Performance testing of sugar beet varieties under conditions of pest and disease infestation in field trials – problems, solutions, restrictions

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Development of the number of sugar beet variety trials in different series

<table>
<thead>
<tr>
<th>Name of variety trial series</th>
<th>Number of trial</th>
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<tbody>
<tr>
<td></td>
<td>1997</td>
</tr>
<tr>
<td>trial without specific infestation</td>
<td>33</td>
</tr>
<tr>
<td>trial with Rhizomania infestation</td>
<td>28</td>
</tr>
<tr>
<td>trial with Rhizoctonia infestation</td>
<td>-</td>
</tr>
<tr>
<td>trial with <em>H. schachtii</em> infestation</td>
<td>-</td>
</tr>
<tr>
<td>trial with <em>D. dipsaci</em> infestation</td>
<td>-</td>
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</tbody>
</table>
The use of tolerant varieties in Germany (surveys of IfZ 1999-2006)
Rhizomania, BNYVV
## Number of trials with Rhizomania-tolerant sugar beet varieties

<table>
<thead>
<tr>
<th>Year</th>
<th>Variety trials with Rhizomania</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>conducted</td>
<td>series with infestation</td>
</tr>
<tr>
<td>2001</td>
<td>36</td>
<td>23</td>
</tr>
<tr>
<td>2002</td>
<td>27</td>
<td>17</td>
</tr>
<tr>
<td>2003</td>
<td>31</td>
<td>19</td>
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<td>16</td>
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<td>2005</td>
<td>31</td>
<td>12</td>
</tr>
<tr>
<td>2006</td>
<td>29</td>
<td>9</td>
</tr>
</tbody>
</table>
Rhizomania

Problem
- Assumed infestation, but absence of a response of the susceptible variety.

(Solution)
- Regional Recommendation: Arithmetical mean of data from both trials with and without Rhizomania.
- Best performing variety in each situation (with or without infestation) is the best for a region.

Restriction
- Since the interaction between Rhizomania tolerant varieties and the level of Rhizomania infestation is likely, the pressure of selecting varieties with high Rhizomania tolerance has to be kept high.
Cercospora beticola

Ramularia beticola

Erysiphe betae
Spread of foliar diseases and fungicide treatments on sugar beet acreage in Germany (surveys of IfZ 1996-2006)
Leaf diseases

Problem
- Information about yield performance of varieties under fungicide application as well as the performance without fungicide got essential.

Solution
- Since 2003 trials are carried out in a two factorial split-plot design (fungicide, variety) with two replications, randomising fungicide as main plot.
- Calculation of tolerance as the difference between the treated and untreated level for each variety.

Restriction
- If disease severity is low in some years, calculations of tolerance don´t give reliable results.
Rhizoctonia solani
Rhizoctonia

Problem
- Occurrence of this disease is extremely heterogeneous among years as well as within individual fields.

Solution
- Strip field trial with harvest plots chosen depending on the visual infestation level.
- Tested now: Artificial inoculation on 4 trial sites in two inoculation levels.

Restriction
- Labour intensive.
- Due to practical restrictions only four resistant and one susceptible variety can be tested.
Experimental design (examples) for determination of sugar beet varieties performance under *Rhizoctonia solani* infestation

* susce**ptible sugar beet variety
Predicted white sugar beet yield in dependence on Rhizoctonia disease severity (13 trials, 2006)

Sugar beet variety:
- susceptible variety
- Calida
- Premiere
- Prestige
- Nauta

White sugar yield (t ha⁻¹)

Disease severity (% of infected beet surface of the susceptible variety)
Rhizoctonia

Problem
➢ Occurrence of this disease is extremely heterogeneous among years as well as within individual fields.

Solution
➢ Strip field trial with harvest plots chosen depending on the visual infestation level.
➢ Tested now: Artificial inoculation on 4 trial sites in two inoculation levels.

Restriction
➢ Labour intensive.
➢ Due to practical restrictions only four resistant and one susceptible variety can be tested.
Heterodera schachtii
Nematodes (*H. schachtii*)

Problem
- Occurrence of this pest is extremely heterogeneous among years as well as within individual fields.
- The degree of infestation is often not visible in the field.

(Solution)
- Randomised complete block design and strip trial with determined harvest plots depending on the results of soil analysis of *H. schachtii* after drilling.

Restriction
- Since the results from field trials concerning variety tolerance often were not reproducible, some greenhouse experiments were conducted.
Summary

- Performance testing of sugar beet variety under conditions of pest and diseases in field trials is challenging.

- Randomized block design is the basis of field trials in general.

- A complementation by other trial designs are necessary to solve the problems of inhomogeneous distribution of pathogens in the soil or uncertain infestation.