How plant architecture affects light absorption and photosynthesis in tomato: towards an ideotype for plant architecture using a functional-structural plant model.

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Résumé en anglais	**BACKGROUND AND AIMS:** Manipulation of plant structure can strongly affect light distribution in the canopy and photosynthesis. The aim of this paper is to find a plant ideotype for optimization of light absorption and canopy photosynthesis. Using a static functional structural plant model (FSPM), a range of different plant architectural characteristics was tested for two different seasons in order to find the optimal architecture with respect to light absorption and photosynthesis. **METHODS:** Simulations were performed with an FSPM of a greenhouse-grown tomato crop. Sensitivity analyses were carried out for leaf elevation angle, leaf phyllotaxis, leaflet angle, leaf shape, leaflet arrangement and internode length. From the results of this analysis two possible ideotypes were proposed. Four different vertical light distributions were also tested, while light absorption cumulated over the whole canopy was kept the same. **KEY RESULTS:** Photosynthesis was augmented by 6 % in winter and reduced by 7 % in summer, when light absorption in the top part of the canopy was increased by 25 %, while not changing light absorption of the canopy as a whole. The measured plant structure was already optimal with respect to leaf elevation angle, leaflet angle and leaflet arrangement for both light absorption and photosynthesis while phyllotaxis had no effect. Increasing the length : width ratio of leaves by 1·5 or increasing internode length from 7 cm to 12 cm led to an increase of 6-10 % for light absorption and photosynthesis. **CONCLUSIONS:** At high light intensities (summer) deeper penetration of light in the canopy improves crop photosynthesis, but not at low light intensities (winter). In particular, internode length and leaf shape affect the vertical distribution of light in the canopy. A new plant ideotype with more spacious canopy architecture due to long internodes and long and narrow leaves led to an increase in crop photosynthesis of up to 10 %.
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