

ADVANCES AND BOTTLENECKS IN MODELLING THE GREENHOUSE CLIMATE: SUMMARY OF A GROUP DISCUSSION

I. Seginer
Department of Agricultural Engineering
Technion
32000 Haifa
Israel

J.C. Bakker
Institute of Agricultural and
Environmental Engineering
P.O. Box 43, 6700, Wageningen
The Netherlands

This report is a summary of a group discussion at the symposium 'Models in protected cultivation' held in Wageningen, August 1997. The discussion focused on the reasons for the relatively limited acceptance and application of greenhouse climate models, especially in commercial practice. The discussion focused on the reasons for the relatively limited acceptance and application of greenhouse climate models, especially in commercial practice.

Three application types were mentioned:

1. Education (all levels, from child to scientist)
2. Design (new greenhouses)
3. Environmental control and management

Several attributes of these models were mentioned: complexity, transferability, reliability, understandability (by the users) and utility.

Complexity: It was felt that there is a range of complexity in each type. The desirable model is the simplest which serves the purpose. Educational models should be oriented towards their potential users, whether scientists, students, manufacturers, advisers or growers. Many users are only exposed to the main features of a complex models.

Transferability (to other structure types, climate conditions, varieties, etc.): The situation for which a model has been developed (and validated) must be stated. Extension to new conditions (e.g. extreme weather conditions) may be attempted at a later stage. It is assumed that the physics and biology of the system does not change from one location to the other. However, structure, equipment, cultivation practices and crops do change. Feedback and auto-tuning may help to overcome transferability problems for control applications.

Reliability: This attribute becomes more and more critical as one moves from education to design and finally to control models. Low reliability of models was considered the main barrier to acceptance by the growers. They do not trust the models and consider their use to be risky. Some of this seems justified, but step by step introduction may increase confidence in model-based controls. In any case the control should be robust, namely insensitive to inaccurate modelling.

Understandability: Participants familiar with grower attitudes suggested that model-based control programs should provide the grower with the reason for taking a certain action. On-line explanations will accelerate the acceptance of these programs. It is believed that simple models might be easier to explain.

Utility: Does the use of model-based control produce a tangible benefit to the users? This is the ultimate question, for which only partial answers are available, also depending on the type of user(s). In general the utility was considered to be reasonable for education and design purposes but hard to quantify in the case of DSS or model based control systems.

What are the reasons for the apparent insufficient reliability and utility? Is it due to insufficient understanding of the physics, biology, economics or psychology of the greenhouse system? The impression was that the bottleneck is in the complex response of the crop to its environment (different crop processes responding in different ways) and the spatial variability in the greenhouse.