

## DISCUSSION ON MODELLING SOIL-PLANT-ANIMAL SYSTEMS

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In general, members attending this session were in agreement that systems analysis and modelling has an important role to play in increasing our knowledge of soil-plant-animal relationships. With limited resources available for research, there was some disagreement as to their allocation between systems research and conventional field research. In the future more emphasis is likely to be placed upon systems analysis, especially with beef cattle, because it is most unlikely that sufficient funds for intensive field research will be forthcoming. Modelling in conjunction with field experimentation on pertinent aspects, rather than in isolation, was considered to be highly desirable.

It was agreed that in the immediate future it will be impossible to construct the perfect soil-plant-animal model which will have application in all environments. However, the inclusion of as many biological functions as possible would result in a general model with reasonable precision under varying conditions. In fact, if this were not done, there would be a danger that important sensitive processes would be omitted. Identification of these processes could lead to more intensive research to describe their function more accurately.

More specific models, where parameters are better defined, usually predict the situation more accurately, but the meeting felt that care should be taken in extrapolating results to a wider range of conditions. In spite of these limitations the more specific models were considered to have greater application in relation to our current state of knowledge.

Limitations to a systems analysis approach were briefly discussed. It was pointed out that modelling was not an end in itself, that inexperienced workers could easily live in a "fool's paradise" achieving the right answer for the wrong reasons and that "getting a model off the ground" too quickly may deter other workers from conducting valuable field studies. Some results could be misleading through obtaining wrong information from the model; the use of non-realistic data in the objective function could cause this. It was suggested that major new discoveries might not be obtained by relying upon an analysis of existing data. Under some circumstances it was suggested that systems analysis could be more costly than field experimentation.

There was some misunderstanding of techniques for validation of the model. "Tuning" or "fudging" was thought to be dangerous unless the model was well defined and restraints were within permitted theory. Internal compensation could occur but it was shown that weaknesses can be identified by looking at each pool and measuring outputs along the way. The need to test the model with independent data was emphasized.

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Farmers have been using simple models in farm management for centuries and the meeting considered that systems analysis can be a major tool in decision making by the farmer and extension worker. However, the objective function, including for example, farmers' attitude to risk and uncertainty, must be initially defined. The co-operation of extension workers to provide input data, and also to educate farmers in the use of more complex models is essential.

Some consideration was given to the present state of knowledge, particularly in relation to forecasting results without the need to check with field data. Generally soil-plant-animal models are at an early stage of development. Formulation of models was considered as having the greatest impact on improving agricultural knowledge in the short term. A lack of models for younger animals and the non-existence of stochastic models was noted. Improvement of models was shown to be a continuous process and the rate of development of this science will depend on the level at which resources are injected.