ADVANCES AND BOTTLENECKS IN MODELLING CROP GROWTH: SUMMARY OF A GROUP DISCUSSION

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This report is the summary of a group discussion at the ISHS symposium 'Models in protected cultivation' held in August 1997, Wageningen, The Netherlands.

Large differences in the available knowledge and models for the basic physiological processes were observed. On the one hand, photosynthesis seems to be most studied and modelled. Nowadays, accurate prediction of crop photosynthesis, based on climatic conditions and leaf area input, is possible. On the other hand, simulation of leaf area is still problematic. Other bottlenecks in the simulation of crop yield are the prediction of organ abortion and dry matter content.

Acclimation of plants to environmental conditions is usually omitted in models. This may be an important limitation for the use of models. However, sometimes acclimation is implicitly modelled (e.g. influence of light intensity on specific leaf area) and its importance is not always clear. For example, it seems that acclimation to high CO_2 is not important for the prediction of crop photosynthesis.

Simulation of crop growth under extreme environmental conditions, e.g. high or low temperatures or sudden strong changes in temperature, forms a bottleneck in crop modelling. Knowledge and modelling activity in this field is scarce. Because of the lack of knowledge on the response of crops to extreme conditions, transferability of models to those environments (e.g. from north-west Europe to the Mediterranean area) is hampered.

The question was raised whether crop modelling at cell level is needed. It was generally believed that this would not be necessary for most modelling purposes. Models should go no deeper than what's really needed for the simulation at the level of our interest. If this is crop growth, simulation at cellular level is far too deep and will not result in better predictions.

Crop models usually predict a mean value, omitting variability. More attention should be paid to the uncertainty in model predictions. Model parameter values all have their uncertainty. However, taking all these error terms into account results in a far too large predicted uncertainty around the simulation results. A better option could be to take the standard error from an actual data set and use this error in the predicted estimate.

Commercialisation of models and interaction with (potential) users were mentioned as weak points. Usually models lack feedback from the real situation. For model use in practice, possibilities for feeding the model (automatically by for example image processing) with actual data are helpful. Also crop registration by the grower providing measured data to the model seems a good possibility. Besides updating the model, this registration learns the grower already a lot about his crop.

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