Animal based indicators for the implementation of a selective usage of anthelmintics in adult dairy cattle

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Introduction: context and issues

Prevalence of GIN infection in adult dairy cows is high: 80 to 95%

Possible negative impact on milk production

Control measure often proposed = whole herd anthelmintic treatment

Lack of reliable tools for the assessment of the parasitical risk

Drug use may be often too intensive

Which runs up against several limits

Rationalization / optimisation of anthelmintic treatments: Is it possible in adult dairy cattle?

After anthelmintic treatment:
+0,63Kg/day (Gross et al. 1999)
+0,35Kg/day (Sanchez et al. 2004)
Introduction: optimizing anthelmintic treatments?

A decrease in milk production ...

We should only treat herds / cows whose MP is negatively impacted by GIN

Targeted selective treatment

Herd-level variability
often reported

Individual-level variability
expected

We need indicators that allow the identification of herds / cows whose MP is affected
Objective

Investigate in adult dairy cows, the relation between 6 indicators and the decrease in MP caused by GIN infection.

3 herd-level indicators
- % positive FEC
- Bulk Tank Milk *O. ostertagi* ODR
- Grazing history of cows

3 individual-level indicators
- FEC
- Serum *O. ostertagi* ODR
- Serum pepsinogen level

Decrease in MP
Measured indirectly by the milk production response after treatment for GIN

Determine if these indicators would be factors of variation of the treatment response (potential predictive factors of the treatment response?)

Useful tools for targeted selective treatment
Materials and methods: study design

Western France
25 pastured dairy herds
1254 lactating cows

Visits: autumn 2010 and 2011

August  | September | October | November | December | January | February | March | April
---|---|---|---|---|---|---|---|---

**Visits**

Treatment: Fenbendazole, Panacur™ 10%

Samples: blood, feces and bulk tank milk

Questionnaire:
Collection of heifers’ grazing management data (grazing history of cows)

**Each cow characterized by**
- Treatment: yes (623 cow) / no (631 cows)
- FEC, individual ODR, pepsinogen level

**Each herd characterized by**
- % positive FEC
- BTM ODR
- Time of effective contact (TEC) with GIN infective larvae before the first calving

Fenbendazole = best compromise for zero withdrawal time for milk + narrow spectrum on nematodes + no drawback related to pour-on formulation
Determination of the Time of Effective Contact with infective larvae (TEC) before the first calving

- **First grazing season**
  - April
- **Second grazing season**
  - Nov. to March
- **Cows’ grazing season**
  - Dec.

**TEC**

- **TEC$_1$** = 7 months – 2 months
  - 5 months
- **TEC$_2$** = 9 months – 1 month
  - 8 months

**Drought and high supplementation**

- **TEC >= 8 months**: high-TEC herds
- **TEC < 8 months**: low-TEC herds

**Persistent treatment**
Materials and methods: study design

**Recruitment:** France, Western
25 pastured dairy herds
1254 lactating cows

**Visits:** autumn 2010 and 2011

**August** | **September** | **October** | **November** | **December** | **January** | **February** | **March** | **April**
---|---|---|---|---|---|---|---|---

**Treatment:** Fenbendazole, Panacur ® 10%

**Samples:** blood, feces and bulk tank milk

**Questionnaire:**
Collection of heifers’ grazing management data
(grazing history of cows)

**Recording of daily MP data of all cows**

14 days before treatment

60 to 100 days after treatment ➔ **TREATMENT RESPONSE**

**Each cow characterized by**
- Treatment: yes (623 cows) / no (631 cows)
- FEC, individual ODR, pepsinogen level

**Each herd characterized by**
- % positive FEC
- BTM ODR
- Time of effective contact (TEC) with GIN before the first calving (reflection of the development of immunity)
Materials et methods: statistical analysis

Assessment of the evolution of milk production after treatment and its factors of variation

- **1077 cows**: 533 treated cows/ 544 control cows
- Linear mixed models
- Outcome: *daily milk production averaged by week*
- Individual and herd-level indicators put in interaction with « treatment »

Each week, the treated cows’ MP gain (in comparison with control cows’ MP) was calculated
Results: « pattern » of the global treatment response

The overall treatment effect is significant but slight \((p<0.0001)\)

Maximal MP gain after treatment= +0.85 Kg/cow/day in week 6

Average MP gain after treatment= +0.27 Kg/cow/day

Which herds / cows are contributing to this moderate global treatment response?
Results: variation of the treatment response according to herd-level indicators

Evolution of MP gain according to the TEC (p< 0.0001)

<table>
<thead>
<tr>
<th>Treatment Description</th>
<th>Average Gain</th>
<th>Gain in week₆</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-TEC</td>
<td>+0.31 Kg/cow/d</td>
<td>+1.3 Kg/cow/d</td>
</tr>
<tr>
<td>High-TEC</td>
<td>-0.65 Kg/cow/d</td>
<td>-0.8 Kg/cow/d</td>
</tr>
</tbody>
</table>

Evolution of MP gain according to the TEC in herds with BTM ODR ≥ 0.74 (p< 0.0001)

<table>
<thead>
<tr>
<th>Treatment Description</th>
<th>Average Gain</th>
<th>Gain in week₆</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-TEC and high BTM ODR</td>
<td>+0.95 Kg/ VL/j</td>
<td>+2.0 Kg/ VL/j</td>
</tr>
<tr>
<td>High-TEC and high BTM ODR</td>
<td>-0.06 Kg/ VL/j</td>
<td>-0.3 Kg/ VL/j</td>
</tr>
</tbody>
</table>

BTM ODR taken into account alone did not appear as a significant factor of variation (p=0.12)
Results: variation of the treatment response according to individual-level indicators (1)

**Evolution of MP gain according to parity (p< 0.0001)**

<table>
<thead>
<tr>
<th>Parity</th>
<th>Average Gain</th>
<th>Gain in week 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parity = 1</td>
<td>+0.004 Kg/cow/d</td>
<td>+0.51 Kg/cow/d</td>
</tr>
<tr>
<td>Parity = 2</td>
<td>-0.11 Kg/cow/d</td>
<td>+0.13 Kg/cow/d</td>
</tr>
<tr>
<td>Parity = 3 et +</td>
<td>-0.40 Kg/cow/d</td>
<td>+0.07 Kg/cow/d</td>
</tr>
</tbody>
</table>

**Evolution of MP gain according to DIM at the time of treatment (p< 0.0001)**

<table>
<thead>
<tr>
<th>DIMt</th>
<th>Average Gain</th>
<th>Gain in week 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIMt &lt;= 100 j.</td>
<td>+0.28 Kg/VL/j</td>
<td>+0.57 Kg/VL/j</td>
</tr>
<tr>
<td>100 &lt; DIMt &lt;= 200 j.</td>
<td>+0.07 Kg/VL/j</td>
<td>+0.55 Kg/VL/j</td>
</tr>
<tr>
<td>DIMt &gt; 200 j.</td>
<td>-0.86 Kg/VL/j</td>
<td>-0.42 Kg/VL/j</td>
</tr>
</tbody>
</table>
Results: variation of the treatment response according to individual-level indicators (2)

Individual FEC and pepsinogen level were not interesting factors of variation of the treatment response.

Evolution of MP gain according to the individual serum ODR ($p=0.005$)

<table>
<thead>
<tr>
<th>RDOind</th>
<th>Average Gain</th>
<th>Gain in week$_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\leq 0.38$</td>
<td>+0.47 Kg/cow/d</td>
<td>+1.14 Kg/cow/d</td>
</tr>
<tr>
<td>$0.38 &lt; RDOind \leq 0.62$</td>
<td>+0.13 Kg/cow/d</td>
<td>+0.42 Kg/cow/d</td>
</tr>
<tr>
<td>$&gt; 0.62$</td>
<td>-0.29 Kg/cow/d</td>
<td>+0.54 Kg/cow/d</td>
</tr>
</tbody>
</table>

But 80% of these cows are cows from low-TEC herds...
Discussion

Better treatment response

Low TEC herds

TEC = Development of resistance

- Low-TEC
  - Low resistance to re-infection
  - heterogeneous status in the herd

- High-TEC
  - High resistance to re-infection
  - Homogeneous status in the herd

High BTM ODR

Exposure to GIN During the last grazing season

Mean value for the lactating herd

Herd level indicators

Combination

Treatment response variable according to the development of resistance and the level of exposure

Individual level indicators

Early lactating cows

Primiparous cows

Low individual ODR

Low individual TEC?
Conclusion

• **TEC: a new promising tool at herd level for targeted treatment**
• **Based on analysis of herd management**
• **Rarely** taken into account in studies dealing with this treatment response

**Selective treatment within herd:**
- Investigation of TEC at an individual level
- Combination of several indicators
- a maximum of easy-to-use and low cost indicators
Thanks to...

- All the farmers who participated
- The team involved on the field and at the laboratory
- All the vets who helped us for the recruitment
- Financial support

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Thank you for your attention