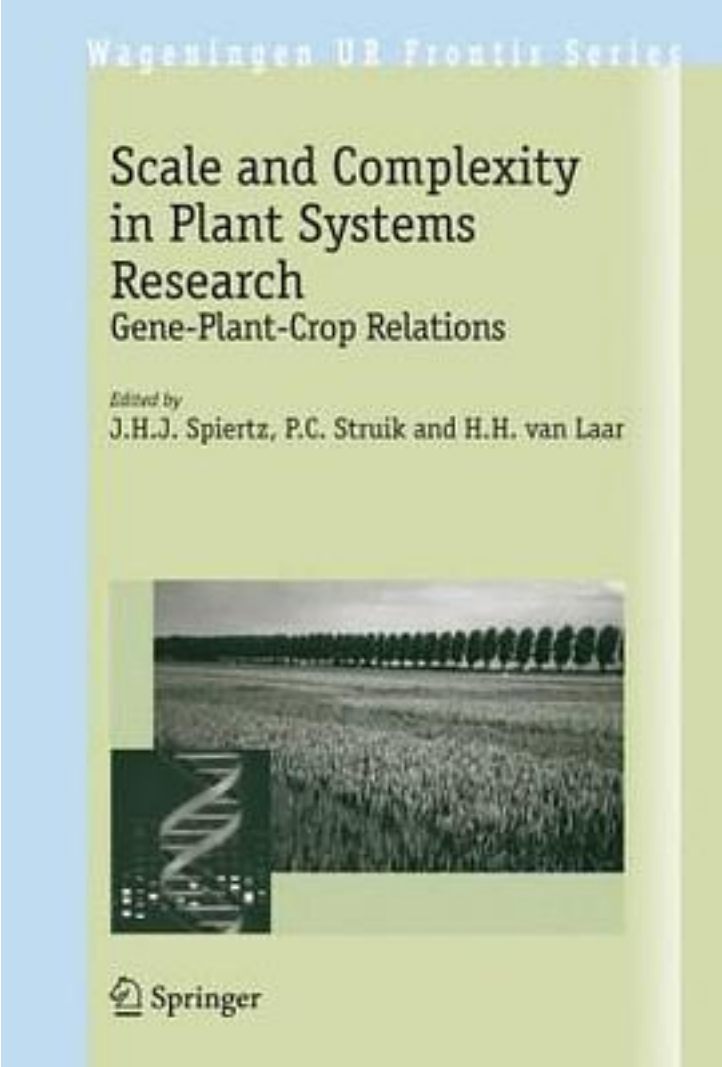
Scale and Complexity in Plant Systems Research



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著者:Spiertz, J. H. J. (EDT)/ Struik, P. C. (EDT)/ Van Laar, H. H. (EDT)

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This book presents and discusses new directions in plant systems research to bridge knowledge from the gene to the plant, crop and agro-ecosystem levels and to assist in solving problems in production ecology and resource use by identifying and applying new research methods. Functional genomics, systems biology and ecophysiological modelling of crop growth and development provide powerful tools for identifying genes and genotypes of agronomic importance. Despite remarkable advances in basic knowledge of plant genes and gene networks, there has been relatively little impact on crop improvement from the application of genomics and recombinant-DNA technology.Novel directions in linking plant sciences to crop and systems research are needed to meet the growing demand for food in a sustainable way. The challenge is to produce more food on the limited available land through more efficient use of natural resources and external inputs. Genetics of plant performance are discussed using examples of Arabidopsis thaliana and food crops. The concept of 'crop system biology' is introduced. Within the theme 'physiology and genetics' traits and mechanisms to improve crop adaptation are discussed. Furthermore, various approaches in modelling G x E interactions and crop performance are presented. Some chapters are dedicated to the role of diversity in optimizing resource use and crop performance. An outlook and dialogue on future directions in plant system research challenges readers with contrasting opinions on the way forward concerning this critical issue for the future of food production.

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