The corn rootworm in Bavaria
- local relevance and economic impact on single farms -

International Conference
on the German Diabrotica Research Program

Berlin, 14th – 16th November 2012
Project aim:

- Assessment of the possible regional significance of the Western corn rootworm (WCR)

- Determination of the economic impact of different eradication and containment measures at farm level
Cultivation of maize in Bavaria

Maize growing area 2009

Source: InVeKoS - Data 2005-2009, own calculations

Bavaria: maize 2010
Source: Halama, LfL Bayern

Bavaria:
Maize growing area: **464,688 ha**
Portion of maize in crop rotation: **22 %**
Area increase: **11 %**
Cultivation of maize in Bavaria

Proportion of maize in crop rotation

- 0 %
- 0 < 33.33 %
- 33.33 < 40%
- 40 < 50%
- > 50%

Source: InVeKoS Data 1996, 2011,
### Study Approach:

#### Steps:

1. **Selection of specific regions**

2. **Selection of case study farms**

3. **Economic calculations**

4. **Qualitative survey**

**Conclusion**
Method: Selection of case study farms

<table>
<thead>
<tr>
<th>Selection of specific regions</th>
<th>Selection of typical single farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>➔ Assuming that the economic importance of the beetle depends on the regional maize density</td>
<td>• Analysis of the InVeKoS-Database</td>
</tr>
<tr>
<td>• Identification of regions in Bavaria with a high maize density</td>
<td>- Regional portion of maize in crop rotation (&gt; 50%)</td>
</tr>
<tr>
<td>• Analysis of the InVeKoS-Database</td>
<td>- Portion of maize grown on single farm (&gt; 66%)</td>
</tr>
<tr>
<td>- Regional portion of maize in crop rotation (&gt; 50%)</td>
<td>• Different farm types (diary cattle, cash crop production, bull fattening, swine production, etc.)</td>
</tr>
<tr>
<td>- Area related development of maize production (2005-09)</td>
<td>• Expert interviews</td>
</tr>
<tr>
<td>• Expert interview</td>
<td>• Willingness of manager to participate</td>
</tr>
</tbody>
</table>
Method: single farm survey

<table>
<thead>
<tr>
<th>1. Economic calculations</th>
<th>2. Qualitative survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>case study farms (n= 9 )</td>
<td>case study farms (n= 50)</td>
</tr>
<tr>
<td>➔ whole-farm simulation</td>
<td>➔ semi-structured interviews</td>
</tr>
</tbody>
</table>

1. Data collection:
   - accountancy data
   - Interviews with farm manager

2. Calculating the gross margin of the main production processes
   (five-year average)

3. Economic evaluation of the different single farm adjustment measures

Purpose:
- prove the results of the case study
- obtain more information about the consequences on farm level
- evaluate the proposed cultivation alternatives for maize

Katrin Köhler 16.11.2012
# Results: Adjustment measures

| **grain maize/silage maize is replaced by:** |  
| **cash crop production** | → winter wheat cultivation  
| **swine production** | → change of feed ration: Substitution of grain silage by wheat and barley, purchase of wet maize, winter wheat cultivation  
| **dairy cattle** | → change of feed ration: Substitution of maize silage by grass silage  
|  
|  | • diets with varying levels of grass silage (50 %, 70 %, 100 %)  
|  | • purchase of feed wheat, reduction of soybean meal, increase of grass-clover cultivation  
| **bull fattening:** | → change of feed ration: Substitution of maize silage by grass silage  
|  
|  | • diets with a levels of 60 % grass silage  
|  | • purchase of feed wheat, reduction of soybean meal, increase of grass-clover cultivation  
| **biogas production** | → purchase of substrate (silage maize), increase of grass-clover cultivation  

Katrin Köhler 16.11.2012
## Results: Adjustment costs

### Adjustment costs: per 1 ha replaced maize area (at single farm level)

<table>
<thead>
<tr>
<th>Farm type</th>
<th>Adjustment measure</th>
<th>Costs [€/ha]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cash crop production</strong></td>
<td>winter wheat cultivation</td>
<td>100-200</td>
</tr>
<tr>
<td><strong>swine production</strong></td>
<td>change of feed ration: Substitution of grain silage by wheat and barley, purchase of wet maize, winter wheat cultivation</td>
<td>100</td>
</tr>
<tr>
<td><strong>dairy cattle</strong></td>
<td>change of feed ration: Substitution of maize silage by grass-clover silage</td>
<td>550 – 650 (extreme values: -500/ 1.200)</td>
</tr>
<tr>
<td><strong>bull fattening</strong></td>
<td>change of feed ration: Substitution of maize silage by grass-clover silage</td>
<td>100-350</td>
</tr>
<tr>
<td><strong>biogas production</strong></td>
<td>purchase of substrate, grass-clover cultivation</td>
<td>650 - 800</td>
</tr>
</tbody>
</table>

### Adjustment costs depend on:

- Cash crop production: high gross margin of alternative crops
- Purchase cost of silage maize
- Land availability for enhanced forage production
- Necessity of farmland lease

---


Katrin Köhler 16.11.2012
Results: Economic impact per year

⇒ great differences of the economic impact

Economic impact depends on:

- size of the affected area
- level of maize restriction  
  (67%, 50%, 0%)
- level of farm-specific costs

### Results: Additional Work

**Additional work: per 1 ha replaced maize area (at single farm level)**

<table>
<thead>
<tr>
<th>Farm type</th>
<th>Adjustment measure</th>
<th>Labour hour [LH/ha]</th>
</tr>
</thead>
<tbody>
<tr>
<td>cash crop production</td>
<td>winter wheat cultivation</td>
<td>0</td>
</tr>
<tr>
<td>swine production</td>
<td>purchase of wet maize, winter wheat cultivation</td>
<td>1</td>
</tr>
<tr>
<td>dairy cattle</td>
<td>change of feed ration: Substitution of maize silage by grass-clover silage</td>
<td>4,5 - 10</td>
</tr>
<tr>
<td>bull fattening</td>
<td>change of feed ration: Substitution of maize silage by grass-clover silage</td>
<td>4,5 - 10</td>
</tr>
<tr>
<td>biogas production</td>
<td>purchase of substrate, grass-clover cultivation,</td>
<td>4,5 - 10</td>
</tr>
</tbody>
</table>

**Additional work depends on:**

- **Cash crop production:** no significant difference between the crops
- **Forage production:** relatively high increase in labour
  - Silage maize causes less work than clover growing
  - Change of feed ration:
    - 1 ha maize = 2 ha grass-clover

---

Katrin Köhler 16.11.2012
Results: Adjustment costs vs. yield loss (Bavaria)

**Proportion maize reduction**
(2/3 portion of maize in crop rotation)

- **8.850 ha**

**Proportion continuous maize**
(3 years in a row)

- **44.000 ha**

### Economic Damage

<table>
<thead>
<tr>
<th></th>
<th>Economic damage yield loss 5%</th>
<th>Economic damage yield loss 10%</th>
<th>Adjustment costs (min*) (2/3 maize reduction)</th>
<th>Adjustment costs (max*) (2/3 maize reduction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected area [ha]</td>
<td>132.150</td>
<td>132.150</td>
<td>8.850</td>
<td>44.000</td>
</tr>
<tr>
<td>Silage maize [ha]</td>
<td>100.430</td>
<td>100.430</td>
<td>6.730</td>
<td>33.440</td>
</tr>
<tr>
<td>Grain maize [ha]</td>
<td>31.720</td>
<td>31.720</td>
<td>2.120</td>
<td>10.560</td>
</tr>
<tr>
<td>Silage maize [€/ha]</td>
<td>105</td>
<td>210</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Grain maize [€/ha]</td>
<td>70</td>
<td>130</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td><strong>Costs [€]</strong></td>
<td><strong>12.800.000</strong></td>
<td><strong>25.000.000</strong></td>
<td><strong>4.400.000</strong></td>
<td><strong>21.700.000</strong></td>
</tr>
</tbody>
</table>

Source: InVeKoS 2010-2012, own calculations
Results: Break-Even anlaysis

yield loss | adjustment costs

<table>
<thead>
<tr>
<th>yield loss (cash crop)</th>
<th>adjustment costs (cash crop)</th>
<th>adjustment costs (dairy cattle)</th>
<th>yield loss (dairy cattle)</th>
</tr>
</thead>
</table>

assumed yield loss

Time to act?

Cash crop:
• Low adjustment costs
• Low tolerance for yield loss
• *Relatively quick response required*

Dairy cattle:
• Relatively high adjustment costs
• High tolerance for yield loss
• *Quick response not required*

Break-even cash crop *8,5 %*

Break-even dairy cattle *27,3 %*

Source: own calculations

Katrin Köhler 16.11.2012
Conclusion of calculation and survey

- Assessment of the possible regional significance of the Western corn rootworm (WCR)
- Determination of the economic impact of different eradication and containment measures at farm level

- Small- scaled, regional Problem
- The calculations and surveys show that necessary adjustments upon the occurrence of the WCR only in individual farms or very limited regions are a major problem.
  - even in most high-risk regions crop farms with high proportions of maize are relatively rare
  - comparatively low consequences for cash crop production
  - swine production: unexpectedly low impacts

- „special status“ region of Rottal-Inn ➔ substantial compliance costs
Conclusion of calculation and survey

- Assessment of the possible regional significance of the Western corn rootworm (WCR)
- Determination of the economic impact of different eradication and containment measures at farm level

- Grassland farms (forage production) comparatively strong impacts
  - Silage purchased almost impossible
  - Feed substitutes expensive
  - Solution: change of feed ration – avoid silage maize

- Most frequently mentioned consequences:
  - additional work
  - higher costs
  - higher demand of arable land

- Most farmers assessed the adaptation measure that maize can be at most 2/3 of crop rotation to be of a minor problem
Conclusion of calculation and survey

- Assessment of the possible regional significance of the Western corn rootworm (WCR)
- Determination of the economic impact of different eradication and containment measures at farm level

- Break-even analysis:
  - Cash crop production low tolerance for yield loss, because of comparatively low adjustment cost.
  - Single farms with high adjustment costs have a relative high tolerance for yield losses

- Analysis of Bavaria: Adjustment costs vs. Yield loss
  - continuous maize 26% 
  - Proportion of maize reduction 2 – 9% (whole Bavaria)
    - gap of 7% - seems that many single farms have continuous maize, although the portion of maize grown is much lower than 66% 
      = large potential for crop rotation – to reduce proportion of continuous maize
  - Adjustment costs between € 4 million – € 22 million
  - Economic damage yield loss (5%, 10%) between € 13 million - € 25 million

Economic no clear basis for decision-making
Thank you for your attention