PREFACE

In plant production, modelling initially concentrated on functional aspects of the behaviour of the system, e.g., describing light interception and canopy photosynthesis. Crop development was generally represented by the thermal time required to complete successive developmental intervals, whereas dry-matter partitioning was governed by partitioning coefficients that were dependent on the stage of development. For various purposes that approach represented the behaviour of crops in a satisfactory way. However, basically, in this approach morphology was not taken into account, making such models unsuitable for application to problems where three-dimensional (3D) aspects mattered. Since the end of the 1960s there has been an independent line of research concentrating on the representation of the 3D structure of plants; beautiful, 'true to botany' images were developed. In the 1990s efforts were made to combine the functional and structural approaches. The term 'functional-structural plant model', FSPM, was born and became established through the activities of an international board for FSPM, launching dedicated conferences. The term 'virtual plant' is used also as a synonym to FSPM.

In crop production the first FSPMs were made in the late 1990s. Since 2001 a series of working visits and informal, small workshops of crop scientists led to exchange of information and to some collaboration between research groups in France, Germany, the Netherlands and the United Kingdom. It was clearly felt that the advancement of the development and application of FSPMs in crop production (field and greenhouses) could benefit from a dedicated workshop. Frontis – Wageningen International Nucleus for Strategic Expertise agreed to sponsor a workshop and the publication of this book in the Wageningen UR Frontis series, published by Springer.

In 2005, titles and contents of chapters of the book were drafted. Participants were invited and the workshop programme was derived from the contents of the book. The objectives of the workshop and – hence – of the current book included:

- to provide an update of the objectives and approaches of combining architectural and functional plant/crop modelling;
- to discuss methods to collect the data necessary for parameterization of FSPMs;
- to discuss methodology (software) to program architectural plant models (e.g., L-systems, Relational Growth Grammars, Greenlab, VICA);
- to explore options for including light absorption, photosynthesis and carbon partitioning in FSPMs (FSPMs open new options to more mechanistic modelling of carbon allocation; therefore, emphasis was placed on the physiological knowledge of sink–source relations and on ways to model these);
- to discuss crop-specific approaches in constructing FSPMs;
- to present examples of the use of 3D plant models in studies with a wider scope, e.g., remote sensing, insect prey–predator relations and studies addressing co-existence of crop plants and weeds.

The workshop was held in Wageningen in March 2006. In addition to local organizers the following persons acted as members of the scientific committee: B. Andrieu (Thiverval-Grignon, France), G. Buck-Sorlin (Gatersleben/Cottbus, Germany), P. Lewis (London, United Kingdom), T. DeJong (Davis, California, USA) and P. Prusinkiewicz (Calgary, Canada). Local contributors included members of the 'Virtual Plant Network–Wageningen University and Research Centre': J. Vos and L.F.M. Marcelis (conveners), J.B. Evers, G.W.A.M van der Heijden, E. Heuvelink, P.C. Struik and P.H.B. de Visser. On behalf of Frontis Mrs P van Boetzelaar, Mrs D. J. Stolp-Diepeveen, Mrs G. Fonteijn and Dr R.J. Bogers contributed much to the success of the workshop.

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The editors hope this book will be found useful by professionals and (under)graduate students who are fascinated by the challenge of quantitatively understanding plant performance.

The editors:
J. Vos
L.F.M. Marcelis
P.H.B. de Visser
P.C. Struik
J.B. Evers

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