

Refined N-Fertilization of Winter Wheat: A model supported approach combining statistical and mechanistic components

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This thesis accounts for the development of a model based strategy for nitrogen (N) fertilization of Winter Wheat, with focus on total fertilizer N demand. The ideal N fertilization strategy allows easy and flexible handling and considers all important information available at the time of the N application. The most important sources of such information are historical N rate experiments representative for the respective region, the experiences, expectations and management targets of the end user (producer) as well as actual weather data.

Historical knowledge is a suitable base if general evaluations optimized for a long term scale are targeted, while the year-specific variation of important crop and soil parameters is influenced by the weather during the vegetation period. The construction of the current approach is therefore supported by two main beams: the first is a statistical approach based on the balance-sheet-method (BSA) for the evaluation of historical, regional and site related information. The second is a mechanistic crop soil model (CSM) and allows year specific adjustment according to the current weather influence.

The CSM developed for this purpose combines previously published with new model approaches parameterized with empirical data. Chapter two (published in *Field Crops Research* 133: 167-175) and three cover modelling approaches for specific CSM issues (modelling of grain number and specific leaf area), while a documentation and evaluation of the newly developed CSM (*HumeWheat*) is supplied in the appendix. The fourth chapter covers the development and evaluation of the statistical model component (BSA) and develops a method for consideration of CSM induced modifications due to the year-specific weather influence. The fifth chapter discusses some key parameters of the CSM and addresses the possibilities and limits of scenario calculation with regard to fertilization planning. The most important results are recapitulated and some perspectives for future developments are given.