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# Relevance of *Rhizoctonia* stem base infections in intensive wheat production systems



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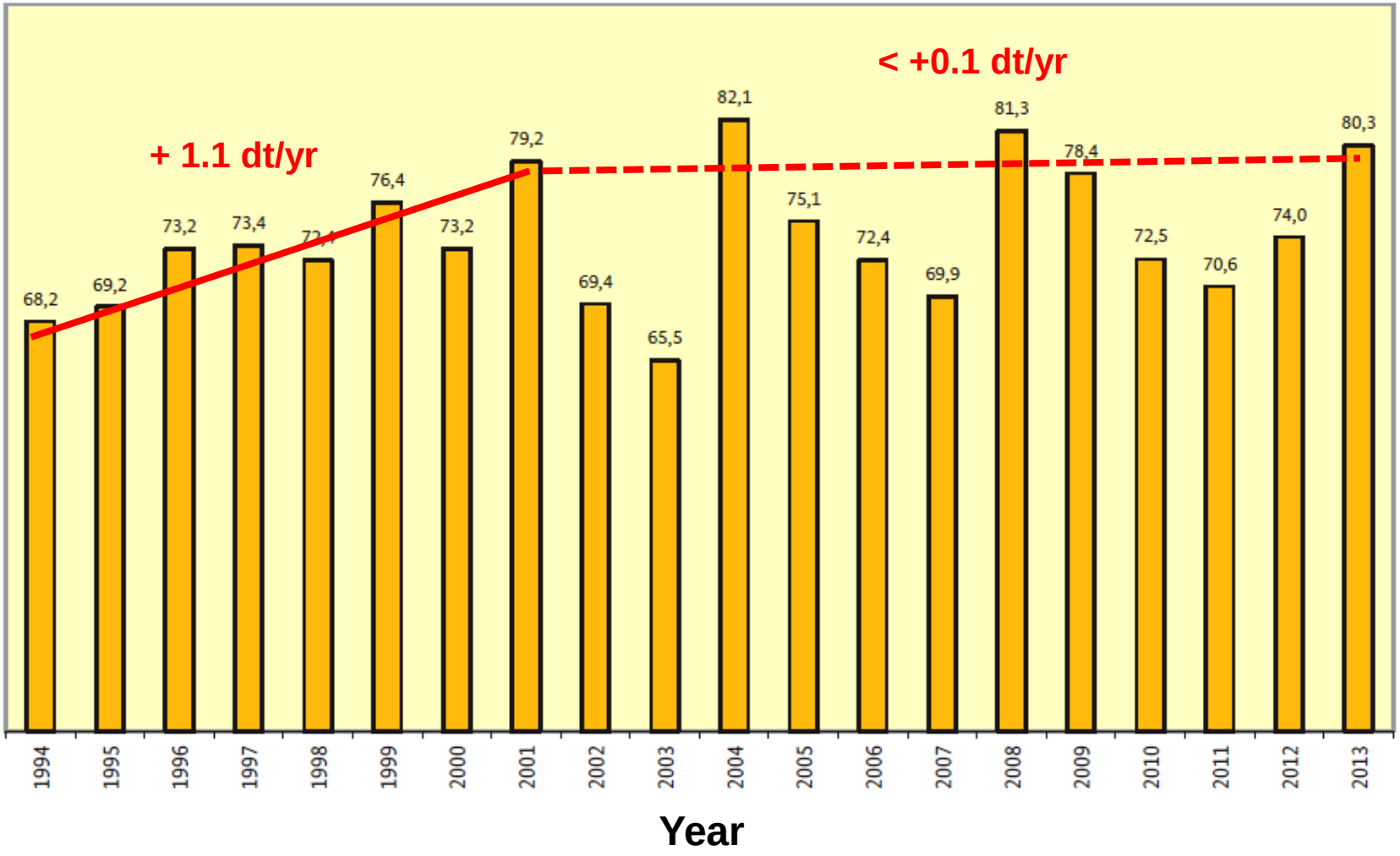
# Yield trends winter wheat, Germany 1994 - 2013




Source: Federal Cultivar Registration Authority, 2015

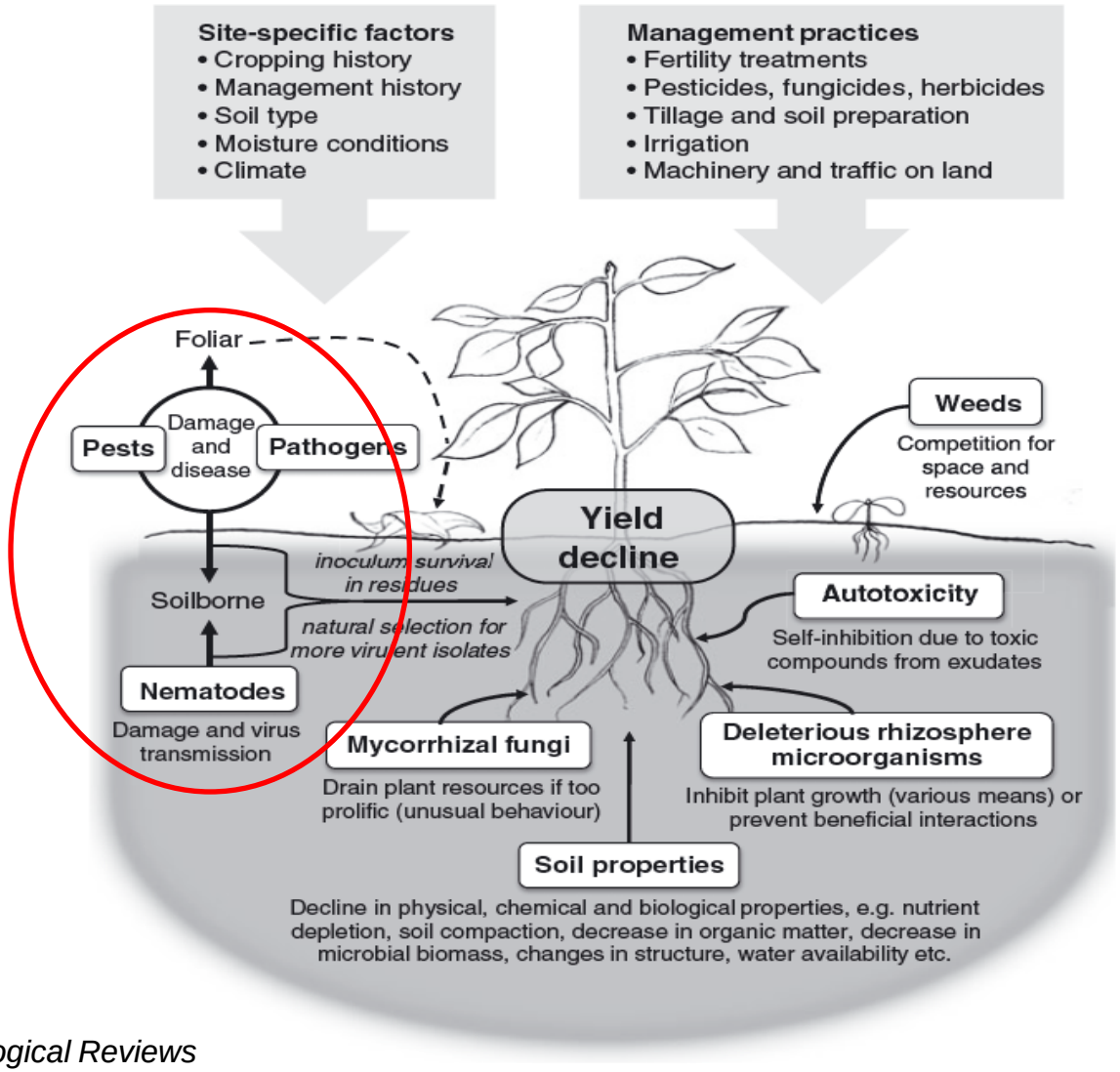
# Potential explanations

- Increased area of wheat & shorter crop rotations
- Expansion of production to marginal production sites
- Decrease in breeding progress
- Reduced tillage
- Bio-energy market: phytosanitary role of maize
- **Neglection of root health: Have root/stem base diseases been overlooked/underestimated?**

# Potential soilborne causes for crop losses

**Impacting factors:**

**Causal detrimental factors:**




Bennett et al. 2012, *Biological Reviews*

## Eyespot (*Oculimacula yallundae/acuformis*)

- Most important stem base disease in GER
- Losses up to 30%
- Increased through early sowing
- Wheat after wheat
- Mostly on medium to heavy soils

## Fusarium foot and root rot (*Fusarium spp.*)

- Yield losses up to 80% AUSTRALIA, USA; in GER 10%
- Mostly after precrop maize and no-tillage
- Seedling blight in warm, dry autunm

## Sharp eyespot (*Rhizoctonia sp.*)

- Prevalence in EU not clear
- Economic damage difficult to estimate
- Increased through minimum tillage and short cereal crop rotations

## Take-all disease (*Gäumannomyces graminis*)

- Mostly in wheat and barley monocultures
- Yield losses up to 50%
- Often on sites with light and nutrient difficient soils
- In fields with destroyed soil structure

# Importance of *Rhizoctonia spp.* in winter wheat in Germany: Occurrence, pathogenicity, relevant species/pathotypes and damage potential

- PhD project **Ines Eikenberg** (2010-2014)
- Cooperation: Georg-August-University of Göttingen and Syngenta Agro GmbH, Germany
- Involved persons: I. Eikenberg, A. von Tiedemann, J. Hempel, M. Käsbohrer
- Field experiments (2011/12 & 2012/13), lab and greenhouse exp.s

# General life cycle of *Rhizoctonia*

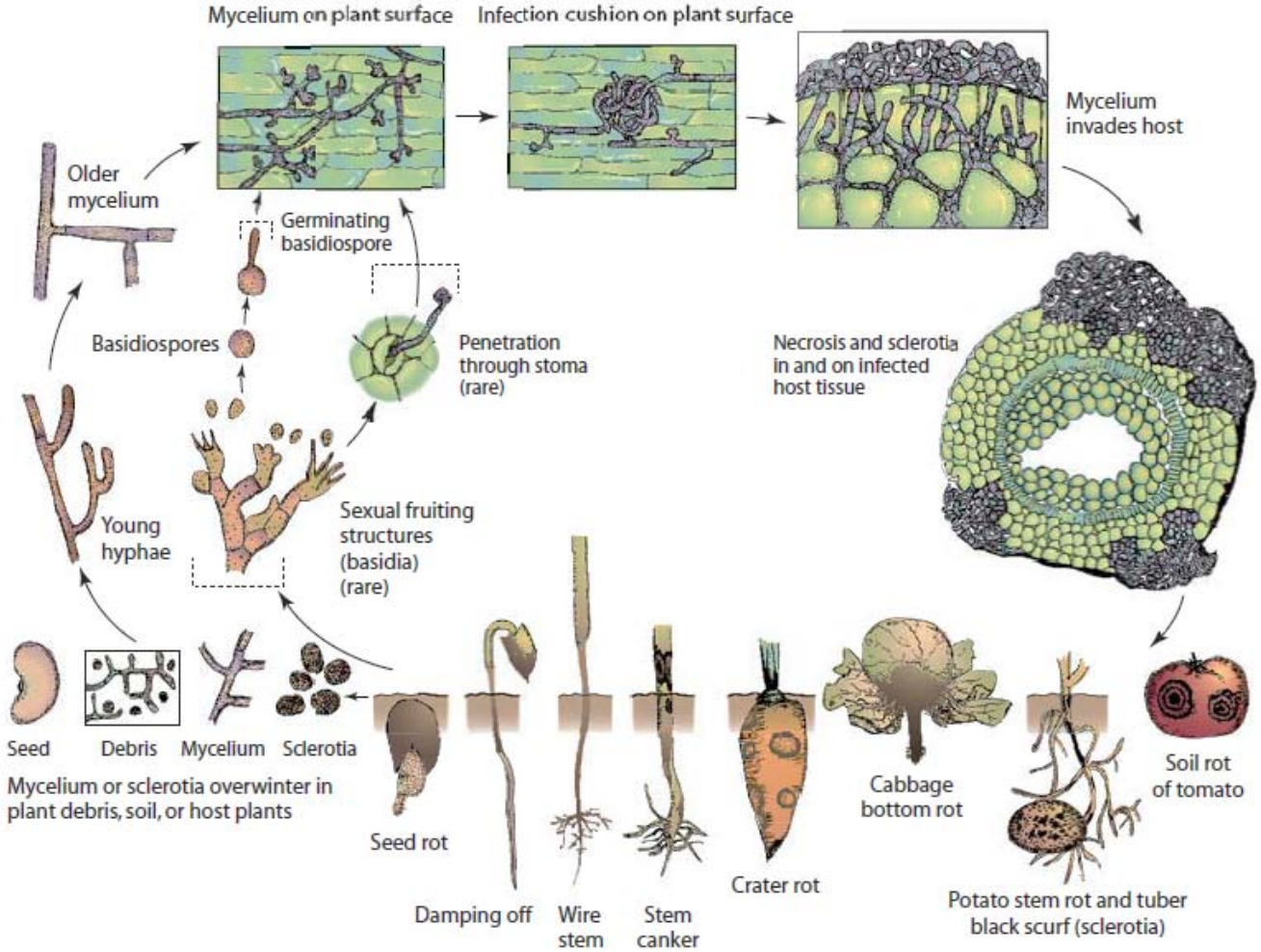



FIGURE 11-154 Disease cycle of *Rhizoctonia solani (Thanatephorus cucumeris)*.

Sharp eyespot wheat

Bare patch turf

Agrios, 2007

# Taxonomy of *Rhizoctonia* (= RHI)

| **Nuclear organi-sation** | **Multi-nuclear (> two nuclei per cell)** | | | | | **Binuclear (two nuclei per cell)** | | |
|---|---|---|---|---|---|---|---|---|
| **Genus** | *Thanatephorus* AG 1 to 14 | | | | | *Ceratobasidium* AG A to S | | |
| **Group/ Subgr.** | AG 1IB | AG 2-2 IIIB | AG 5 | AG 8 | AG 11 | AG C | AG D | AG E |
| **Hosts** | Bean, lettuce, cabbage | Sugar-beet, maize/corn | potato, bean, soybean, wheat[1] | Poaceae wheat[2] | wheat | -- | wheat[3], maize/ corn[4] | -- |
| **Anamorph** | *Rhizoctonia solani* | | | | | *R. globularis* | *R. cerealis* | *R. muneratii* |
| **Teleomorph** | *Thanatephorus cucumeris* | | | | | *C. cornigerum* | *C. cereale* | *Ceratobasidium sp.* |

(Gonzalez Garcia *et al*., 2006; modified)
AG = Anastomosis-Group

[1]Woodhall *et al*., 2012 (*UK)*
[2]Paulitz & Schröder, 2007
[3]Hamada, 2011
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# *Rhizoctonia cerealis* AG-D on wheat

→Typical symptoms of sharp eyespot in the field (GS 75)

Field experiment Göttingen-Weende, 2011/12

Photos: Eikenberg

# Monitoring of *Rhizoctonia spp.* in plant & soil samples

## 1. Plant samples

- ➔ Samples field experiment Gö 2011/12: **105 isolates**
- ➔ Samples 2013 (GS 75) from 35 fields in Germany & 6 in Poland: **48 isolates**

## 2. Soil samples

- ➔ Samples from 2 field trials in Germany (Gö-Gladebeck, Gö-Torland), collected 12/2011: **40 isolates**
  (identification by *Epilogic*, Weihenstephan)

# Monitoring of *Rhizoctonia spp.* in plant & soil samples

## Results

**1. Plant samples** (Germany, Poland):

→ all 105 isolates from 2011/12: ***R. cerealis* AG-D**

→ all 48 isolates from 2013: ***R. cerealis* AG-D**

**2. Soil samples:**

| ***R. solani*** | |
|---|---|
| AG 6 | 2 |
| AG 9 | 3 |
| AG 11 | 2 |

| ***R. cerealis*** | |
|---|---|
| AG-E | 19 |
| AG-K | 13 |
| AG-I | 2 |

PhD project Ines Eikenberg

# Monitoring of RHI incidence in wheat in Germany & Poland 2013

(cooperation Syngenta & PhD project Ines Eikenberg)

| | **German fields** n = 35 | **Polish fields** n = 6 |
|---|---|---|
| Fields infected [%] | 48.6 | 83.3 |
| Average DI [%] | 4.04 (0 – 36.5) | 20.2 (0 – 37.3) |
| DI infected fields [%] | 8.3 | 24.2 |

# Summary

- *R. cerealis* AG-D is dominant in symptomatic wheat plants (Germany, Poland).
- *R. solani* AG 5 and AG1-IB are non-pathogenic on wheat, no active penetration into healthy wheat tissue detectable *in vitro*.
- Significant yield losses induced by *R. cerealis* in combination with frost stress on frost-sensitive winter wheat varieties.
- Combined frost stress + RHI infection reduces [grains/ear] and plant density [ears/$m^2$].
- Early sowing increases risk of RHI-infection and multiple stress damage.
- *R. cerealis* AG-D infection can be significantly reduced by seed treatment.

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