Green leaf area decline of wheat top three leaves in Belgium and G-D of Luxembourg from 2003 to 2006: the relationships with grain yield

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Plan of the presentation

- Introduction
- Objectives
- Materials and methods
- Results
- Integration of a «disease module» into B-CGMS: calibration & validation
- Conclusions
Introduction

- B-CGMS: an integrated information system predicting reliable, timely and objective estimates of crop yields.
- No integration of the effects of the diseases in the system.

*Septoria tritici* → major cause of yield loss in wheat (20 to 30%) (El Jarroudi, 2005)

- Effects of contrasting diseases on yield of wheat grain can be related to effects on green leaf area, or precisely, absorption of photosynthetically active radiation by healthy green tissues (Waggoner & Berger, 1987; Bryson et al., 1997)
- The yield of wheat is particularly related to leaf area duration between ear emergence and maturity (Thorne, 1966)

Objectives

To develop and to introduce a « diseases module » into B-CGMS.
Materials and methods: the data

Materials and methods: the model
Results

- Fungicide effects on $m$ varied greatly among experiments and cultivars, reflecting the disease levels.
- Benefits of extending the life of the top three leaves for grain yield.
- Considering that parasitic pressure reduces leaves lifespan and therefore the photosynthetic capacity, this approach makes it possible to take into account the influence of this pressure on yield predictions in B-CGMS.

Values of parameter $m$

Integration of a « diseases module » into B-CGMS: How?

- Modification of one of the parameters influencing the leaf senescence: the SPAN parameter.
  - by definition SPAN is the lifespan of leaves for a temperature of 35°C.
- The initial value of the parameter SPAN is $31/3$.

Days after flag leaf emergence
- - - - Treated
- - - - Control
Integration of a « disease module » into B-CGMS: calibration

\[ y = 0.215794x + 20.509573 \]
\[ R^2 = 0.46 \]

\[ y = -0.012x^2 + 1.453x - 10.539 \]
\[ R^2 = 0.33 \]

Integration of a « disease module » into B-CGMS: calibration

(CERES): \[ y = -0.1099x + 5.9065 \]
\[ R^2 = 0.0792 \]

(CROPSYST): \[ y = -0.2005x + 5.8787 \]
\[ R^2 = 0.0209 \]

(STICS): \[ y = -0.0583x + 5.7728 \]
\[ R^2 = 0.0148 \]

(WOFOST): \[ y = -0.0325x + 5.3621 \]
\[ R^2 = 0.0098 \]
Integration of a « disease module » into B-CGMS: validation

\[ y = 0.215794x + 20.509573 \]
\[ R^2 = 0.46 \]

\[ y = -0.012x^2 + 1.455x - 10.539 \]
\[ R^2 = 0.53 \]

Conclusions

- Substantial improvement of yield assessments: 
  \( R^2 \) from 0.11 to 0.57

- These results confirm the benefits of extending the life of the top three leaves for grain yield

- For a practical use: estimation for each grid or for a group of grids of the parameter \( m \) based on fields observations (network of observations)
Thank you