 61.00 |
| **Total costs liver fluke per year:** | £ 641.00 |
| **Total costs liver fluke per cow:** | £ 9.00 |

Save and Return | Delete | Download PDF Report

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# Putting it all in the right context

G Model
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## Conceptual framework for analysing farm-specific economic effects of helminth infections in ruminants and control strategies

Mariska van der Voort[a,b,c,*], Johannes Charlier[b], Ludwig Lauwers[a,c], Jozef Vercruysse[b], Guido Van Huylenbroeck[c], Jef Van Meensel[a]

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# Conclusions

- **Wide array of diagnostics** available
  - Antibody detection: detect farms/animals "at risk"
  - Coprology: support treatment decisions
- Traditional focus very much on **Se/Sp**
- Need for novel approaches to assess the **farm-specific impact of fasciolosis** before taking remedial measures

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