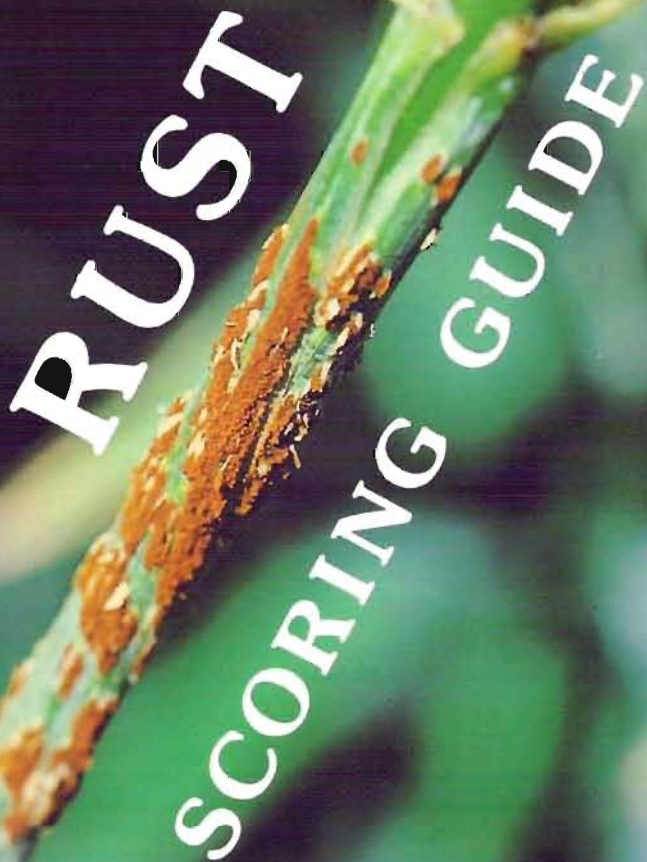


**Produced through a grant from the Government of
The Netherlands**

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A close-up photograph of a green plant stem, likely a wheat or maize stem, showing significant damage from rust. The stem is covered in numerous small, brown, powdery lesions that are characteristic of rust fungi. The background is a blurred green, suggesting other parts of the plant or foliage.

RUST SCORING GUIDE

GROWTH STAGES OF SMALL GRAINS

code _____ (after Zadoks et al.) _____

0 germination

- 00 Dry seed
- 01 Start of imbibition
- 03 Imbibition complete
- 05 Radicle emerged from seed
- 07 Coleoptile emerged from seed
- 09 Leaf just at coleoptile tip

1 seedling growth

- 10 First leaf through coleoptile
- 11 First leaf unfolded
- 12 2 leaves unfolded
- 13 3 leaves unfolded
- 14 4 leaves unfolded
- 15 5 leaves unfolded
- 16 6 leaves unfolded
- 17 7 leaves unfolded
- 18 8 leaves unfolded
- 19 9 or more leaves unfolded

2 tillering

- 20 Main shoot only
- 21 Main shoot and 1 tiller
- 22 Main shoot and 2 tillers
- 23 Main shoot and 3 tillers
- 24 Main shoot and 4 tillers
- 25 Main shoot and 5 tillers
- 26 Main shoot and 6 tillers
- 27 Main shoot and 7 tillers
- 28 Main shoot and 8 tillers
- 29 Main shoot and 9 or more tillers

code _____

3 stem elongation

- 30 Pseudostem erection (winter cereals only)
- 31 1st node detectable
- 32 2nd node detectable
- 33 3rd node detectable
- 34 4th node detectable
- 35 5th node detectable
- 36 6th node detectable
- 37 Flag leaf just visible
- 39 Flag leaf ligule just visible

4 booting

- 41 Flag leaf sheath extending
- 43 Boots just visibly swollen
- 45 Boots swollen
- 47 Flag leaf sheath opening
- 49 First awns visible

5 ear emergence

- 51 First spikelet of ear just visible
- 53 One-fourth of ear emerged
- 55 One-half of ear emerged
- 57 Three-fourths of ear emerged
- 59 Emergence of ear completed

6 flowering

- 61 Beginning of flowering
- 65 Flowering half-way complete
- 69 Flowering complete

7 milk development

71	Seed water ripe	} An increase in the solids of the liquid endosperm is notable when crushing the seed between fingers
73	Early milk	
75	Medium milk	
77	Late milk	

8 dough development

83	Early dough
85	Soft dough (Fingernail impression not held)
87	Hard dough (Fingernail impression held; head losing chlorophyll)

9 ripening

91	Seed hard (difficult to divide by thumbnail)
92	Seed hard (can no longer be dented by thumbnail)
93	Seed loosening in daytime
94	Over-ripe; straw dead and collapsing
95	Seed dormant
96	Viable seed giving 50 percent germination
97	Seed not dormant
98	Secondary dormancy induced
99	Secondary dormancy lost

RECORDING IN THE FIELD

Detailed outlines for recording stripe, stem and leaf rust intensities in cereals, based upon **severity** (percentage of rust infection on the plants) and **field response** (type of disease reaction), have been developed by Loegering.

Severity is recorded as a percentage, according to the modified Cobb scale. This recording process relies upon visual observations, and it is common to use the following intervals: Trace, 5, 10, 20, 40, 60, 100 percent infection.

Field response is recorded using the following letters:

- O No visible infection on plants.
- R **Resistant**; visible chlorosis or necrosis, *no uredia* are present.
- MR **Moderately Resistant**; *small uredia* are present and surrounded by either chlorotic or necrotic areas.
- M **Intermediate**; *variable sized uredia* are present, some with chlorosis, necrosis, or both.
- MS **Moderately Susceptible**; *medium sized uredia* are present and possibly surrounded by chlorotic areas.
- S **Susceptible**; *large uredia* are present, generally with little or no chlorosis and no necrosis.

Severity and field response readings are usually combined.

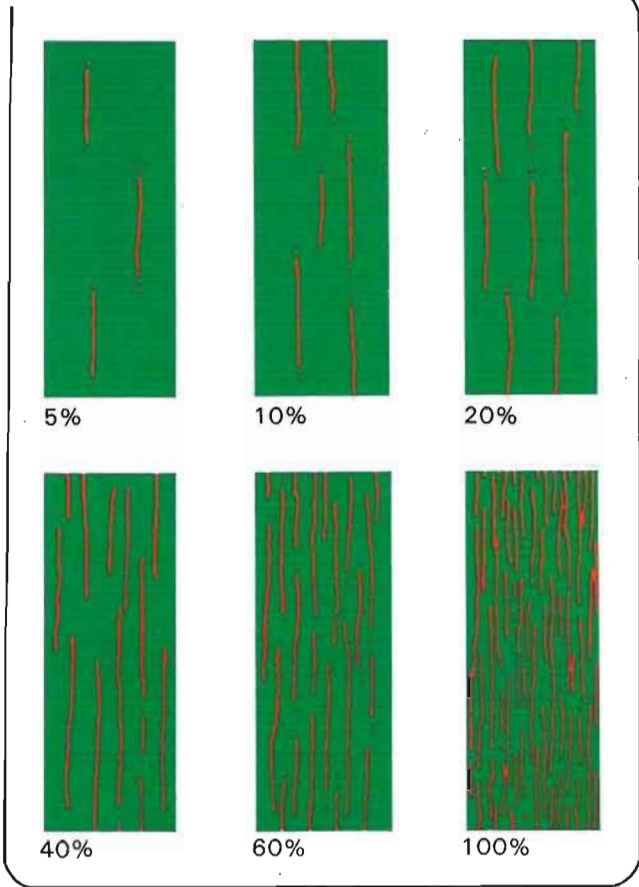
For example:

- tR = Trace severity with a resistant field response.
- 5MR = 5% severity with a moderately resistant field response.
- 60S = 60% severity with a susceptible field response.

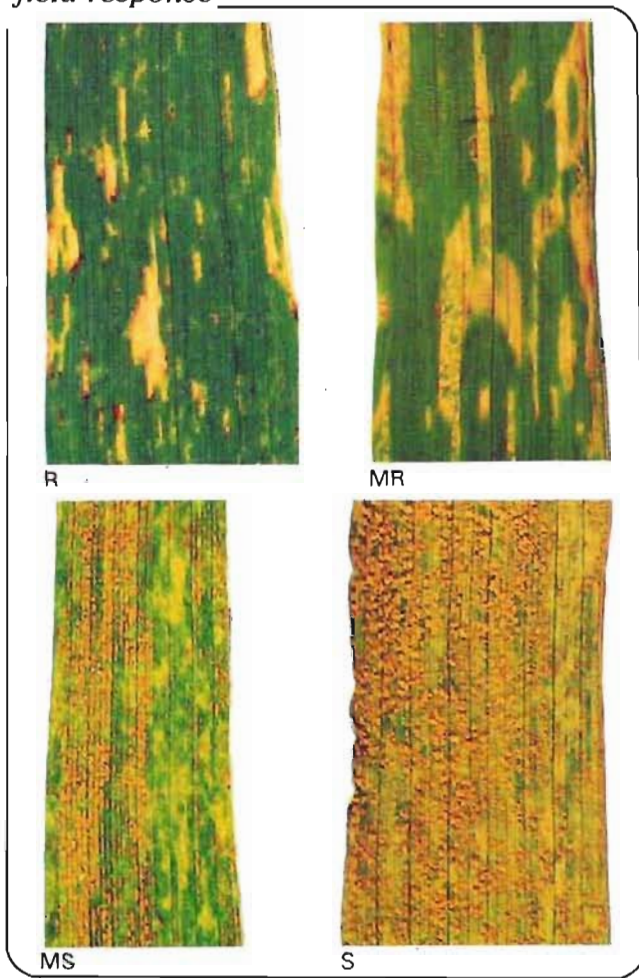
STRIPE RUST (Yellow Rust)

Puccinia striiformis

severity

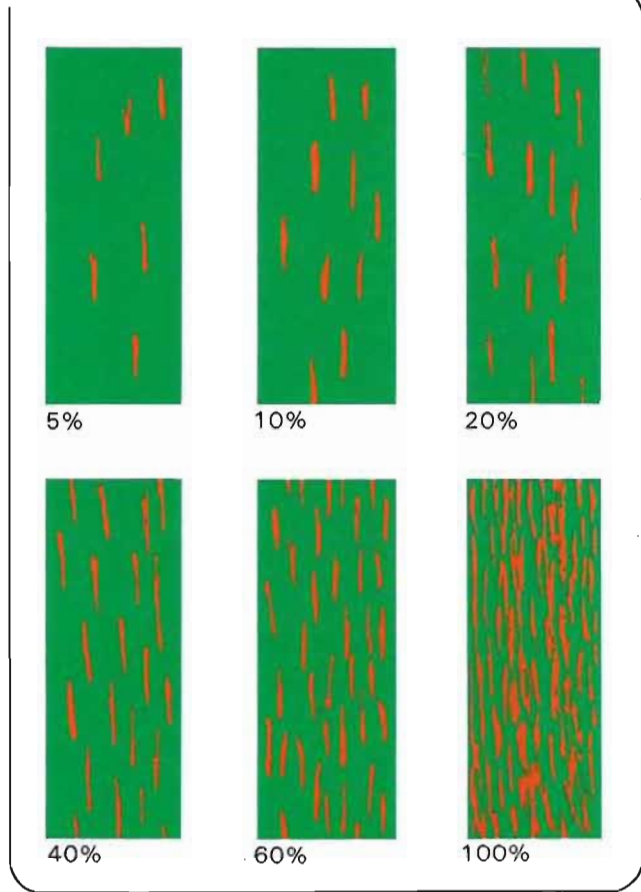


field response

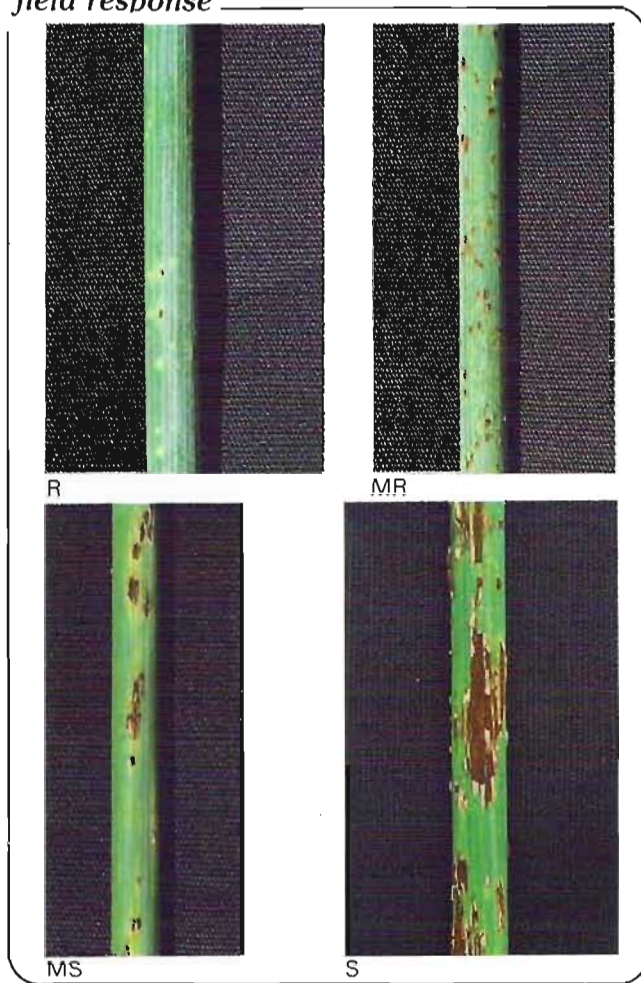


STEM RUST (Black Rust)
Puccinia graminis

severity

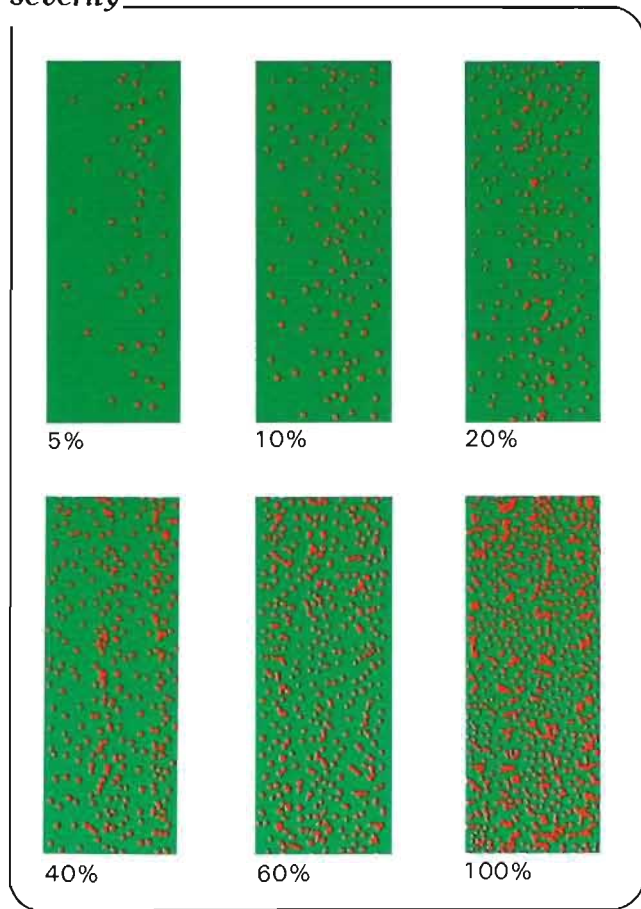


field response



LEAF RUST (Brown Rust)
Puccinia recondita

severity



field response

