

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

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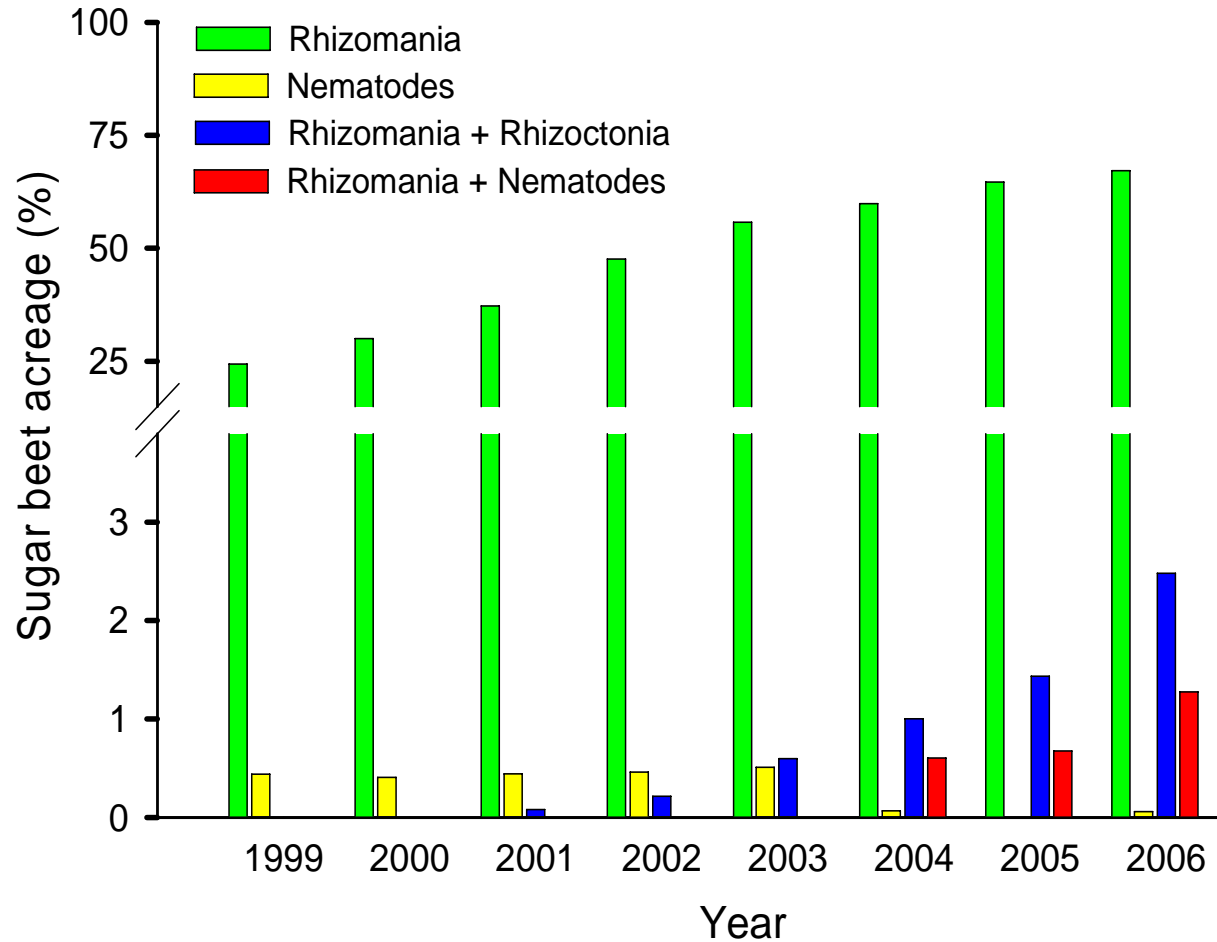


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Development of the number of sugar beet variety trials in different series

Name of variety trial series	Number of trial		
	1997	2003	2007
trial without specific infestation	33	18	15
trial with <i>Rhizomania</i> infestation	28	30	29
trial with <i>Rhizoctonia</i> infestation	-	21	8
trial with <i>H. schachtii</i> infestation	-	-	11
trial with <i>D. dipsaci</i> infestation	-	-	5

The use of tolerant varieties in Germany (surveys of IfZ 1999-2006)



Rhizomania, BNYVV



Number of trials with Rhizomania-tolerant sugar beet varieties

Year	Variety trials with Rhizomania		
	conducted	series with infestation	series without visible infestation
2001	36	23	5
2002	27	17	4
2003	31	19	6
2004	31	16	5
2005	31	12	10
2006	29	9	6

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.**



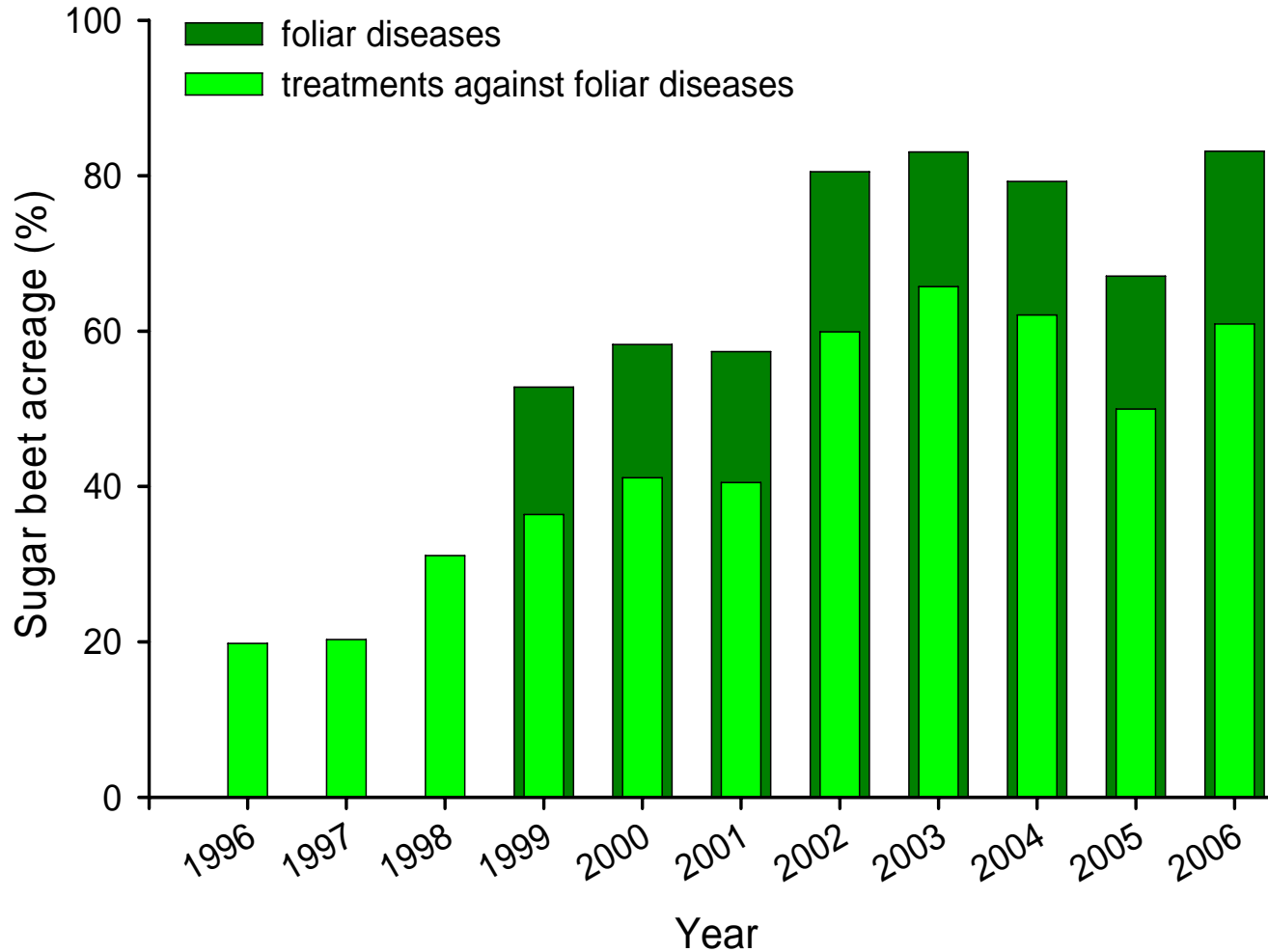
Cercospora beticola

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.

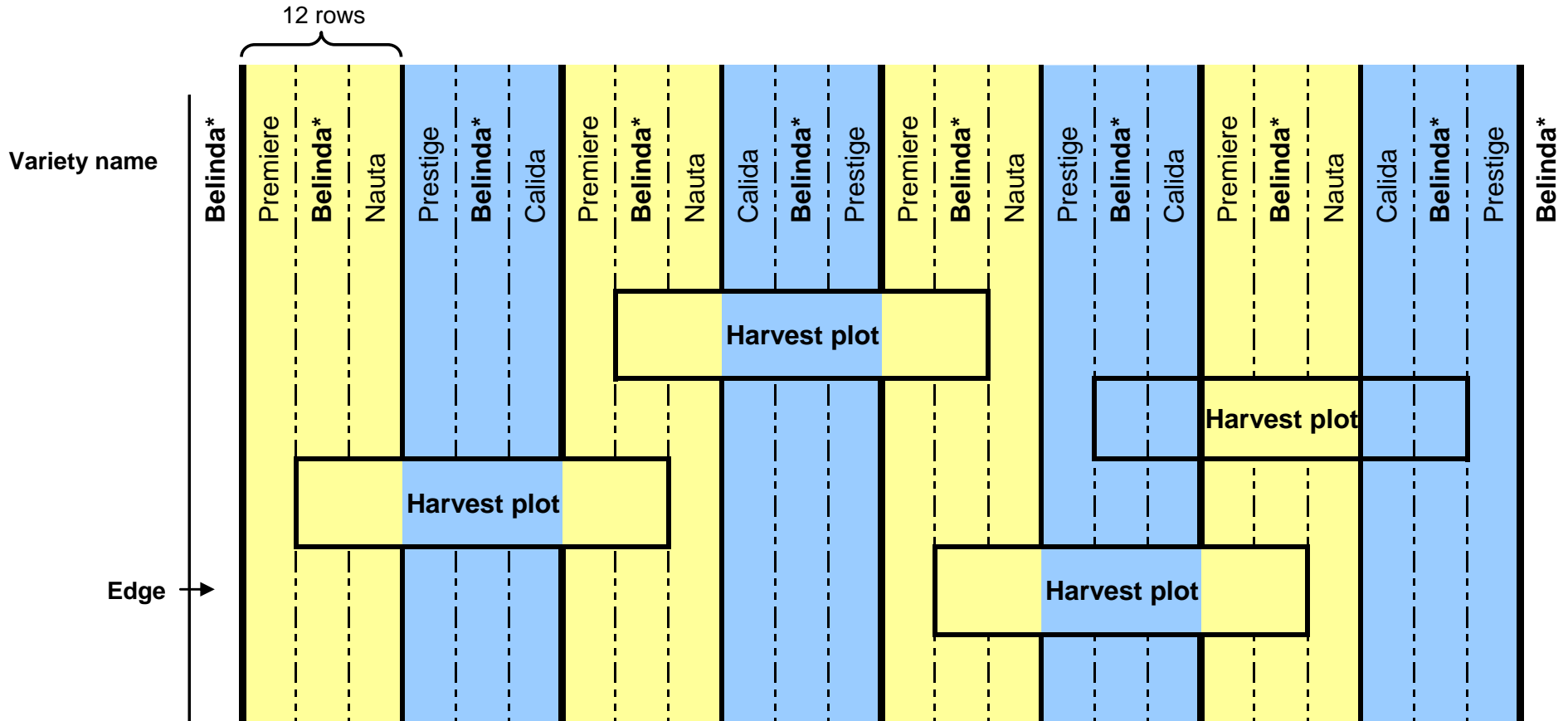
Solution

- 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

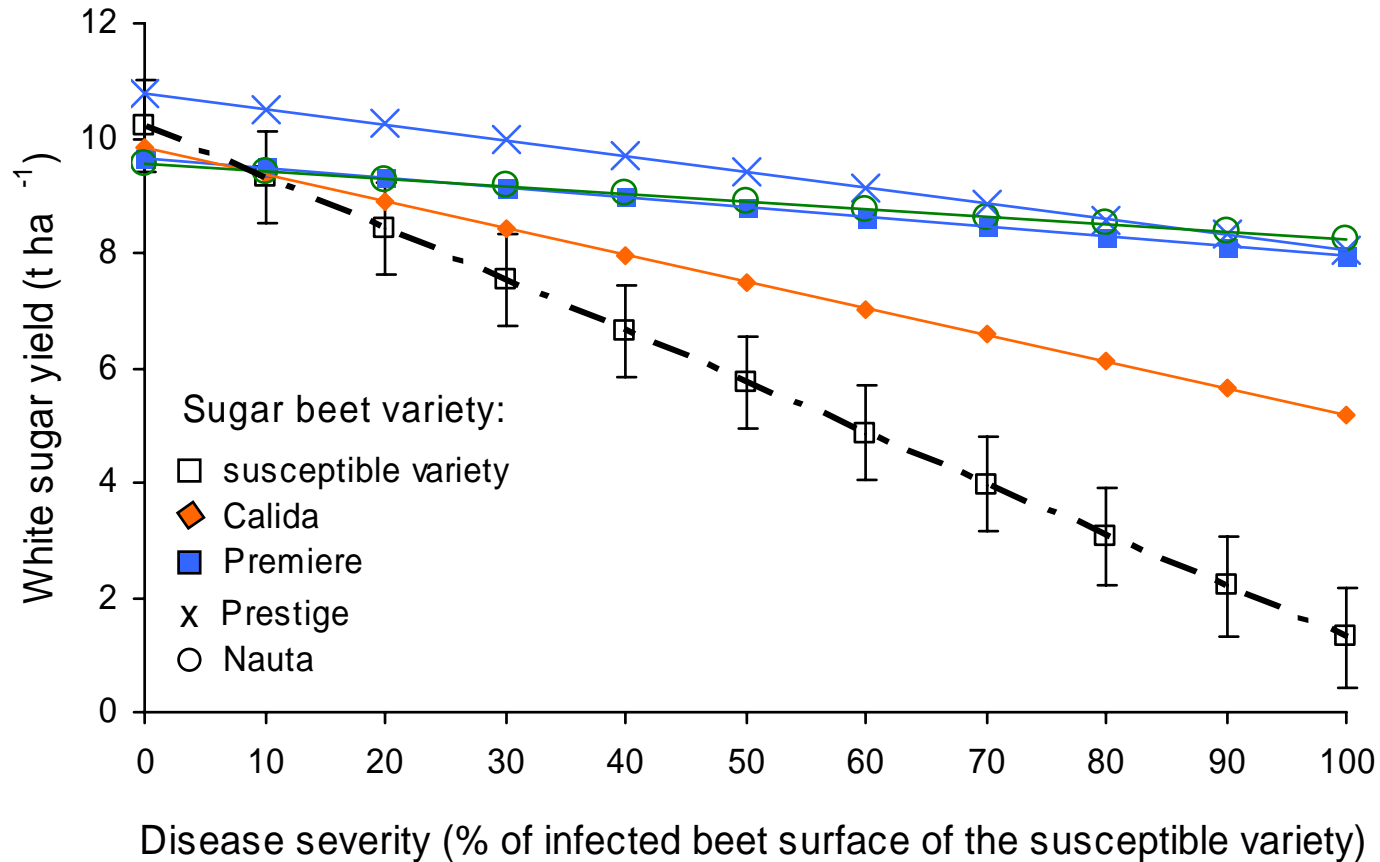
- Labour intensive.
- Due to practical restrictions only four resistant and one susceptible variety can be tested.

Experimental design (examples) for determination of sugar beet varieties performance under *Rhizoctonia solani* infestation



* susceptible sugar beet variety

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



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.**