DISCUSSION ON ECONOMIC MODELS AND AGRICULTURAL PRODUCTION SYSTEMS

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Of the four papers presented at this session, three dealt explicitly with models of livestock production systems and the fourth discussed the possible use of a systems analysis approach in determining research priorities in agriculture. Rather than summarize the discussion that took place it is the purpose of this report to highlight the main underlying principles and themes that emerged.

(a) The disciplinary gap

It became quite apparent that there still exists a wide gap between biologists and economists, not only in their objectives but also in their conceptual understanding of, and approach to agricultural production problems. This was illustrated by the fact that the three models presented were developed by economists but required a considerable amount of biological information. The biologists reacted strongly and criticised the validity of these models. Models developed largely by economists (as described by Anderson in his introductory paper) are, in terms of their degree of sophistication, ahead of those being used by biologists. However, any model is only as good as its data inputs.

It was also established that the two disciplines use the systems analysis approach for different purposes. The biologist, in general, tends to use models to better his understanding of the system he is modelling and seldom does the output from the model lead to specific management advice. The prime aim of the economist, on the other hand, is to get answers that will aid in the decision-making process. His models must have a formal mathematical objective function which endeavours to increase profits or utility. His need to give management advice is, he claims, urgent and cannot wait 10 years for specific experiments to yield factual data. He therefore resorts to “hen-pecking”? the biologist who often responds with some additional unpublished data. The obvious comment came in the form of a First Commandment of Systems Analysis: “Thou shalt not analyse alone”.

(b) Terminology

The disciplinary gap was also apparent in the misunderstanding of terminology. Apart from “deterministic” and “stochastic”, there was also confusion about the term “objective function”. There is apparently a need for those involved in systems analysis to distinguish clearly between the purposes for building a particular model and the rigid mathematical objective function of that model.

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(c) Validation

The need to validate a model was probably the most significant and controversial aspect discussed. Some felt that a model has little use or application unless all parts of it are valid, i.e. that it gives results that agree with real data. On the other hand it was pointed out that there are circumstances where formal validation of a model is not possible because of lack of data; the analyst must to some extent rely on “gut feeling” when making certain assumptions and when drawing conclusions or forming recommendations from the results. It was suggested, firstly, that this should be done by the farmer rather than the analyst; secondly, that any uncertainty in the assumptions should be explicitly stated when the model is presented. It was clear that a lack of validation is far less acceptable to biologists than it is to economists.

(d) Sensitivity

The sensitivity of results to changes in certain parameters was discussed in response to the statement in the paper by Greig that a 1% fall in the digestibility of the food caused the model to predict a decrease from $8,000 to $6,700 in the profit of a feed lot enterprise. It was suggested that if profits are as sensitive as this to inputs then the entrepreneur would have little faith in the model, given the large fluctuations that will occur in stock and feed prices. Such high estimates of sensitivity may in fact lead to a reappraisal of the mathematical relationships in the model.

(e) Balance

Given that models are based on imperfect data, it was generally agreed that models need balance. There is little point in achieving a high degree of accuracy in some parts of a model while others are based on doubtful assumptions.

(f) Usefulness of systems analysis

Although time did not allow the topic to be discussed explicitly, the reporters judged that most of the group felt that systems analysis does have immediate application; firstly as a way of gaining insight into feedback mechanisms in agricultural systems, secondly for determining research priorities and thirdly, to a limited extent at the present time, as a tool for farm management decision making.