POSTER PAPER ABSTRACTS

THE USE OF AN ENTERPRISE SIMULATION PROGRAM TO PREDICT THE PHYSICAL AND FINANCIAL PERFORMANCE OF A PIG HERD

P. R. D. Avis, G. E. Pollott and A. P. Landon, *MLC, Bletchley*

A generalized Enterprise Simulation program has been developed and is described for a particular application relating to a pig herd. The program is supplied with data defining the expected physical parameters of the herd, the predicted cost relating to the input and the expected prices received for the output. The program then simulates the herd for any given time period and produces summaries for specified time intervals. These summaries include cash flow forecasts, weekly pig and sow numbers, feed usage, physical performance summaries and a profit and loss account.

A SIMPLE INTERACTIVE APPROACH TO RATION FORMULATION

G. D. Barber and N. W. Offer, *Agricultural Chemistry Division, West of Scotland Agricultural College, Ayr*

The program for dairy and suckler cow rationing starts from the premise that there is no single correct solution to a rationing problem. Forage intake is a major determinant of the solution and forage intake prediction is uncertain, so that a certain amount of subjective judgement combined with a knowledge of the particular farm and farmer is required. The program therefore supplies a series of solutions to the formulation problems based upon a range of assumed dry matter intakes. The adviser is left to make his own choice of the appropriate solution but is given guidelines: a forage/concentrate ratio, a limitation on bulk intake and a prediction of dry matter intake for mid-lactation cows (Lewis and Peers — personal communication). Ration costs are indicated if required.

The formulation is based upon energy requirements only. There is also an ability to evaluate an existing ration. In this example, with a restricted forage intake, the quantity of cake fed may be varied and the effect of this on milk yield and ration cost may be examined.

Following formulation or evaluation on an energy basis, the selected ration may be evaluated for mineral and/or protein status. The results in terms of shortfalls or excesses over requirements may be quickly used to modify the original formulation. The mineral evaluation examines calcium, phosphorus, magnesium and sodium. The protein evaluation uses the new A.R.C. protein system. A shortfall of R.D.P. is translated into a weight of urea supplement required. An alternative route supplies a list of levels of crude protein in the concentrate, together with the range of degradabilities for each level which would supply an adequate ration.

The program is currently mounted on both Commodore PET and North Star Horizon micro-computers.

AN APPLICATION OF THE MICRO COMPUTER/PROCESSOR IN THE MANAGEMENT OF A SPRING CALVING DAIRY HERD

S. Blowers, *Welsh Agricultural College, Aberystwyth*

A dairy herd management information and control system has been designed, (and implemented) which is meant to assist the economically efficient production of milk. It enables individual cow attention — where herd size defeats the competence of stockmanship alone.

It relies upon yield data being 'micro' processed and analyzed weekly. Then, cows producing below performance are reported and an explanation is required, if not demanded. The performance standard to be achieved by any individual cow is set by an analysis of previous lactations and the standard is calculated as a yield rate of change.

https://doi.org/10.1017/S0263967X00003840 Published online by Cambridge University Press

By tabulating and graphing lactation data, between cows, groups and years, the herdsman should have sufficient information to control individual performance but in an adaptive manner; that is, simply learning by his own experience and where control is mainly by accurate individual rationing. This is generally determined for the individual by yield and grass/silage quality but may be adjusted to suit individual need in any week, as performance demands (N.B. where a cow has been queried if she is not cleared in the rationing program then that program will not proceed).

If the object of the system is to enable individual attention, then it must be said that the system recognizes that efficiency in milk production may not be gained without basic stockmanship and therefore has deliberately maintained the involvement of the herdsman by his having to respond to the weekly report and, of course, the rationing — for the individual cow.

The system may be worked with a micro-computer and only manual yield records and feed inputs but, obviously, the efficiency must be improved with automation of parlour inputs and outputs. To achieve this, electronic equipment is installed in the parlour and the farm office, then yield and feed quantities are stored automatically for each day's milkings and re-set weekly by a paper tape transfer to and from the management computer.

BIO-ENERGETIC SYSTEM FOR PIG HOUSING

J. M. Bruce and J. J. Clark, *The Scottish Farm Buildings Investigation Unit, Craibstone, Bucksburn, Aberdeen*

A major problem in agricultural building design is how to consider climatic, building, nutritional, biological and financial factors in a common frame of reference so that design decisions can be made on a rational and economic basis. A bio-energetic system for pig housing has been defined with several distinct components: external climate, nutrition, management, building, pig and thermal environment and pig response. Each component has one or more attributes identified. Within the system, any changes in one component can exhibit an effect on several other components. To model the system and investigate the effect of changes within components, a computer program has been written. The lower and upper critical temperatures and heat production of the pig are calculated based on data for the weight of the pig, the number of pigs in a group, feed intake, floor type and air-speed. The internal temperature for the building is calculated for several ventilation rates, using data for the external climate and building structure. The computer model is used to estimate the influence of changes in the building structure (for example, levels of insulation, supplementary heating, floor type), in feeding levels and in external climate. The program is interactive and has graphical and tabular output so that the designer can clearly visualize the effect of changes in variables.

FEEDPLAN — INTERACTIVE FORMULATION OF CATTLE DIETS

J. R. Crabtree, *School of Agriculture, Aberdeen*

This program, written in Honeywell 6600 Fortran, facilitates the formulation of diets for dairy cows, suckler cows and growing cattle. It operates interactively and is particularly suited to use on remote terminals with access to the mainframe machine via a GPO telephone line.

After accessing the program, the user inputs information in response to prompts (questions or instructions). The first data input refers to the type of animal for which the diet is to be formulated (e.g. steer of medium, mature size), together with its liveweight and performance level. Daily requirements for energy, protein, calcium, phosphorus, sodium, magnesium, copper and cobalt, together with voluntary intake limits are calculated according to the Agricultural Research Council's 1980 recommendations.

The facility exists for each user to establish a file of feed specifications and prices and this file may be extended or amended during running of the program. This allows a diet to be formulated using the specific composition and price information for each feed available on a particular farm. Where compositional data from chemical analysis are not available, a 'standard' specification for a feed may be used. The list of feeds available for incorporation in a diet are input by the user and the level at which any feed appears in the diet may be constrained to a maximum, minimum or fixed quantity.

144

In the context of the feeds available, a linear programming subroutine is called to derive a diet at minimum cost that satisfied all the nutritional requirements and the constraints improved on individual ingredients. A search routine is incorporated, in order to take account of the fact that the requirement for metabolizable energy is a function of the metabolizability of the diet, which is not fixed prior to diet formulation. When a feasible diet has been derived, this is listed together with its nutrient specification. Should the diet be unsatisfactory, the facility exists for rapid re-formulation following changes in input data.

FEEDPLAN has been used since 1978 by advisory staff at NOSCA. In 1979/80, five offices throughout the North of Scotland accessed the program on Texas 745 terminals and a wider use is anticipated in 1980/81.

SYCO (SYSTEM COMBINATION)

P. De Lille, *System Combination (SYCO), Bogaardestrat 768, 9990 Maldegem, Belgium*

During 1980, a group of software companies working for Feed Manufacturers came together and founded the idea of SYCO.

SYCO Computer programs are represented at the moment in six European countries by ten different Companies. System Combination in collaboration with many feed manufacturers and other allied trades, developed a series of programs, which can offer a separate or integrated solution to the following problems:

— accountancy, with customers, suppliers administration and, eventually, exploitation control
— invoicing system, independently of the stock or annexed to the stock
— stock control, with cost price control
— contract administration
— statistics, concerning — customers, suppliers, representatives, articles
— herd administration
— cow administration
— animal feed formulation, "Bestmix"

It is up to the user how far he will examine these problems and how much he is willing to spend on the modular purchasable programs and machinery.

A SIMPLE COW MODEL FOR STUDENTS

J. M. Forbes, *Department of Animal Physiology and Nutrition, University of Leeds*

A previously published model of the control of voluntary intake of dairy cows by physical and metabolic constraints has been modified to allow concurrent "feeding" of roughages and concentrates and to be used interactively. Initially, the student is asked to type in the condition score at calving and the expected peak milk yield. A roughage of predetermined quality is assumed to be available *ad libitum* and the student is then asked the level at which concentrates of predetermined ME concentration are to be fed in the first week of lactation (kg/day or kg/kg of milk). The program then predicts the voluntary intake of roughage (which is not allowed to be less than 2 kg/day), the milk yield (assuming a standard shape of lactation curve, with depressed yield if underfed) and the change in body score; it then waits for the next week's concentrate allowance to be typed in and so on. If the user wishes to adopt the same rate of concentrate feeding for several weeks (e.g. 0.4 kg/kg milk) this can be done automatically for as long as is specified.

The program is written in BASIC and in its simple form uses 2K of memory; it would be improved by use of a visual display, when graphs of predicted performance would have more impact than columns of figures. If the size of computer memory permits, or if subroutines can be overlayed, a version of the program is available which also calculates income from milk against costs of feeds.

A WHOLE ENTERPRISE MODEL FOR 18-MONTH GRASS/CEREAL BEEF SYSTEMS

E. H. Glover, *Wye College, (University of London), Ashford, Kent*

A computer-based model has been developed to aid in the planning of an 18-month beef enterprise. Operation is by a series of interactive "commands" which request from the user information about an existing or intended enterprise. Feed requirements, fertilizer inputs, etc., are calculated as appropriate. Commands cover input of sex, numbers and age/weight targets for cattle, available goods, available grassland area, division between grazing and conserved areas and levels of supplementation at grass. Predictions are then made of the required rations during the two winter periods and of the N fertilizer input and total grass requirements for grazing and silage. Finally, a gross margin budget for the enterprise is calculated. Predictive equations are based upon the ME system and the results of the GRI/ADAS grassland manuring trial, GM 20. Model output has been compared with a fully recorded 18-month beef enterprise at Wye College and with a similar enterprise at the National Agricultural Centre. Moderately good agreement has been obtained. Also, the response to changes in summer daily live-weight gain and to changes in stocking rate, agrees well with MLC figures. The structured programming approach is a key feature which gives great flexibility in operation and permits easy expansion and modification of the model. Future developments will extend the model to other non-suckler beef enterprises.

FARMFAX SYSTEMS

R. J. Govier, *Farmfax Ltd; Stockbridge, Hampshire*

The FARMFAX Pig Management System is designed to take data entry directly from existing farm records without any complicated data capture sheets.

Numerous verifications checks are made on the data before they are stored. A data base is created from which individual sow and boar record cards can be created and numerous analyses are carred out to monitor all the important indicators of both individual and herd performance. Performance is measured against user defined targets and any deviations are shown indicating the need for further analysis and/or action. Analysis can be carried out down to a very detailed level, using the numerous inbuilt programs, without the operator needing to have any knowledge of computers or computer programming. Full pedigrees and performance details are stored on all breeding animals. Analyses of performance on a sire or dam basis are easily carried out, as is performance by treatment and/or disease. As well as full physical details on both stock and feed, financial information is stored and utilized to show the economic performance of the herd.

Details of herd inventory can be displayed, showing numbers of animals in each category and giving an indication of the forward production pattern.

Action lists can be produced to show animals due to farrow, due to wean, due to serve or due for treatment at any specific time. All FARMFAX systems have been developed by farmers for farmers and the foregoing comments would apply generally to other systems, e.g. Dairy Management.

THE ANALYSIS OF REPRODUCTIVE PROBLEMS IN POST-PARTUM COWS BY MEANS OF MILK PROGESTERONE PROFILES

K. Gregson and P. J. M. Ball, *University of Nottingham*

A study of post-partum ovarian activity has been carried out on 2000 dairy cows over a period of 2 years. Milk progesterone measurements are made on samples taken from each cow thrice weekly, from a few days after calving until the subsequent pregnancy is confirmed.

The primary aim of the experiment was to use these data in the early detection of various reproductive problems such as inactive ovaries ("acyclic cows") and non-detected oestrus ("silent cows"). The profiles of progesterone levels were used in the prescription and subsequent evaluation of treatments for these problems.

A sequence of programs has been developed for the calculation of progesterone values and subsequently to store them in a data base together with supplementary information such as calving, insemination and oestrous dates.

146

The data base may be readily examined (and edited, if necessary) and current profiles for the most recent 70 days are produced for examination on a VDU screen. The entire data for a given animal may be produced at any time, either on a line printer or graph plotter.

Detection of the various conditions is aided by automatic warning messages which are generated whenever an update of the data base is carried out.

The implementation of this process in an on-farm situation (or in a veterinary surgeon's office) would give obvious benefits in the management of reproduction.

COMPUTER SERVICES

S. Hallam, *Pauls and Whites Foods Ltd, Ipswich, Suffolk*

Compounders and merchants supply farmers with a range of services to back up their products. A major growth area in service provision is the use of computing techniques as an aid to farm management. Pauls and Whites Foods Limited have studied many schemes. Consequently, we have adopted as simple an approach as possible. The farmer is faced with a minimum of mathematics and form-filling. In return, he is presented with the criteria that fundamentally affect his profitability.

Two different costings are available under the Dairy Herd Management Scheme. These are the Margin of Milk over Concentrate and all Purchased Feed and a full Gross Margin analysis on a herd, per litre, per cow and per hectare basis.

The Pig Herd Management Scheme consists of two parts, Breeding and Feeding. The Breeding Scheme can operate at four levels; Simple Physical Output and Performance Analysis, Pig Output over Feed Cost, Gross Margin Analysis and Full Enterprise Analysis.

In addition, Pauls Computer facilities are available to farmers for more specific operations such as performance curves and cash flow analysis.

Pauls also undertake Performance Analysis on the herds in our schemes. This type of information enables Pauls to maintain an approach to agriculture that is balanced and progressive and to advise producers on trends within the industry.

ADAS USE OF COMPUTERS IN ANIMAL PRODUCTION

C. I. Harris, *ADAS Nutrition Chemistry Operations Research Group, MAFF, Reading*

Two examples of computer usage are demonstrated:
1. Diet specification and ration formulation for the laying hen.

   Physical data, namely white or brown birds, bird weight, daily live-weight change, house temperature, egg mass and feed intake (or ME concentration of the diet) are used to produce a ration specification with reference to ME (MJ/kg), percentages of crude protein, tryptophan, lysine and methionine, calcium, phosphorus and sodium. From the diet specification, a least-cost formulation is produced by means of linear programming.

2. A least-cost daily diet for dairy cows.

   Solutions to the above, by means of linear programming, have over the years often resulted in producing rations which are excessively bulky. The development of this model has concentrated on in-built factors which will produce acceptable rations without recourse to arbitrarily imposed upper limits on the fresh weight of feeds on offer:

   a) the total dry matter intake should contain not less than 300g of "long roughage" per kg dry matter;

   b) indigestible organic matter is constrained to a maximum of 200g/kg dry matter;

   c) analysis of the rumen contents from the paunches of dairy cows has indicated that these have a dry matter content in the range of 180-190g/kg. If drinking water is forced into the solution at a level dependent upon milk yield, then the intake of wet bulky feeds will be constrained in order to prevent the dry matter of the rumen contents falling below 180g/kg.

A MODELLING TOOL FOR AGRICULTURALISTS

P. Jackson, *DatAgro Ltd, Maidenhead, Berkshire*

Agriculture is a high-risk business, in which uncertainty is the norm. Variability in biological data and business information, often over long timescales, combine to limit the degree to which it is possible to manage agricultural enterprises to achieve a set target of profitability.

But, mathematical techniques are available to aid the manager in his assessment of the risks: Risk Analysis, Cash Flow, Enterprise Analysis are all in current use. However, their complexity has limited their effective use in farm situations; largely through the inevitable delay in the collection and interpretation of the data.

FINAL is a simple to operate, yet powerful, system for all types of financial planning, models, budgets, enterprise analysis, forecasts and consolidation of accounts. It enables persons untrained in computer programming to develop their own specific model in only a few hours. The model may then be used most effectively to evaluate various alternative strategies or to answer WHAT IF? type questions.

FORMAL is a simple to operate linear program for use in the establishment of optimal nutritional feeding programmes for livestock. It contains full parametric and ratio capabilities and may be linked with FINAL to optimize input/output relationships within livestock ventures.

FORMAT COMPUTER SYSTEMS

E. J. Jones, *Format Farm Computer Services, Sunningdale, Berkshire*

Format was started 8 years ago, staffed by both Agriculturalists and Computer Specialists. Format have developed a range of agricultural programs designed specifically for the Animal Feed and Agricultural Supply Industry. The systems have been developed on sophisticated microprocessors with the objective of an integrated Feed Mill Control System. The company's objective is to supply the appropriate combination of hardware and software to suit either the small local Feed Compounder or the large Multi National Agri Business Enterprise. Each part of the package operates independently and on a wide range of digital computers.

The software may be divided into 5 sections:
1. Mill Process Control
2. Stock and Raw Material Control
3. Administration and Feed Business Control
4. Animal Feed Formulation
5. Technical Livestock Programs.

The programs developed in each of these categories have been designed to transfer information from one program to another to make a fully integrated system.

Programs directly related to the use of computers in animal production are:

1. *Feed Formulation*
   Optimal cost formulation, within nutritional and physical limits determined by Animal Feed Compounders, is the normal basis to feed production. The Format singlemix product is presently used by well over 120 companies throughout Europe. The multimix program, which imposes raw material availability limits and produces least-cost formulation for full mill production, is an advanced program to maximize profit in the feed mill.

2. *Dairy Programs*
   Dairy Feed Plan: This program predicts the nutritional requirements of a given cow in dry matter terms, produces a least-cost feeding system and projects the result in financial and physical terms for a given herd over a given period.
   Dairy Yield Prediction: Designed as a planning and management aid, this program projects the milk yield of a herd over a period of up to 12 months, utilizing farm historical data and projecting production based on the make-up of the herd.
   Dairy Costing: A financial report provided monthly for the farmer to enable him to plan his cash flow.

3. *Pig Program*

The Edinburgh Model Pig, a biological model to predict the growth and ultimate slaughter value of the pig under differing environmental and financial situations. Successfully used by pig farmers, pig processors and breeding companies as a forecasting model.

4. *Poultry Programs*

The range of programs are designed to schedule production of layers, broilers and turkeys and to assist the producer in planning replacement stock, etc.

MMB COMPUTER SERVICES FOR FARM MANAGEMENT

G. R. Lake, *Milk Marketing Board, Thames Ditton, Surrey*

The display has two parts:

(A) A description with examples of each of the existing farm management services which have computer assistance in their operation. They are:

(i) *Total Farm Business* — a financial system for the whole farm, incorporating the regular visit of a Production Recorder.

(ii) *Dairy Management Scheme* — a post in/out system for the dairy enterprise, leading to the production of monthly and annual management information. (This scheme is under revision.)

(iii) *National Milk Records* — through the monthly visit of a Contractor to collect milk samples and to record yield and event data, an accredited lactation record is prepared for each cow, together with monthly action lists for herd administration. This scheme forms the basis for the operation of HMC (see iv) and for further services yet to be announced.

(iv) *Herd Management Control* — information used by the Consulting Officer as the basis for a regular review of milk yield and reproductive performance of each cow and of the total herd. This may be regarded as the first in a group of services using NMR information.

(B) A summary of the work of the FARM COMPUTER UNIT combined with an outline of the MMB plans for the development of new interactive computer services for use on and off the farm.

Featured within the display will be some of the equipment currently available or under consideration for use in conjunction with advisory work on the farm.

The Farm Computer Unit has been established to coordinate developments in the use of farm computer systems and to integrate these with established services. By working alongside farmers using computer-based services, the unit hopes to promote the appreciation and effective use of new technology.

THE USE OF A COMPUTER MODEL IN THE PLANNING OF A GRAZING EXPERIMENT

T. J. Maxwell, A. R. Sibbald and J. A. Milne, *Hill Farming Research Organization, Edinburgh*

Results from grazing experiments on the utilization of heather by sheep, show that the removal of approximately 40% of the current season's shoots of heather during the summer and autumn has advantages in terms of plant productivity, sward morphology and digestible OM intakes. However, it was argued that these levels of utilization would only be practical in systems of sheep production if the breeding ewe consumed a diet containing herbage of a higher digestibility, for example from sown-grass species. A preliminary experiment to test this hypothesis was conducted with sheep grazing areas containing different proportions of grass and heather.

A computer simulation model was developed, based on relationships derived from these grazing experiments. The objectives of the modelling exercise were to examine the output of the model over a range of grass/heather ratios and grazing pressures and to test the sensitivity of the component relationships, as an aid to the design of future experimentation on the grazing of grass/heather swards.

149

From a series of model runs, it was found that the range of proportions of grass area to total area necessary to achieve adequate intakes of digestible OM was between 0.2 and 0.4. Intakes of digestible OM by the sheep were more sensitive to changes in the relationship between the proportion of grass in the diet and the herbage mass of grass and to the shape and timing of the heather growth curve than they were to changes in other relationships.

The relationships identified from the sensitivity analysis were among the least well-established and experiments were subsequently conducted to determine them more rigorously. These experiments also allowed the validity of the model to be tested on different data sets.

A SPECIALIST COMPUTER SERVICE FOR PIG FARMERS

W. M. Miller, *Pigtales Ltd, Great Hatfield, Near Hull*

Pigtales Limited has been formed by a group of producers and veterinarians in the Holderness area of East Yorkshire. It is based on the shared use of a Tektronix 4052 system and provides weekly analysis of production and problems on an individual sow basis. Data are submitted from the Pigtales diary (which is virtually the only input document required) and are entered into the database at our office. These diary pages are collected or posted to us on a weekly basis.

The Pigtales System provides:

Action Lists (weekly):
Sows due for pregnancy diagnosis;
Sows due to farrow;
Boar usage and sows weaned but not served within 7 days.

Production Report:
Weekly: Services, farrowings, weaning and herd size; ·
Quarterly: Production indices and summary.

Graphs of performance against target (weekly).

Service: Cumulative Sum Diagrams.

Sow Cards (after service):
A card accompanying the sow, which describes her lifetime performance and indicates potential culls.

Histograms, graphs and special analyses (on request):
Litter size distribution;
Parity versus litter size, etc.

We have more than 3000 sows, in herds ranging from 50-650 sows, currently on our books. Our immediate plans include detailed analysis of the fattening and financial aspect of pig production. Other versions of the software can be prepared for other types of computer.

The system is based on the concept of a 'parish service', where producers can share a recording system which gives them rapid response without the problems of maintaining and operating their own computer. Yet, they also have the security of a local facility and can discuss matters of mutual interest, knowing that their data are comparable but confidential.

BREEDING RECORD ANALYSIS FOR THE INVESTIGATION AND MONITORING OF REPRODUCTIVE PERFORMANCE IN THE PIG

T. A. Pepper, *Department of Animal Husbandry, University of Glasgow*
P. Toplis, *RHM Animal Feed Services Ltd, Wimbourne, Dorset* and
J. T. Lowe, *Simmons Watts Ltd, Banbury, Oxon.*

Poor reproductive performance is an important cause of low productivity and reduced profitability in a pig breeding herd.

Its occurrence is not generally evident from an inspection of the herd but depends upon a detailed examination of the breeding records. The constraints of a commercial enterprise dictate that any system of recording and data collection proposed for the monitoring of reproductive performance be clearly cost effective and confined to the necessary items effecting management activity.

A computer program was developed at Glasgow University School to analyze individual sow records and determine, in detail, the components and reproductive performance. The analysis can be carried out for any period of time. Thus, information based on the most recent record data is available and an adviser can test, retrospectively, the effect of any change at a pig unit (e.g. environment, management, nutrition, disease) on the performance of the herd. A summary table of the main parameters is also produced, in order to facilitate the routine monitoring of a herd's performance. As reproductive performance is highly variable, some guide lines are given to help distinguish between poor performance and random fluctuations.

The question of how best to aid managers and stockmen in adopting control measures is considered. The use of management check lists for guiding investigation diagnosis and remedial action is outlined.

EVALUATION OF AUTOMATIC DATA COLLECTION FROM A DAIRY HERD

G. Powley and J. P. Wray, *Bridgets Experimental Husbandry Farm, Martyr Worthy, Hampshire*

A system for automated cow identification, milk yield and body weight recording has been installed at Bridgets EHF. Cows are identified at Interrogation points on the parlour mangers and on the body weigher as the transponder around each cow's neck is energized. The capture rate is 98%. Cows which fail to be identified automatically are manually identified via an in-parlour keyboard. Each recorder jar is mounted on a weighing strain beam to effect milk yield recording at every milking. The accuracy of recording milk yield by weight is better than visual recording by volume. Body weight recording occurs at the parlour exit as the cows walk over an unattended electronic weigher. The capture rate of true body weights averages 40% at each milking. Evaluation of the system will continue.

BETA — A COMPUTER SYSTEM FOR BUILDING EXPERIMENTAL TABLES FOR ANALYSIS

G. J. Rowlands, L. M. A. Francis and R. M. Pocock, *ARC Institute for Research on Animal Diseases, Compton, Newbury, Berkshire*

The increased automation of analytical equipment makes it possible for animal scientists to conduct experiments in which many variables are frequently measured. Some data, such as body weight, can be recorded immediately but serum, plasma, milk or other tissue samples are often stored for several weeks before analysis. Measurements may be taken daily, weekly, bi-weekly, bi-monthly, etc. and their frequency may differ for different variables and may vary during an experiment. Until now, it has been the normal practice for all the data to be assembled onto a master sheet and to be punched onto cards at the end of the experiment. This process is time consuming, is subject to errors in the transcription of data from a variety of sources and delays the processing and statistical analysis of experimental results. A computer system, BETA (Building Experimental Tables for Analysis), has been developed at the Institute for Research on Animal Diseases to reduce these problems, by enabling experimental data obtained from long-term experiments on animals to be assembled and managed as the experiment progresses. As data become available, BETA is used to enter them from an input file into a matrix stored on magnetic tape — with variables as columns and with animals and dates of measurement within animals as rows. At any time, BETA can be used to retrieve subsets of data for statistical analysis or for 'house-keeping' purposes so that errors or omissions can be investigated. The system reduces the need for data transcription, can accept data punched or typed directly from automated equipment, allows corrections to be made to the stored data and enables a scientist to examine his data critically during the course of an experiment. The system is easy to use after a little training and is now managing experimental data for five projects, each of which has one person responsible for ensuring that data are entered correctly.

COMPUTER SYSTEM FOR RECORDING EVENTS AFFECTING ECONOMICALLY-IMPORTANT LIVESTOCK (COSREEL)

A. M. Russell, G. J. Rowlands and S. Lucey, *ARC Institute for Research on Animal Diseases, Compton, Newbury, Berkshire*

COSREEL is a computer system used for validating and storing on magnetic tape records kept on dairy cattle at the Institute for Research on Animal Diseases and for retrieving these records in various ways to meet the specified needs of herd managers, veterinarians and scientists. A wide range of data can be recorded, including management events such as calving, services, movements between premises, pregnancy diagnoses, weighing, assignment for experiment and disposal. Each animal has its own life history stored on magnetic tape, which is begun automatically for new offspring born at the Institute. The coding system for veterinary data is comprehensive and permits data to be recorded which include diagnosis of disease, local and general symptoms, medical and surgical treatment, vaccination, therapeutic treatment, tests and their results and experimental procedures. Extensive checks are made on all data entered into the system, to minimize the chance of erroneous data being accepted into the database. Weekly lactation records are recorded and the system has also been designed to handle records kept on pigs and sheep. Retrieval programs aim to provide herd-managers and veterinarians with the information needed to assist in routine herd management and to aid disease control. COSREEL is also being used to simplify the selection of animals for experiment and to provide epidemiological analyses for guidance in planning research. COSREEL differs from other systems currently used for livestock management in that it is designed for terminal use to a central computer. This increases its potential value for future extension to other herds, for data can be assembled centrally for wider epidemiological analysis. This potential application is currently being tested by two veterinary practitioners who are using the system on herds at two agricultural colleges, to investigate the suitability of the coding system for general use.

COMPUTERIZED CONTROL SYSTEMS FOR ENVIRONMENT CONTROL

P. Russell, *ADAS On-Farm Computing Team, Reading, Berkshire*

A Motorda 'Exorciser' development system is used to demonstrate direct data capture, with subsequent analysis. In the simple example, temperatures are sensed at three locations, the data are displayed on the VDU and stored on flexible disc. Various analyses are then performed on the stored data.

The objective of this demonstration is to show that the same basic microcomputer can be used for farm office applications and for automatic monitoring and control purposes. It also promotes discussion of hardware topics.

THE PREDICTION OF FEED INTAKE — THE PRIMARY STEP IN MODELLING BROILER GROWTH

A. D. F. Simpson and H. Raine, *RHM Ltd, High Wycombe, Bucks*

Various equations can be developed, both linear and sigmoidal, which allow the prediction of feed intake in response to changes in such variables as feed ME level, temperature and age. Logically, since feed intake and growth occur concurrently and not consecutively, the response equations should include the effects of growth.

Feed intake can be predicted as a proportion of metabolic body-weight:

$$\frac{\text{Feed intake}}{\text{Body-weight}^{0.67}} = A - B(E^{-1}/\text{days})$$ where A and B are related to feed ME level and to temperature.

Solution of this equation, for a range of feed ME values, ages and temperatures, defines a response solid within which the reference point moves. The relationship can be expanded to model the movement of the reference point from one response curve within the solid to another:

On day x after a change in conditions on day x*:

$$\frac{\text{F. Intake}}{\text{B.Wt. } 0.67} = (A_{old} + (A_{new} - A_{old})e^{\beta/x-x^*}) - (B_{old} + (B_{new} - B_{old})e^{\beta/x-x^*}) X(e^{-1/x})$$

152

Data are required to identify β above, i.e. the rate at which the change in feed intake pattern occurs after a change in conditions.

A potential design for an experiment to determine β is given and requires groups of birds fed 4 constant ME levels at each of 4 temperatures plus several groups which are, at different ages, changed from one ME to another at constant temperature and from one temperature to another at constant ME. Results of such an experiment do not appear to be available in the literature.

The use of the falling exponential equation given above has been tested in the construction of a biological model of broiler growth and is found to give reasonable results. The model has yet to be comprehensively validated but although being empirical in nature, may be useful in the design of efficient broiler feeds and in the efficient production of broiler meat.

THE PROGRAMMABLE CALCULATOR AS AN AID TO THE RECORDING AND PLANNING OF BEEF ENTERPRISES

A. W. Spedding and G. E. Pollott, *University of Reading and Meat and Livestock Commission, Bletchley*

Programs have been developed to allow the on-farm processing of records for beef enterprises using a programmable calculator. Financial results culminating in a gross margin and the associated physical performance parameters are produced by three programs summarizing grassland utilization, stock sales and purchases and feed usage for all types of beef enterprises producing stores and slaughter cattle. For suckler herds, the grassland and feed usage programs are combined with an analysis of breeding performance to produce the final financial and physical results.

A series of programs have also been developed to assist in the planning of beef enterprises. Budgeting programs for suckler herds and for beef enterprises allow a set of expected performance levels and costs to be stored in the calculator and then used to reproduce the financial consequences. The effect of changing one or more of these values can be easily demonstrated to the producer. Further programs to assist in the winter rationing and feed budgeting of beef enterprises are also described.

AN ECONOMIC MODEL OF FEEDING STRATEGIES FOR DAIRY COWS

M. Topham, *The Department of Agricultural Economics, The University of Newcastle-upon-Tyne*

An economic study of feeding strategies for dairy cows was carried out using a computer model. The management variables considered were: fertilizer (on grassland) and feed regimes through a lactation cycle, stocking rate, the proportion of grassland which is conserved (first and second cuts), lactation yield and calving time.

Much analysis of the effect of these management decisions on feed margin has been conducted. Interestingly, results from a part of the analysis showed that, at 1979 prices, if least-cost feed rations are fed, including grass produced from fertilizer, for a given stocking rate and calving time, there were many combinations of lactation yield and the proportion of grassland conserved over which there was little change in feed margin.

A major reason for constructing the model was to investigate the inferences of possible future fertilizer, feed and milk prices on management decisions and feed margins.

FARMPLAN COMPUTER SYSTEMS

G. R. Tuer, *Farmplan Ltd, Northallerton*

Farmplan, following 8 years of experience in the computer bureau business, with their milk monitor and milkrate systems, identified the need for a low cost on-farm micro-computer. These systems are now available in the UK at under £5000. This price includes for all necessary hardware and software. Enthusiasm for the systems had led to marketing arrangements being established in many of the developed agricultural economies, with Australia taking a leading role.

Programs Available:

The Dairy Management program is designed for weekly or monthly data input. It provides facilities to produce reports in the whole herd, a group of cows or an individual animal, with the details as specified by the farmer. Other reports include: herd status, performance and action lists. A special feature is the projection of individual lactation curves on the screen in either black and white or colour.

The Pig Breeding and Management program is designed for weekly data input. Regular outputs can include sow and boar reports; a summary of herd production statistics along with 4, 26 and 52 week rolling averages, an action reminder list covering sows due to farrow, possible returns to service, sows due or overdue for pregnancy diagnosis and piglets due for weaning, etc.

Other programs available include Dairy Herd Rations, Live-weight Gain Calculator, Budget and Cashflow program, Dataplan and a very comprehensive Financial Package designed to provide the farmer with up-to-date management and tax accounts.

BANTAM — A COMPUTER PROGRAM TO OPTIMIZE TEMPERATURE AND KILLING AGE FOR BROILER CHICKENS

C. M. Wathes and D. R. Charles, *Ministry of Agriculture, Fisheries and Food, Shardlow, Derby* and B. D. Gill, *School of Agriculture, University of Nottingham, Sutton Bonington, Loughborough*

The effects of dietary nutrient density and post-brooding temperature on the performance of broiler chickens were investigated in three factorial experiments. In each experiment four temperatures were compared over a range from 15°C to 27°C and finisher diets of four nutrient densities were fed; 13.3, 12.9, 12.4 and 11.7 MJ/kg and 199, 197, 195 and 188g crude protein/kg, respectively. Cumulative food consumption and body weight were recorded at 42, 49 and 56 days. A total of 9600 birds of each sex were used.

Following a standard analysis of variance of the results, a computer model of the performance responses was developed in which temperature and age were treated as independent variates while nutrient density was regarded as a factor of four levels. The responses to age and temperature were adequately described by first and second order polynomials. Significant interactions were included in this predictive model.

Finally, a computer program was written, in which, for any given set of food costs and broiler live-weight prices, the economic optimum age at killing and temperature during the post-brooding period is determined. The program, called BANTAM (Broiler Analysis of Nutrition, Temperature, Age and Margins), calculates the margin of live-weight income less food costs at the optimum killing age and temperature for each diet. The margin is expressed per bird (£) and per unit floor area per day alive (£/m²/day). The financial effects of deviations from the optimum temperature are also derived. At current prices (June, 1980), the optimum age at which male and female broilers should be killed is 59 and 54 days, respectively, if kept at 20°C and fed a finisher diet of 12.9 MJ/kg and 197g crude protein/kg. Access to BANTAM is via the authors.

ADAS DAIRY FORECASTING AND MONITORING PROGRAM

H. J. Westlake, *ADAS On-Farm Computing Team, Reading, Berkshire*

This program runs on an Apple II micro-computer. It has been written primarily as a demonstration program. However, with further development it could be an extremely useful 'on-farm' tool for the dairy farmer.

The program gives a 12-month physical and financial forecast of:
1. Milk production and revenue for a dairy herd, based on individual cow calving dates and expected yields;
2. Concentrate requirements for up to four different concentrates per year. This calculation is based on the individual cow anticipated yield in each forecast week and adjusted for expected milk from storage;
3. All feed requirements for predetermined rations for groups of cows or any combination of groups up to the whole herd;
4. Coloured histograms of the results;
5. Tabular and graphical comparisons of actual results against forecasts. This includes individual cow forecasts.

154

ADAS BELGIAN PIG INDICES PROGRAM

H. J. Westlake, *ADAS On-Farm Computing Team, Reading, Berkshire*

Individual sow production indices have been developed in Belgium by Dr J. Daelemans, as a means of comparing the relative productivity of sows. Computer programs containing these indices are being offered to Belgian pig farmers by Government Advisers and by the Farmers Union.

The indices relate the number of piglets reared to the cycle time. This cycle time is taken from 1st service for one litter to 1st service for the next litter. Figures for each litter and all the litters to date are produced for each sow. Adjustment is made for age of maturity. There is a novel graphical method of comparing sows.

The ADAS program is at present the same as the Belgian version. The intention is to test and develop it under UK conditions before offering it to firms producing 'on-farm' pig programs.

THE APPLICATION OF A MICRO-COMPUTER IN LIVESTOCK MANAGEMENT

D. A. Wilkins, *Farm Systems (Cambridge) Ltd, Cambridge*

A considerable problem in livestock management is that posed by the amassing of a large amount of detailed information concerning performance, feed consumption and the events taking place. There is also the need to assess this information with a view to taking the best possible decisions, both with regard to day to day management and longer term policy.

The use of a suitable computer program can enable such tasks to be performed quickly and efficiently and the use of a low cost micro-computer on the farm can result in the immediate availability of the required information.

Various programs have been written for both pigs and cattle, and they have been designed to provide three major elements of assistance in management.

These are, first, the analyzing of performance and efficiency, both on a period basis and for a cumulative and rolling annual appraisal, to allow assessment and comparison of the current situation and trends. This can also include herd health parameters.

Second, there is the maintenance of individual animal records, the recognition of any deviations from a satisfactory norm and the production of action lists, or worksheets, to assist the stockman in anticipating all due events in the herd.

Third, there is the ability to predict such probabilities as output per animal and from the herd, what use will be made of facilities and the likely financial results from any changes made.

An important aspect, in the use of micro-computers and the programs, is the provision of well designed programs, easy to use by farmers and stockmen, prompted by appropriate displays on the VDU, with the use of error trapping procedures and the ability to correct inputs where necessary, at all stages in using the program.