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Modelling faba bean with the STICS soil-crop model: Parameterization and independent validation

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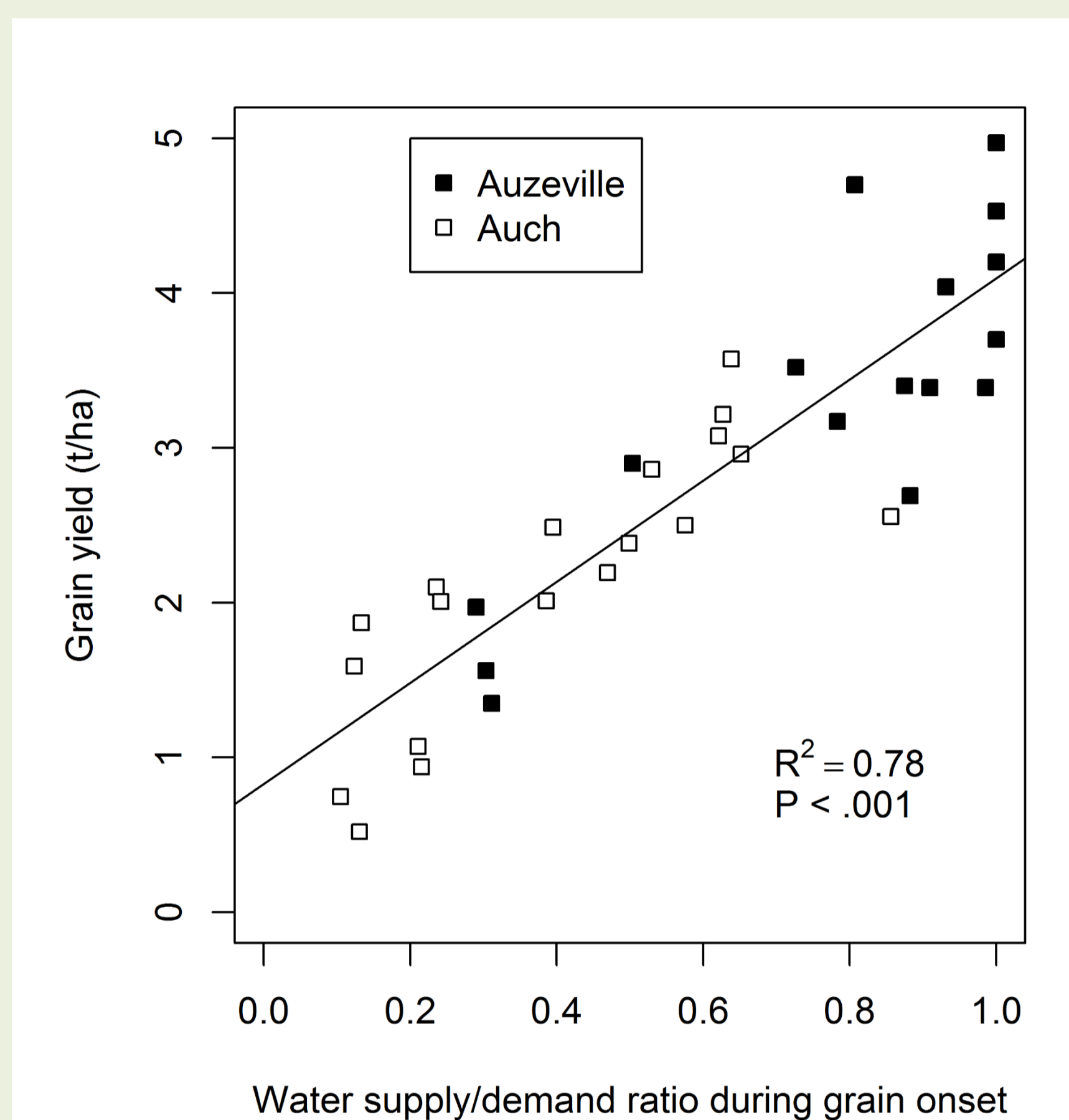
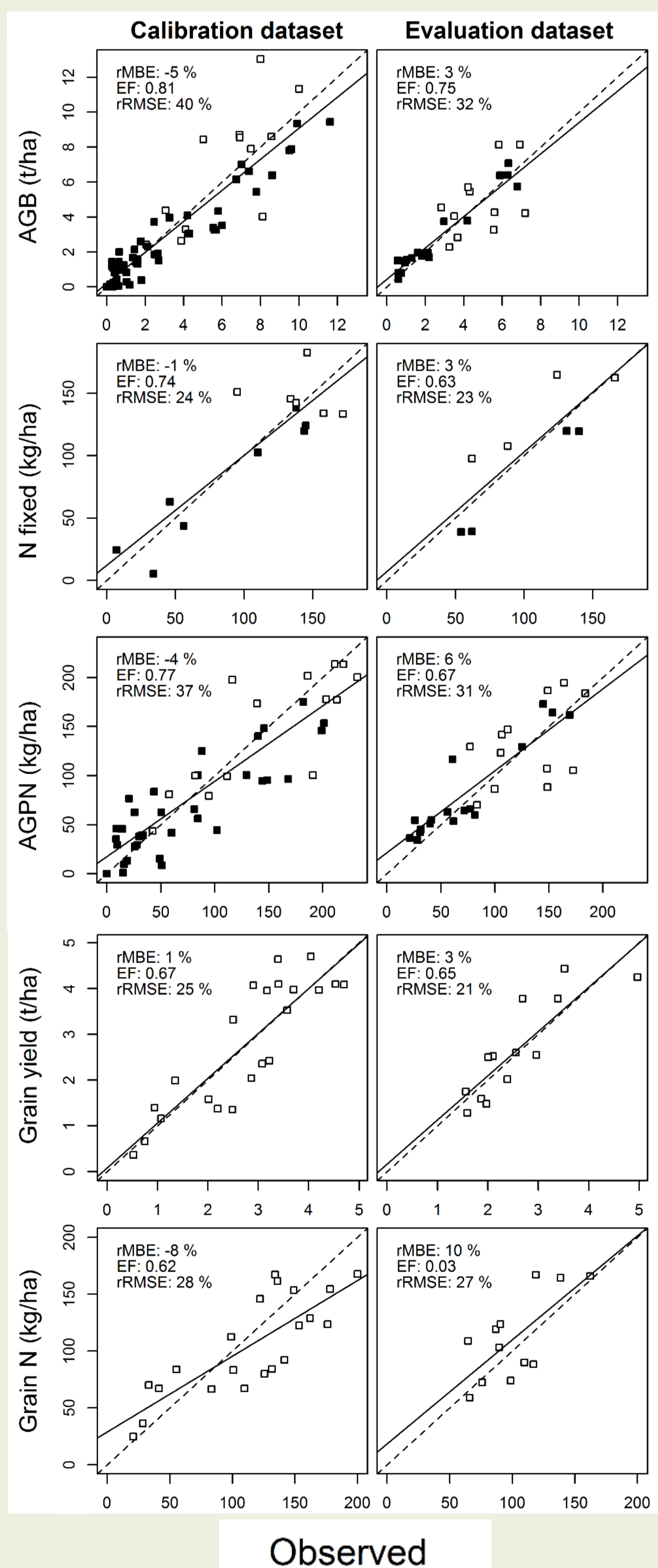
Introduction

- Faba bean (*Vicia Faba* L.) is the second most widely grown grain legume in Europe after pea.
- The *STICS* model can generate the quantitative information needed for the design of innovative cropping systems including legumes but **no parameterization for faba bean for the *STICS* model**.
- Twofold objective :
 - Calibrate** and **assess** *STICS* performance to simulate N acquisition (mineral uptake and N₂ fixation), growth, grain yield formation, N content in grains and residues
 - Analyze if *STICS* can accurately simulate the **temporal dynamic of water stress** and account for the **observed yield and fixed N variability**

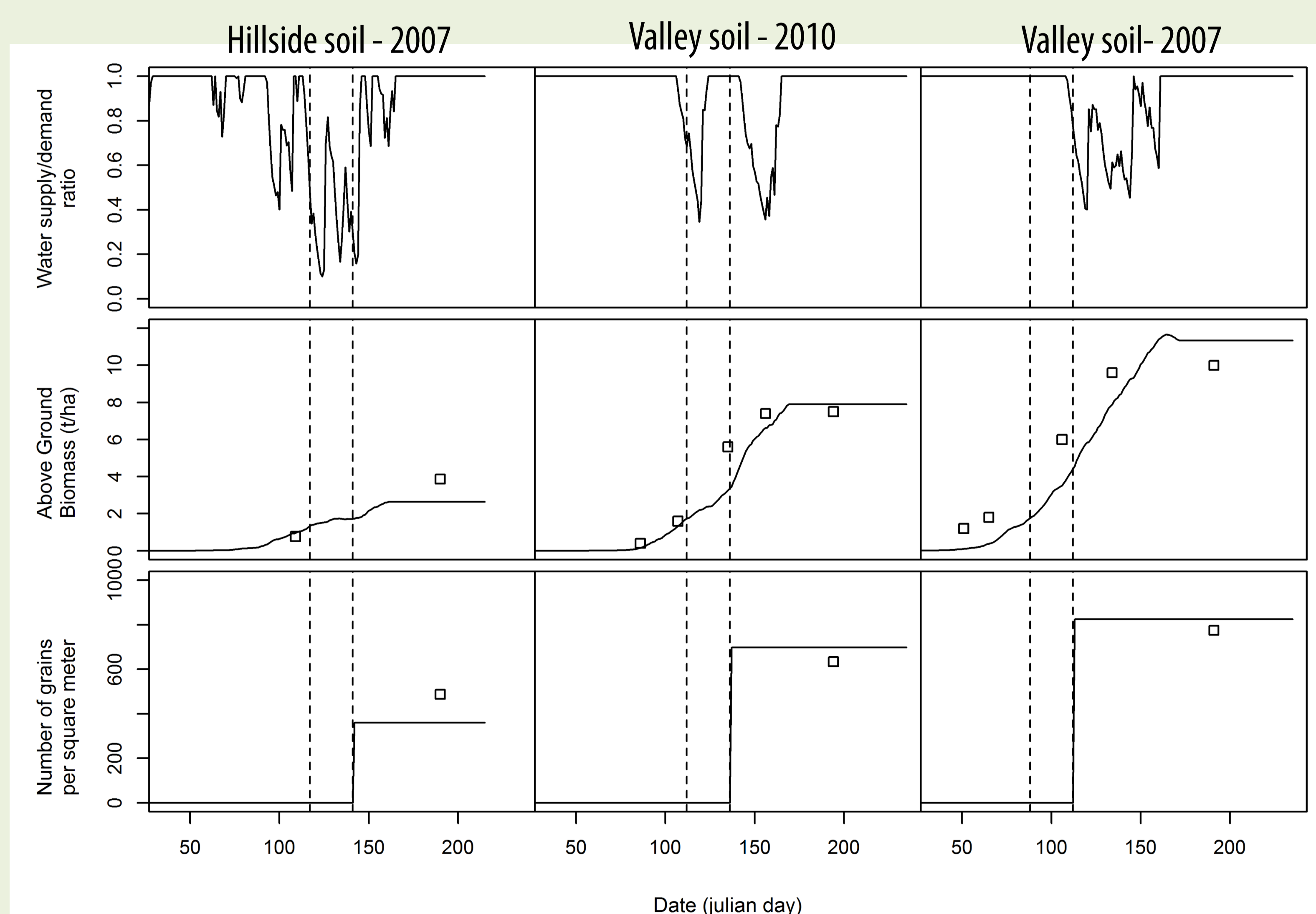
Methods

- Experiments in Auzeville and Auch (2002-2015)
 - Contrasting soil types (valley/hillside)
 - Similar cultivars (Castel/Irena)
 - 35 site – year – management simulation units
 - Monitoring of crop development stages, LAI, above-ground biomass, fixed N and total N accumulated, grain yield and grain N
- Step parameterization procedure with ten steps carried out on 29 crop-related parameters. Mathematical optimization with OPTIMISTIC
- Water supply/demand ratio, i.e. the ratio of actual evapotranspiration over potential evapotranspiration

Results



Water supply/demand ratio averaged over a period of six days preceding grain filling explained 78% of the observed grain yield variability in the experiments



Dynamic simulation of contrasting water stress occurring in different soil type (valley/hillside) for a range of climatic conditions and final impact on number of grain and grain yield

- The model reproduced well dynamic growth of above ground biomass, uptake of mineral N and N₂ fixation with satisfactory model Efficiency (EF) and relative Mean Bias Error (rMBE)

Conclusion

- First calibration and evaluation** of faba bean with the *STICS* model
- Relevance of the model for the analysis of **variability in grain legume yield and N fixation due to abiotic stresses**