

FINAL REPORT

**THE STRATEGIC UTILIZATION OF AMINO ACIDS
IN LAYING HEN NUTRITION**

Project leader:

**Prof R M Gous
Department of Animal Science and Poultry Science
University of Natal
P O Box 375, Pietermaritzburg 3200**

**Submitted to the Chairman
Protein Research Advisory Committee
Agricultural Research Council
P O Box 8783
Pretoria 0001**

July 1993

EXECUTIVE SUMMARY

THE STRATEGIC UTILIZATION OF AMINO ACIDS IN LAYING HEN NUTRITION

R M Gous

University of Natal, Pietermaritzburg

The objective of the work reported here was to provide information on responses of laying hens to amino acids, the ultimate goal being a useful simulation model of the laying hen, which would, in turn, provide a means by which strategic protein resources could be allocated most efficiently to this sector of the poultry industry. By producing a simulation model of a population of laying hens it would be possible to determine the effects on food intake, egg production and overall profitability of changes to the quality of food supplied to the hens. Such a model would assist resource planners in making decisions regarding the strategic use of protein sources in the poultry industry. A secondary, but equally important, objective of the project was to answer some of the questions in this field which had not yet been tackled by poultry nutritionists, such as the effect of rearing treatments on the subsequent performance of laying hens, and this became an important aspect of the project. Similarly, research into some of the nutritional principles of laying hens, using broiler breeders, proved useful in that these birds have not received as much attention as have commercial laying pullets, yet contribute substantially to the poultry industry.

The research programme was subdivided into four categories, with research on growing pullets, laying hens, broiler breeders and simulation modelling being addressed separately. A comprehensive review of the literature pertaining to the effect of rearing treatments on subsequent performance was undertaken by a post-graduate student, and this, together with six experiments dealing with growing pullets are described in the first section. Three of these experiments were conducted by post-graduate students in the course of their research. These experiments have moved our knowledge of the requirements of laying pullets forward in two ways, the first by determining theoretically what their daily amino acid requirements are, and then comparing these with actual experimental evidence; the second by measuring the effects of different rearing treatments on the subsequent performance of laying hens. Although a number of experiments of this nature have been conducted in the past, there is no theory which will account for these effects on performance. We have tackled this subject from the point of view of attempting to produce a simulation model, and this has helped in designing experiments that ask the right questions. This work is not yet complete, but we have made significant progress, as is evidenced by the model that Mrs S Johnston has produced.

Four experiments are reported on work with laying hens, one of which was conducted by a post-graduate student, whilst of the four experiments reported on broiler breeder nutrition, all were conducted by post-graduates. The results of these experiments are important in demonstrating the considerable ability possessed by laying hens to adjust their food intake according to the composition of the food on offer. This ability is not absolute, and fails under extreme conditions, this being of particular interest in simulation modelling, where the prediction of food intake is attempted. With the information available from these experiments we are in a better position to improve the theory of food intake regulation contained in the simulation model being produced within the Department. We have also identified the need to do more specific research in environment chambers, in which the interaction between the bird, the food and the environment can be assessed. Only one of the experiments reported here has been a failure, and this was due to our inability to produce a threonine-limiting feed from the available raw materials in this country. The manner in which the experiment was set up, however, allowed us to demonstrate that threonine was not limiting, which otherwise would have caused us to draw the wrong conclusions from the research.

The information on broiler breeder nutrition proved to be of great interest when this was published in *British Poultry Science*. Many reprint requests were received from around the world, and many

congratulatory messages have been received for the work that was done by Miss J Bowmaker. On the strength of that work, invitations were received from both the USA and Australia to present talks on the subject. The work has received wide coverage in South Africa, where one large broiler company has implemented the theory and has benefitted economically from the work. It is likely that two other papers from the work reported here will be published within the next year, and these publications could be as popular as the previous two. The research started by Mr G Smith, and which is slow in being completed because of his move to Zimbabwe, should be completed by the end of this year.

Most of the work conducted on this project has been designed to improve the accuracy of the simulation model of the laying hen being produced in the Department. There are two aspects to this model, one, the period before laying commences, and the other, the effect of the treatment of the pullets during the rearing period on subsequent performance. The simulation of the growing pullet is almost complete, the model producing an accurate estimate of the growth and food intake of growing pullets. The second part of the exercise has a long way to go before it is complete. In order to complete this exercise, more experiments need to be conducted in the growing period, and in controlled environment chambers in the laying period. These experiments are being addressed in another project that is being supported by the Protein Research Advisory Committee, that has taken the place of this project.

In many cases the research described in the 17 Appendices in this report have been published either as scientific papers or as conference proceedings, thereby making the results known to a wider audience. However, the simulation model being produced by the Department is the best way of making information of this nature available to the poultry community, as the majority of those in the industry are not scientists, and are not in a position to read and draw inferences from the scientific literature. To make their job easier, they should have available to them all the information necessary to make good decision about feeding practices and management practices, without having to assimilate the wealth of information that has been published on the subject. This is the great advantage of simulation models, and this is the reason that we are enthusiastically pursuing this avenue of research in the future.

A list of publication emanating from this project is appended to the report. A total of eight scientific publications in refereed journals has been produced, six presentations have been made at international conferences, most of which were invited lectures, and ten presentations have been made at local conferences. Four students have completed their M Sc Agric. degree whilst working on this project, with an additional thesis still outstanding, and one Ph D programme was completed on this project also.

In summary, in the past five years the Protein Research Advisory Committee has supported this project. During that time, 17 experiments have been conducted, all with the objective of improving our understanding of the growing pullet and the laying hen with a view to producing a simulation model that would be able to be used by poultry producers to make good decisions about feeding and management practices. Ultimately, the purpose is to ensure that protein resources in this Country are utilized efficiently, and not squandered as a result of misunderstandings or ignorance. In almost all cases the results have moved forward our understanding of the nutrition and management of this class of poultry, many of the results have been published, and in some instances, the publications have been very well received by the scientific community. The ultimate goal of the project has not yet been accomplished, but the research work is continuing.