Towards a functional-structural plant model of cut-rose: simulation of light environment, light absorption, photosynthesis and interference with the plant structure

Titre	Towards a functional-structural plant model of cut-rose: simulation of light environment, light absorption, photosynthesis and interference with the plant structure
Type de publication	Article de revue
Auteur	Buck-Sorlin, Gerhard [1], de Visser, Pieter H. B. [2], Henke, Michael [3], Sarlikioti, Vaia [4], van der Heijden, Gerie W. A. M. [5], Marcelis, L. F. M. [6], Vos, J. [7]
Editeur	Oxford University Press (OUP)
Type	Article scientifique dans une revue à comité de lecture
Année	2011
Langue	Anglais
Date	Jan-10-2011
Numéro	6
Pagination	1121-1134
Volume	108
Titre de la revue	Annals of Botany
ISSN	0305-7364
Mots-clés	bud break [8], Cut-rose [9], FSPM [10], functional–structural plant model [11], interactive modelling [12], L-system [13], light distribution [14], Rosa × hybrida [15], virtual PAR sensor [16]

Résumé en anglais	Background and Aims The production system of cut-rose (Rosa × hybrida) involves a complex combination of plant material, management practice and environment. Plant structure is determined by bud break and shoot development while having an effect on local light climate. The aim of the present study is to cover selected aspects of the cut-rose system using functional–structural plant modelling (FSPM), in order to better understand processes contributing to produce quality and quantity. Methods The model describes the production system in three dimensions, including a virtual greenhouse environment with the crop, light sources (diffuse and direct sun light and lamps) and photosynthetically active radiation (PAR) sensors. The crop model is designed as a multiscaled FSPM with plant organs (axillary buds, leaves, internodes, flowers) as basic units, and local light interception and photosynthesis within each leaf. A Monte-Carlo light model was used to compute the local light climate for leaf photosynthesis, the latter described using a biochemical rate model. Key Results The model was able to reproduce PAR measurements taken at different canopy positions, different times of the day and different light regimes. Simulated incident and absorbed PAR as well as net assimilation rate in upright and bent shoots showed characteristic spatial and diurnal dynamics for different common cultivation scenarios. Conclusions The model of cut-rose presented allowed the creation of a range of initial structures thanks to interactive rules for pruning, cutting and bending. These static structures can be regarded as departure points for the dynamic simulation of production of flower canes. Furthermore, the model was able to predict local (per leaf) light absorption and photosynthesis. It can be used to investigate the physiology of ornamental plants, and provide support for the decisions of growers and consultants.
URL de la notice	http://okina.univ-angers.fr/publications/ua8867 [17]
DOI	10.1093/aob/mcr190 [18]
Lien vers le document	http://dx.doi.org/10.1093/aob/mcr190 [18]
Titre abrégé	Annals of Botany

Liens

[1] http://okina.univ-angers.fr/ge.bu/publications
[2] http://okina.univ-angers.fr/publications?f[author]=15685
[3] http://okina.univ-angers.fr/publications?f[author]=15684
[4] http://okina.univ-angers.fr/publications?f[author]=15707
[5] http://okina.univ-angers.fr/publications?f[author]=15690
[6] http://okina.univ-angers.fr/publications?f[author]=15664
[7] http://okina.univ-angers.fr/publications?f[author]=15665
[8] http://okina.univ-angers.fr/publications?f[keyword]=11774
[9] http://okina.univ-angers.fr/publications?f[keyword]=14555
[10] http://okina.univ-angers.fr/publications?f[keyword]=14559
[11] http://okina.univ-angers.fr/publications?f[keyword]=11856
[12] http://okina.univ-angers.fr/publications?f[keyword]=14558
[13] http://okina.univ-angers.fr/publications?f[keyword]=3519
[14] http://okina.univ-angers.fr/publications?f[keyword]=14557
[15] http://okina.univ-angers.fr/publications?f[keyword]=14556
[16] http://okina.univ-angers.fr/publications?f[keyword]=14560
[17] http://okina.univ-angers.fr/publications/ua8867

[18] http://dx.doi.org/10.1093/aob/mcr190