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Title: SIMULATION OF A BROILER BREEDER FARM

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This thesis describes a control tool for managers of a Broiler Breeder Farm, a farm which raises chickens for the purpose of fertile egg production. It presents the development of a simulation of a Broiler Breeder Farm which uses a deterministic step by step process to generate expected values of variables which represent the behavior of the farm. For the purpose of the simulation, the Broiler Breeder Farm was considered a system which is affected by factors related to the physiology of the birds and to management practices. Some of these factors were taken into account as parameters and variables in the simulation while assumptions were made regarding others because of the difficulty in measuring them. The simulation was developed using FORTRAN 77 as the programming language and its application is shown by three examples. The results obtained from the application of the simulation indicate that the simulation can be used to assist the Broiler Breeder Farm manager in the planning and decision making regarding the requirement which should be met in order to satisfy the needs of the flock.

Simulation of a Broiler Breeder Farm

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CHAPTER I

GENERAL CONSIDERATIONS

Introduction

A Broiler Breeder Farm is the first phase of an Integrated Poultry Complex which can be defined as the conjunction of interrelated functions that transform resources into a finished product: the commercially grown and packaged poultry. An Integrated Poultry Complex is seen as a system of components such as those shown in Figure 1. The most important parts of a Broiler Breeder Farm are the birds and the management. The birds have been studied in depth by specialized companies and the results of such studies are very reliable and are available for everyone. On the other hand, management is a topic that has many aspects yet to be analyzed.

Broiler Breeder Farm management involves the study of daily records and the attention to details with a positive reaction to these in order to control and improve the performance of the farm. There are so many variables to be evaluated regarding the performance of the farm that the existence of a control device seems essential as a management tool in order to fulfill its functions.

The management of the Broiler Breeder Farm in Valencia, Venezuela does not have such a control device. The simulation of a Broiler Breeder Farm has been chosen as a means to provide values which can be expected regarding the performance of the farm.

Objective

The objective of this thesis is to produce a simulation of a Broiler Breeder Farm and to determine if the simulation could be used as a control device, to investigate its use as a way to measure the effectiveness of different operational policies and to define what aspects of the topic under study are most significant to management decision making.

Approach

To develop the base for the simulation, a study was performed in Venezuela in which it was found that a Broiler Breeder Farm can be treated as a system consisting of a number of interacting parts (see Figure 2).

The second step in the development of the thesis included a literature review in order to establish what work has been done in this area and to explore the different techniques that could be used to achieve the objective.

There were certain selections to be made in choosing a technique for the simulation and toward that end, an exploration of three different methods was performed. The three different methods were:

1) the use of GASP IV as a simulation language;
2) the use of FORTRAN 77 as the programming language to create the computer program which uses a table-driven algorithm to simulate the behavior of the farm

3) the use of FORTRAN 77 as the programming language to create a more complex computer program which is able to consider the farm as a dynamic system whose variables change with every new flock.

The second method was selected as the one best adapted to the information available.

The next step was to develop the computer program. It was run and its results were analyzed in order to prove if the the objective had been achieved.

The following chapters will provide the description of a Broiler Breeder Farm as a system, the development of the computer program as the simulation model, some examples showing the different applications of the simulation model and the conclusions and recommendations derived from the research.

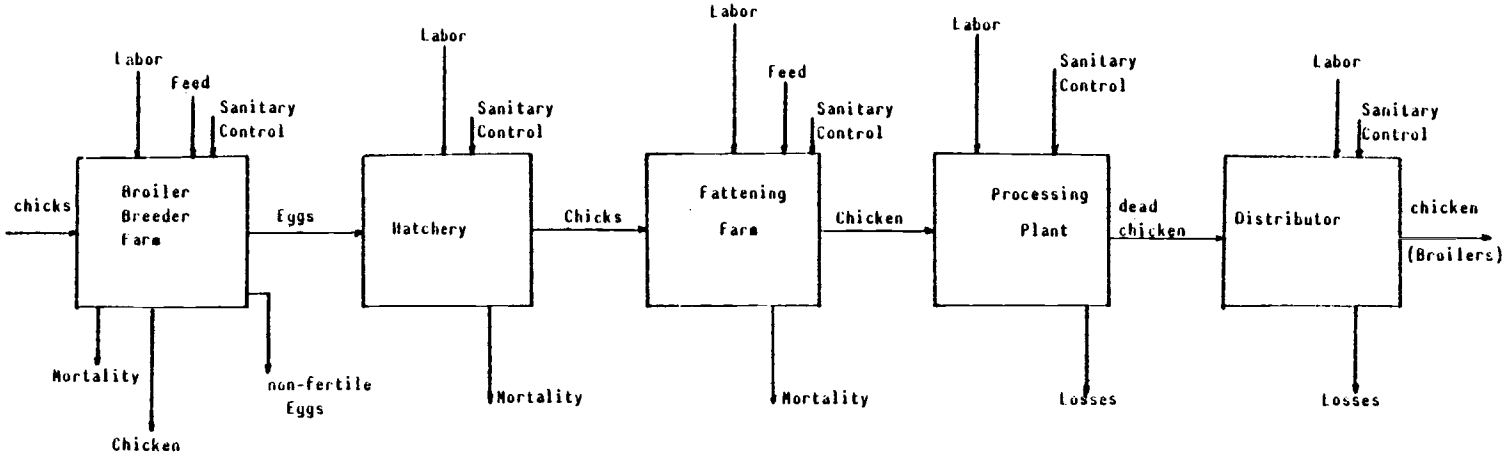


Figure 1

Typical Structure of an Integrated Poultry Complex

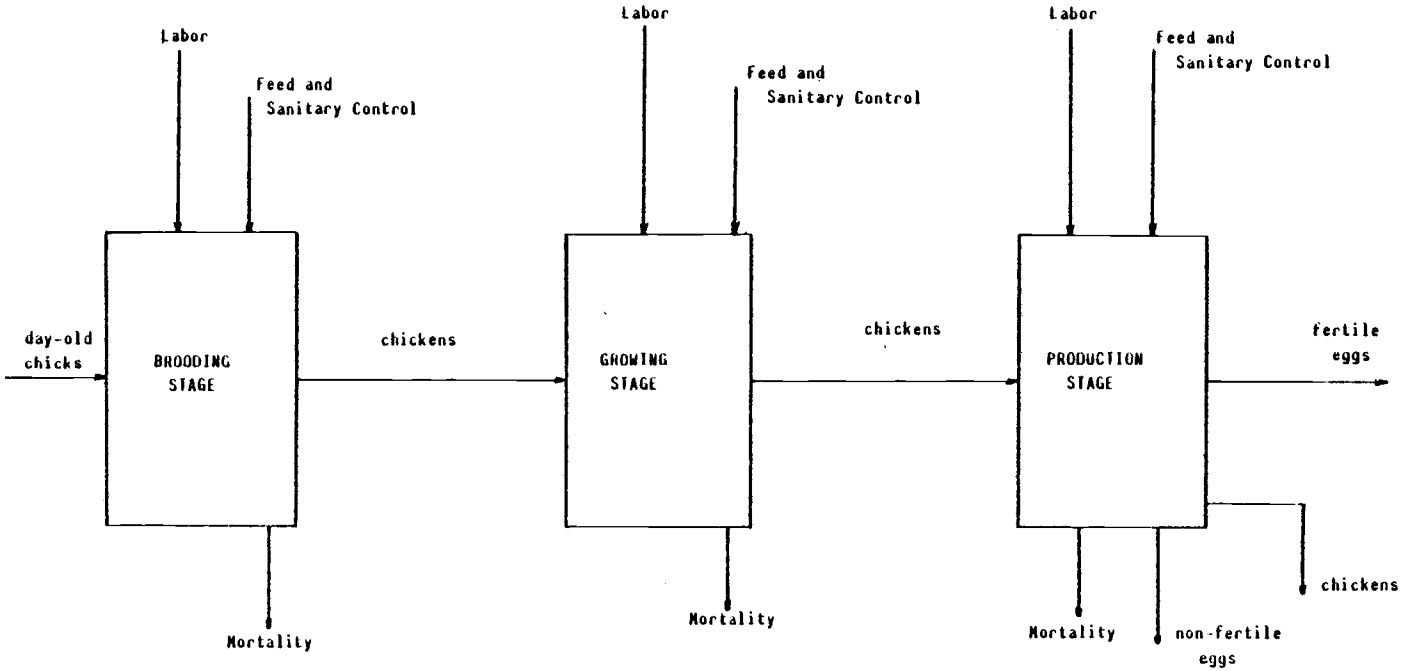


Figure 2
A Broiler Breeder Farm as a System

CHAPTER 2

DESCRIPTION OF THE SYSTEM

In order to understand the behavior of a Broiler Breeder Farm (BBF) a clear view of different aspects which influence the life of the bird seems indispensable. This chapter presents such a view, providing a description of a BBF as a system which can be defined as a set of interacting components which are affected by different forces and perform a definite task. A Broiler Breeder Farm is an important part of an Integrated Poultry Complex (IPC).

To better define what a BBF represents, a brief review of the IPC follows. The first phase of the IPC is the BBF where the fertile eggs are produced. The hatchery is the place where the transformation from fertile eggs to baby chicks takes place. The hatching of chicks can be achieved independently from the hen because there is no relation between the fertilized ovum and the mother and the development of the embryo occurs outside the body of the mother. The fattening farm provides an adequate environment to assure the complete development of the baby chicks. The processing plant transforms the live fowl into processed poultry. The distributor is the last phase of the IPC and it is here where the finished product is shipped to the consumer centers.

The Broiler Breeder Farm as a System

A BBF can be considered a system whose main input is one-day-old chicks. Its function is to provide all the necessary conditions for raising the chicks and achieving an adequate growth of female

layers. These are hybrid animals whose genetic program is directed towards the production of fryers which grow and gain weight rapidly and efficiently. The adequate growth of the female layers is accomplished when they mature at the proper rate without excessive body weight and produce large quantities of fertile hatching eggs. The adequate growth of the female layers is affected by factors which can be classified into two broad categories:

1) factors due to the physiology of the bird itself, and

2) factors determined by management practices.

Factors Due to the Physiology of the Bird Itself

These factors are those which affect the fertility, or productiveness, of the pullets[1] and cockerels,[2] and are related to the bird's genetic constitution.

The fertility of the population is subject to the combined processes which occur in the reproductive physiology of the male and female. Some of the factors involved in or affecting those processes are:

Genetic Factors

Different breeds of fowl have specific ages at which they reach sexual maturity, egg production and semen production. All these characteristics are brought about by the existing genetic differences. There are, for example, some features of the semen which have high heritability values, such as motility and concentration of spermatozoa and volume of semen.

[1,2] See Glossary of Terms

It has been determined that different breeds show a basic physiological difference in spermatozoan activity (Wilcox, Shaffner and Wilson, 1961).

The hereditary characteristics in the bird can be modified by the environment. Some characteristics are affected by environment much more than others. For example, the hen may have genes for brown plumage but the environment will not modify this characteristic. On the other hand, if the hen carries genes which allow her to lay 200 eggs a year and she is not fed properly and given good housing, these genes affecting egg production may not be expressed.

There have been reported significant breed differences in egg production as a result of different protein and energy levels in the diet of the bird (Kondra and Sell, 1966). This implies that the food intake in the bird is going to be very dependent on the breed.

Nutritional Requirements

The good nutrition of the bird is always necessary in order to achieve maximum reproductive performance because each one of the specific nutrients has an effect on the hatchability of the embryos. The nutrition of the bird involves many aspects, some of them related to the feed and others related to the bird.

The bird requires a compounded feed which contains a satisfactory variety of raw materials, and in its preparation the aspects of quality, form and density of the materials should be taken into account.

How the bird is going to respond to the nutrients will be influenced by its genetic potential for growth and its need to maintain an energy equilibrium with its environment.

The bird eats to keep an energy equilibrium. The digestible energy intake is distributed in three different ways: first, as the energy stored in the body or products; second, as the heat lost to the environment and third, as the energy stored in the urine. Nitrogen metabolism produces the urinary energy as a by-product and therefore the rates of fat and protein deposition and heat loss are going to determine the amount of energy and feed to be consumed by the bird.

If the bird is going to maintain the energy balance in the long-term, it must adjust its food intake inversely with dietary energy concentration at least within its capabilities to lay down fat and disperse heat to the environment.

To control all the aspects involved in the nutrition of the bird, feeding programs should be followed with their nutrient recommendation already available for some breeds (see Appendix 1).

Light

Light is a very important aspect in the growth of birds, influencing some basic chemical responses. Some of these are: the concentration of amino-acids in the tissues which varies according to dark-light cycles, sexual maturity which is retarded by a decreasing length of light, and others.

Light stimulates gonodal activity because its presence activates the pituitary gland. The pituitary gland releases hormones which

control the functions connected with sexual development and growth.

Lighting cycles are generally controlled according to programs. A lighting program defines the control of length and frequency of light application.

Temperature and Altitude

Ambient temperature causes changes in the food intake of the bird and therefore affects the reproductive performance. If the levels of essential nutrients of the bird are provided, increased egg production can be expected by increasing temperature up to 30°C. In addition, the effect of temperature on reproduction must be borne in mind when poultry are transported throughout the world.

High altitude also affects some characteristics in animals and man, some of which are related to fertility. For example, high altitude adversely affects hatchability in birds.

Some breeds of fowl evidence adaptation to high altitude but the worst effects were noted in birds from sea level that were taken to a high altitude for a short time (Franus, 1967).

Mating Behavior

Birds have complex courtship behaviors which are associated with mating and when the full expression of that behavior is allowed the optimal fertility can be reached.

Mating frequency is an inherited characteristic of the fowl (Wood-Gush and Osborne, 1956; Wood-Gush, 1960) which makes the selection of the breed very important.

Factors Determined by Management Practices

Since the farm consists of animals which need to be fed and taken care of, the human response to those needs is going to determine how the flock will perform during its growing and production periods. The human response is manifested in the following management practices.

Control of Feeding

An adequate control of feeding is necessary to maintain correct body weight levels. Control of feeding starts when the flock is about four to six weeks old and it is done based on the following aspects:

a) Nutritional requirements for growth including carbohydrates, fats, proteins, vitamins, minerals and water. In order to satisfy those requirements controlled feeding is performed using different types of feed during the life of the flock. There are three commonly-used types of feed: starter feed, developer feed and breeder feed. The optimal composition of each type of feed depends on the particular breed (see Appendix 1).

b) Season of flock hatching and site of proposed growth. This aspect is related to the influence light has on the bird.

If the flock was hatched between April and September, north of the equator, it has decreasing natural light days during part of its growing period. Therefore its development is retarded. To compensate in the bird's growth, more body weight is required.

c) Breed of the flock. Companies specializing in each breed have developed guides to the amount of feed consumption and other

aspects related to the performance of the bird. The breed of the flock is a very important factor in determining its growth.

d) Feeding Program. This point refers to how the flock will be fed. There are several feeding programs but the most common are: (1) Limited every day. Under this program, the bird is fed daily with an amount of feed defined by the average flock body weight. (2) Skip two days per week. Under this program, the bird is fed only five days per week and the feed consumption is determined by the average flock body weight, and (3) Skip a day. Under this program the bird is fed every other day and its feed consumption determined using the average flock body weight. Some of the feeding programs available for different breeds are presented in Appendix 2.

Body Weight

The feeding programs for each breed give the feed consumption amount per bird according to the average flock body weight. Therefore body weight is the key to all feeding programs. In order to get an average flock body weight it is necessary to obtain sample weights of the flock and to determine if the flock is growing uniformly. For practical purposes a variation of ten to fifteen percent from the average is permissible.

There are some aspects which should be considered to obtain uniform growth of breeder cockerels. Early feed restriction is one of them. This is used because the cockerels tend to accumulate excessive amounts of body fat. Feed restriction is therefore beneficial from the standpoint of producing a healthier bird and also in reducing feed costs. Another aspect is a uniform debeaking (elimination of

part of the bird's beak) which produces less stress on the birds. Rapid feed distribution allows the bird to get their equal share and adequate feeder space prevents overcrowding of feeders. Therefore these two aspects are important regarding the uniformity of the bird's growth. The use of accurate feed scales becomes indispensable to achieve uniform growth of the birds.

There are suggested average weekly weight standards established by each broiler breeder female, some of them are shown in Appendix 2.

Controlled Lighting

The light influences the growth of the bird. Therefore adequate use of light during the life of the bird is a very important tool in poultry management.

There are suggested lighting programs that were developed based on the following factors: (1) Breed of the chickens, (2) The month when the flock was hatched, (3) Characteristics of the poultry house (windowed or windowless), and (4) latitude of the farm.

The lighting program is developed with the main purpose of stimulating the reproductive organs of the cockerels prior to a large increase in food consumption. Some lighting programs available for selected broiler breeds are shown in Appendix 3.

Poultry Husbandry

Sound poultry husbandry involves careful control of the following elements:

a) Group size. it has been determined that the larger the group size, the smaller the growth rate (Sainsbury, 1967).

An economic study should be made to find the group size which balances the cost of keeping and feeding a large group size with a small growth rate and the cost of maintaining a smaller group size but with a larger growth rate.

From a practical point of view, the farms already have the poultry houses built and therefore the defining factor will be the required space per bird, which is usually determined for each broiler breeder.

b) Stocking density. The space required for one-day-old chicks is one square foot per bird, and it increases as the chick grows. There are other aspects that affect the space required for the bird such as the broiler breed and the type of floor in the poultry house. There are suggested values regarding the required space per bird. These have been determined to avoid crowding in the poultry house and to achieve good biological performance. Crowding produces poor ventilation and increases the chances for disease.

c) Brooding equipment. The equipment which provides optimum brooding temperature for the chicks is called a brooder and it represents a very important cost for the farmer.

The brooding temperature is determined according to the age of the chicks, the broiler breed, the environment where the chicks are and the stresses under which the chicks live, such as diseases, poor ventilation, etc.

d) Production system This aspect refers to the kind of floor to be used in the poultry house. The most common kinds of floor used are: (1) Litter. This is a very popular method of rearing birds and consists in covering the floor with a mixture of suitable

litter materials. The troubles involved in this method are the limited availability of litter materials and the cost of labour necessary for cleaning out the poultry houses. (2) Cages. This consists of using perforated floors and soft plastic vats. It represents a problem for heavy birds because of the possibility of bone fragility and leg abnormalities, and (3) Slats. This involves the use of cushioned slats as a floor. With the use of slats the required space per bird could be decreased.

Some important aspects of the behavior of chicks regarding the brooders as well as different production systems are shown in Appendix 4.

Sanitation Program

A sound sanitation program involves all environmental measures taken into account to avoid disease hazards. A sound sanitation program contains the following measures:

a) Vaccination. A vaccination program should exist in a BBF and it should be determined by the geographical location of the farm and the prevalence and severity of the disease.

The majority of the diseases which attack the birds are produced by viruses which are resistant to drugs and antibiotics. For this reason, a vaccination program is essential.

The vaccination is the inoculation of a specific biological substance called an antigen to stimulate immunity against a specific disease. The antigen usually is part of the live virus against which a protection is required.

How the birds respond to the vaccination program will depend

on the age of the flock, parental immunity, nutrition of the birds, parasitism and sanitation conditions. Vaccination programs need periodic review and it is important to keep an accurate record of dates and times of administration, manufacturer, serial number and expiration date of each vaccine used.

b) Ventilation. Good ventilation is required for the best performance of the chickens. The outside temperature and existing weather conditions should be taken into account in producing good ventilation.

c) Insect, parasite and rodent control. Internal and external parasites should be controlled. The poultry house must be free of rodents and wild birds because they are potential carriers of many poultry diseases.

d) Visitor and worker control. All personnel on the farm should be disinfected every time they enter the poultry hosue. As much as possible, visitors should not be admitted. Sometimes they are the ones who carry the diseases into the farm.

e) Careful, precision debeaking. Debeaking consists in the elimination of approximately half of the upper part of the beak and half of the lower part. Debeaking is necessary in order to prevent feed waste and it helps to reduce picking among the chickens. The debeaking is done when the bird is six to ten days old, producing less stress on the bird. This method of debeaking, when done properly, is permanent. There is special equipment designed for precision debeaking.

Some vaccination programs and aspects related to the precision debeaking are shown in Appendices 4 ard 5.

Stages of a Broiler Breeder Farm

After considering the factors which affect the system represented by a BBF, the functioning of the system will be described. A BBF can be divided into three stages: brooding, growing and production.

Brooding Stage

During this stage a good environment as well as the necessary care to raise the one-day-old chicks during the beginning of their life are provided.

Since the chicks are very young they are unable to maintain body temperature without the aid of supplemental heat. This implies that a warm, clean environment is indispensable for an optimal performance of the chicks during the rest of their lives. The use of brooders provides warmth and the cleaning and sanitation of the farm are accomplished through effective management practices.

The length of this stage depends on the breed of the chicks. During this stage the chicks require special feed, commonly called starter, whose composition assures the good nutrition of the chicks. Nutrient recommendations regarding the chick starter for selected broiler breeders are shown in Appendix 1.

There are feeding, vaccination and lighting programs to be followed during this stage, some of which are shown in Appendices 2, 5, 3. The feed intake levels of the chicks are determined by the average flock body weight, and for the purpose of this research the tabulated values provided by each breed will be used (see Appendix 2).

In addition to the food care, the provision and sanitation of the water represent a very important aspect in the sanitary control of the chickens. The water should be warm and available to the chicks three hours before feeding.

The mortality rate among the chicks takes its highest value during the first two weeks of the flock, that is during part of the brooding stage. These values of mortality rate are so high because of the adjustment to a new environment that is taking place in the flock.

Growing Stage

Like the brooding stage, the broiler breeders must have access to the required conditions conducive to their optimum growth and development. Those conditions involve an adequate control of feeding, an effective lighting program, and a good supply of water, which working together help to maintain the broiler breeders at the recommended weekly body weight averages and let them reach their sexual maturity at the appropriate time which is different for each breed.

Like the brooding stage, the length of the growing stage depends on the broiler breed and the nutrients required in this stage are provided through a special feed called developer (see Appendix 1). The growth of the broiler breeders is determined following the growing program already available for some breeds (see Appendix 2).

It should be pointed out that the growth of the broiler breeds could be predicted using growth equations, some of which relate weight to food intake (Spillman and Lang, 1924); this type of equation allows only one food parameter and therefore they are limited to a

single feeding program. There are equations which relate weight to time (Robertson, 1923) and there are other equations which combine the two mentioned before, that is, weight and cumulative food consumed with body weight and age (Parks, 1970). There are growing programs which have been developed by specialized companies which show how the broiler breeders grow under certain circumstances.

There are vaccination, lighting and feeding programs especially developed for this stage and for each broiler breeder (see Appendices 5, 3, 2).

Production Stage

The function of this stage is to provide the broiler breeders with adequate conditions in order to obtain an efficient level of egg production. There are two characteristics of the egg which determine if the production stage is efficient or not, fertility and hatchability.

A fertile egg is one which, at the time it is laid, has already started to become a chick. A hatching egg is a fertile egg which survives the period of incubation and produces a baby chick.

The hatchability of the eggs involves external factors such as sanitation, disease control, and egg handling practices but it may be more dependent on what happens after the egg is laid than upon those external factors.

To satisfy the nutrients required by the flock special feed called breeder feed is used during this stage (see Appendix 1).

The production of the flock is tabulated for each breed as well

as the percentage of hatching eggs based on a certain percentage of total eggs produced (see Appendix 2). The simulation will use their values to determine the overall performance of the flock.

With the background provided by the description of the system some facts become evident such as, the existence of many variables which determine the behavior of the flock, and the difficulty of controlling each one of them. For example, the amount of feed required by the flock will depend primarily on the average flock body weight, which suggests that records should be kept regarding the weight of the flock in order to have control over that variable. But at the same time, the average flock body weight will be modified by other variables such as the amount of light that the flock is receiving, the feeding program utilized, etc. This situation shows the need of a control device which could supply values to be used as guides to determine how the flock is performing by means of comparisons. The next chapter will present the simulation of a BBF as such a control device.

CHAPTER 3

DESCRIPTION OF THE SIMULATION

Having described the Broiler Breeder Farm as a system and having determined the factors that affect its functioning, the next step is the model development of the system. Such a model should make it easier to visualize the behavior of the system by showing its significant elements and its most important interrelationships. The model is based on the information already available and on some assumptions concerning different aspects of the system. The model will permit us to find ways of improving our understanding of the system.

The present chapter presents a simulation as a mathematical model which is used to compute the growth and production of a Broiler Breeder Farm. It provides information which represents how the male and female population should grow during the first 24 weeks and how the flock (males and females together) should perform regarding egg production and other aspects during the last 43 weeks.

Description of the Simulation

Simulation refers to a process in which step-by-step solutions are found. That is, the condition of the system in time t is calculated based on the condition of the system in time $t - \Delta t$.

The manager of a Broiler Breeder Farm needs to know the condition of the farm in order to make decisions. The simulation uses inputs

such as male and female breed, number of males and females arriving at the farm, growing rate of the flock, production rate of the flock, predicted mortality among the flock, and feeding programs, to calculate the values which represent the condition of the farm. Those values represent the outputs of the simulation and some of these are the number of birds at the end of each week, the recommended body weight of the bird, feed consumption, egg production, hatching egg production, number of hours of required light per day, etc. All these outputs provide the manager with information of what to expect of the farm and the necessary requirements to be met by the flock in order to perform as it is predicted. The manager can use those values as guidance in determining the requirements of the real flock. The condition of the farm at the end of week t is calculated based on the condition of the farm at the end of week t-1 and on the average mortality during week t. As it was mentioned before, the simulation can be described in terms of its inputs, the program and its outputs.

The inputs are the elements that enter the system for transformation. The inputs are considered as the data of the system. The primary sources of data for this simulation were current manuals, professional journals and data collected at the Broiler breeder Farm.

The inputs can be classified into two categories, parameters and variables. The parameters are those which remain constant during the simulation and determine the values of the variables. The variables will be used as bases for the calculation of the outputs to be generated by the simulation.

The inputs and outputs are described below by specifying the names they assume in the simulation, their definition, the values they can take on and any related information. There is a glossary of simulation parameters and variables at the end of the thesis which provides a definition of each term and the page where it is explained.

The parameters of the simulation include the following.

1) Parameters: MBREED and FBREED

Definition: male and female breed, respectively.

Values: 1 for Arbor Acres Broiler Breeders

2 for Cobb Broiler Breeders

3 for Pilch Broiler Breeders

4 for Hubbard Broiler Breeders

5 for Shaver Starbro Broiler Breeders.

The selection of the breed depends on various factors, such as egg production, body size, growth rate, egg quality and the experience of the farmer. The male and female breed partially define the growth rate, feed amount, light requirements, and egg production of the flock.

2) Parameters: LOCFA and MOFLHA.

Definition: location of the farm and month when flock was hatched, respectively.

Values: for LOCF

1 when the farm is located north of the equator

2 when the farm is located south of the equator.

for MOFLHA

1 when the flock was hatched in January

2 when the flock was hatched in February

.
.
.

12 when the flock was hatched in December

These two parameters take into account the seasonal effect of lighting on sexual maturity, and they determine the lighting program to be used in the farm.

3) Parameters: FEEPRM and FEEPRF

Definition: male and female feeding program, respectively.

Values: -for both parameters

1 for "Limited every Day" feeding program

2 for "Skip-A-Day" feeding program

-for FEEPRF

3 for "Skip Two Days per Week" feeding program

These parameters determine how the males and females are fed during the growing period. It should be noticed that the feeding program followed during the production period is always "Limited every Day"

4) Parameter: LATFA

Definition: Latitude where farm is located

Values: 0 to 45 degrees.

The latitude area where the farm is located together with the values of LOCFA and MOFLHA define the lighting program to be followed during the life of the flock (the World Latidudinal Area Map and some Lighting Program for selected breeds can be seen in Appendix 3)

The second category of inputs are the variables whose description follows.

1) Variables: MARR and FARR

Definition: number of males and females arriving at the farm

Values: they depend on the capacity of the farm and managerial decisions.

These variables give the bases for future calculations of the outputs in the simulation

2) Variables: AMBWS, AFBWS and AFBWPS

Definition: average male body weight (Kg) each week during the growing period, average female body weight (Kg) each week during the growing period and average flock body weight (Kg) each week during the production period.

Values: they are provided by the poultry breeding companies for selected breeds (see Appendix 2).

Purpose: the simulation determines the recommended values of these variables as one of its outputs, according to the selected breed, MOFLHA and LOCFA

The variables AMBWS and AFBWPS, computed by subroutine GROWTH, and AFBWPS, computed by subroutine PRODUC, represent the growing rate of the flock.

3) Variables: AFAMS, AFAFS and AFAFPS

Definition: average feed amount (Kg) per 100 males/day during the growing period, average feed amount (Kg) per 100 females/day during the growing period and average feed amount (Kg) per 100 birds/day during the production period.

Values: they are provided by the poultry breeding companies for selected breeds (see Appendix 2).

Purpose: the simulation will determine the values of these variables according to the selected breed, MOFLHA, LOCFA, FEEPRM and FEEPRF.

The variables AFAMS and AFAFS, computed by subroutine GROWTH, and AFAFPS, computed by subroutine PRODUC, define the feed intake of the birds.

4) Variable: AREPRS

Definition: average rate of egg production per female per day from week 25 to week 67 of the flock's life.

Values: they are provided by poultry breeding companies for selected breeds.

Purpose: the simulation will use this variable to calculate the total egg production of the flock according to the selected breed.

This variable, computed by subroutine PRODUC, determines how many eggs the female should lay per day assuming that good poultry husbandry is being practiced.

5) Variable: ARHEGS

Definition: average rate of hatching eggs/day from week 25 to week 67 of the flock life.

Values: they are provided by poultry breeding companies for selected breeds

Purpose: the simulation will use this variable to determine the total number of hatching eggs produced by the flock.

This variable, computed by subroutine PRODUC, provides the percentage of the total number of eggs produced each day which will hatch assuming that good poultry husbandry is a fact in the farm.

6) Variable: THRLD and AHDL

Definition: total hours of required light per day and the average length of day for specific lighting programs.

Values: they are provided by poultry breeding companies for selected breeds

Purpose: the simulation will choose the recommended lighting program among those available according to the values of LOCFA, LATFA, and MOFLHA.

Subroutine LIGHT contains all the possible lighting programs for the selected breed.

7) Variables: APMMOR and APFMOR

Definition: average percentage of male mortality and average percentage of female mortality for each week of the flock's life.

Values: for the first two weeks of the flock life:

APMMOR(1) = 5.80

APMMOR(2) = 3.30

APFMOR(1) = 2.69

APFMOR(2) = 1.71

for the rest of the flock life the following two equations are used to generate the values of the mortality rate:

$$APMMOR(AGE) = .2851+.0887*AGE-.0011*(AGE)^2$$

and $$APFMOR(AGE)=.6007*^{e^{-\frac{4.4998}{AGE}}}$$

where AGE is the age in weeks of the male and female population respectively.

Purpose: the simulation will use the values of these variables to update the number of birds in the farm every week.

The possible values of these variables, computed by functions APMMOR and APFMOR, show how the mortality rates among males and females behave in one farm located in Valencia, Venezuela and therefore they cannot be generalized for any flock. The process followed to obtain the equations is explained in Appendix 6.

The simulation program represents the behavior of the system. It sets the mode of operation through a set of rules and arranges the procedures, functions and routines to be followed by the computer in order to generate the desired outcomes. A description of the ideal outcomes (outputs) of the simulation becomes essential in order to comprehend the logic of the simulation. This description follows.

1) Variable: THRLD and AHDL

Definition: total hours of required light per day (natural and artificial) and the average number of hours of daylight for the recommended lighting program.

Values: SUBROUTINE LILGHT will determine the recommended values for THRLD and the value of AHDL according to the values of LOCFA, LATFA and MOFLHA

These outputs tell the manager how many hours of daylight the flock requires each day.

2) Variable: AMBW and AFBW

Definition: average male body weight (Kg) each week and average female body weight (Kg) each week, during the growing period

Values: Subroutine GROWTH will determine the values for this variable according to the values of LOCFA, MOFLHA, FEEPRM and FEEPRF.

3) Variable: FEMOR

Definition: number of dead females each week

Values: Function APFMOR provides the average percentage of female mortality per week. The value of FEMOR (t) is calculated from the number of females at the end of week t-1 using APFMOR (t)

This variable will show the effect of the female mortality every week.

4) Variable: ANFEM

Definition: total number of females in the farm per week

Values: they are generated by updating the number of birds at week t-1 taking into account the value of FEMOR (t)

5) Variable: TAFAF

Definition: total amount of feed consumed by females on a given day (Kg) during the growing period

Values: Subroutine GROWTH provides the recommended values of AFAF (average feed amount -Kg- per 100 females per day) for the growing period. The value of TAFAF is

determined by multiplying AFAF by the total number of females at the beginning of each week.

6) Variable: CFEAMF

Definition: cumulative amount of feed consumed by females (Kg) per week during the growing period

Values: this variable accumulates the total amount of feed consumed by females every week during the growing period.

7) Variable: MAMOR

Definition: number of dead males per week.

Values: Function APMMOR provides the average percentage of male mortality per week. The value of MAMOR (t) is calculated from the number of males at the end of week t-1 using APMMOR (t)

This variable shows the effect of the male mortality every week.

8) Variable: ANMAL

Definition: total number of males in the farm per week.

Values: they are generated by updating the number of males at week t-1 taking into account the value of MAMOR(t). When the value of ANMAL is less than ten percent of the total number of females in the farm an order of males is made to assure that the male population is at least ten percent of the female population.

9) Variable: TAFAM

Definition: total amount of feed consumed by males on a

given day (Kg) during the growing period.

Values: Subroutine GROWTH provides the recommended values of AFAM (average feed amount--Kg--per 100 males per day) for the growing period. The value of TAFAM is determied by multiplying AFAM by the total number of males at the beginning of each week.

10) Variable: CFEAMM

Definition: cumulative amount of feed consumed by males (Kg) per week during the growing period.

Values: this variable accumulates the total amount of feed consumed by males every week during the growing period

11) Variable: AFBWP

Definition: average flock body weight (Kg) per week during the production period

Values: Subroutine PRODUC determines the values for this variable accordiong to the values of LOCFA and MOFLHA.

12) Variable: TAFAFP

Definition: total amount of feed consumed by flock (Kg) on a given day during the production period.

Values: Subroutine PRODUC provides the recommended values of AFAFP (average feed amount--Kg--per 100 females per day). The value of TAFAFP is determined by multiplying AFAFP by the total number of birds (males plus females) at the beginning of each week.

13) Variable: AMEGGD

Definition: average number of eggs produced per day

Values: Subroutine PRODUC provides the recommended values of AREPR (average rate of egg production per female per day). The value of AMEGGD is calculated multiplying the AREPR by the total number of females in the farm at the end of each week.

14) Variable: AMHAEG

Definition: average number of hatching eggs produced per day.

Values: Subroutine PRODUC provides the recommended values of ARHEG (average rate of hatching eggs per day). The value of AMHAEG is determined by multiplying ARHEG by the total number of eggs produced each day.

15) Variable: CFEAMP

Definition: cumulative amount of feed consumed by flock--Kg--per week during the production period

Values: this variable accumulates the total amount of food consumed by the flock every week during the production period.

16) Variable: CHATEGG

Definition: cumulative number of hatching eggs produced per week.

Values: this variable accumulates the average number of hatching eggs produced every week.

17) Variable: FEPDEG

Definition: cumulative amount of feed consumed by the flock in production per dozen eggs produced per week

Values: this variable is calculated through a ratio based on the cumulative amount of feed consumed by the flock and the cumulative number of eggs produced per week.

The simulation program was developed to calculate the outputs just described. The flow diagram of the program is shown in Figure 3. For a better understanding of the existing relationships between the main program and subprograms (subroutines and functions) a Program System Chart is presented in Figure 4.

The program starts reading the inputs which include the initial conditions for the simulation: age at which the simulation should start (DAGE) and the values of the cumulative variables up to that age. Then the program prints those variables. The next step is the calling of subroutine LIGHT which provides the lighting program with the average length of day for that specific program. Then subroutine GROWTH is called providing in that way the necessary values to calculate the output to be printed during the growing period for males and females. These values are the average female body weight (AFBW), average male body weight (AMBW), average feed amount per 100 females per day (AFAF) and the average feed amount per 100 males per day (AFAM).

The program then checks to see if the age for the simulation to start is greater than 25 weeks. If that is so, the program calculates

all the outputs concerning the production period. Otherwise, the program calculates all the outputs for the growing period (for males and females, separately). When the program is simulating the behavior of the system during the first 24 weeks, it starts with the female population generating the number of dead females, number of females in the farm, total amount of feed consumed by females per day, cumulative feed amount consumed by females and then prints them.

After the program has finished with the female population for the first 24 weeks it continues to calculate the same variables already generated for the females, but now for the male population. There is a check on the number of males in the farm to see if the males are at least ten percent of the female population. If that is so, no change is made in any of the variables; otherwise, an order of males is made in order to have a number of males at least equivalent to ten percent of the female population. After all the variables for the male population have been generated, the program prints them.

When the program is generating the outputs of the production period, it starts calling the subroutine PRODUC which provides the average flock body weight (AFBWP), average feed amount per 100 birds per day (AFAFP), the average rate of egg production per female per day (AREPR) and the average number of hatching eggs per day (ARHEG). Then the outputs concerning the production period are calculated every week, such as the number of dead males and females (MAMOR and FEMOR), the number of males and females in the farm (ANMAL and

ANFEM), the total amount of feed consumed by flock (TAFAFP), the average number of eggs produced per day (AMEGGD), the cumulative amount of feed consumed by the flock (CFEAMP), the cumulative number of hatching eggs produced (CHATEGG) and the cumulative feed amount consumed by the flock in production per dozen eggs produced. Then the program prints all these values.

During the production period a check on the number of males is done to see if there is an amount of males equivalent to at least ten percent of the female population. If that is not so, an order of males is made.

The listing of the computer program for the simulation is presented in Appendix 7.

The simulation of the system will provide the necessary outputs to serve as a control device for the manager of the Broiler Breeder Farms. Some applications of the simulation program will be provided in the next chapter where the usefulness of the simulation will be established.

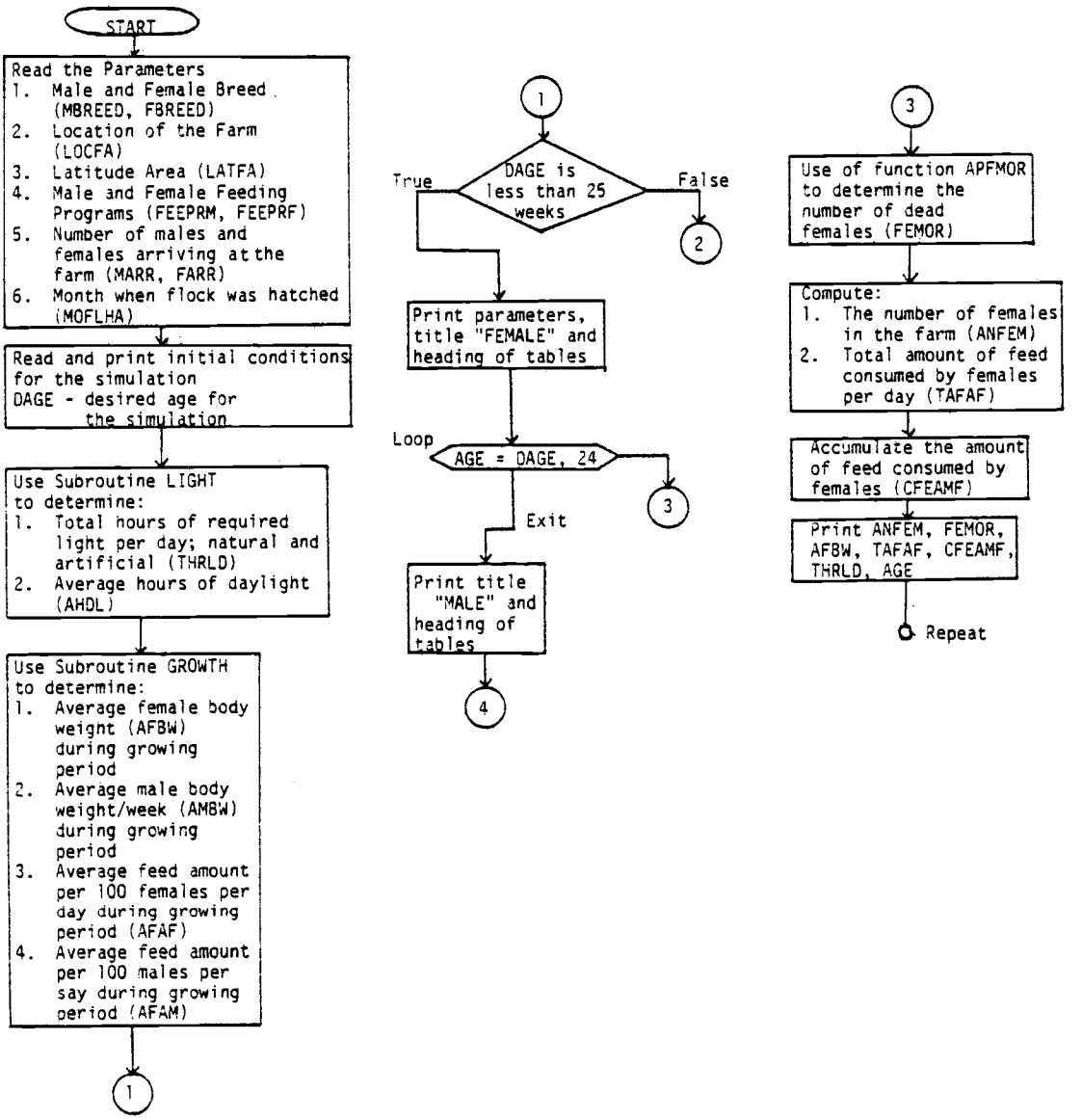


Figure 3. Flow Diagram

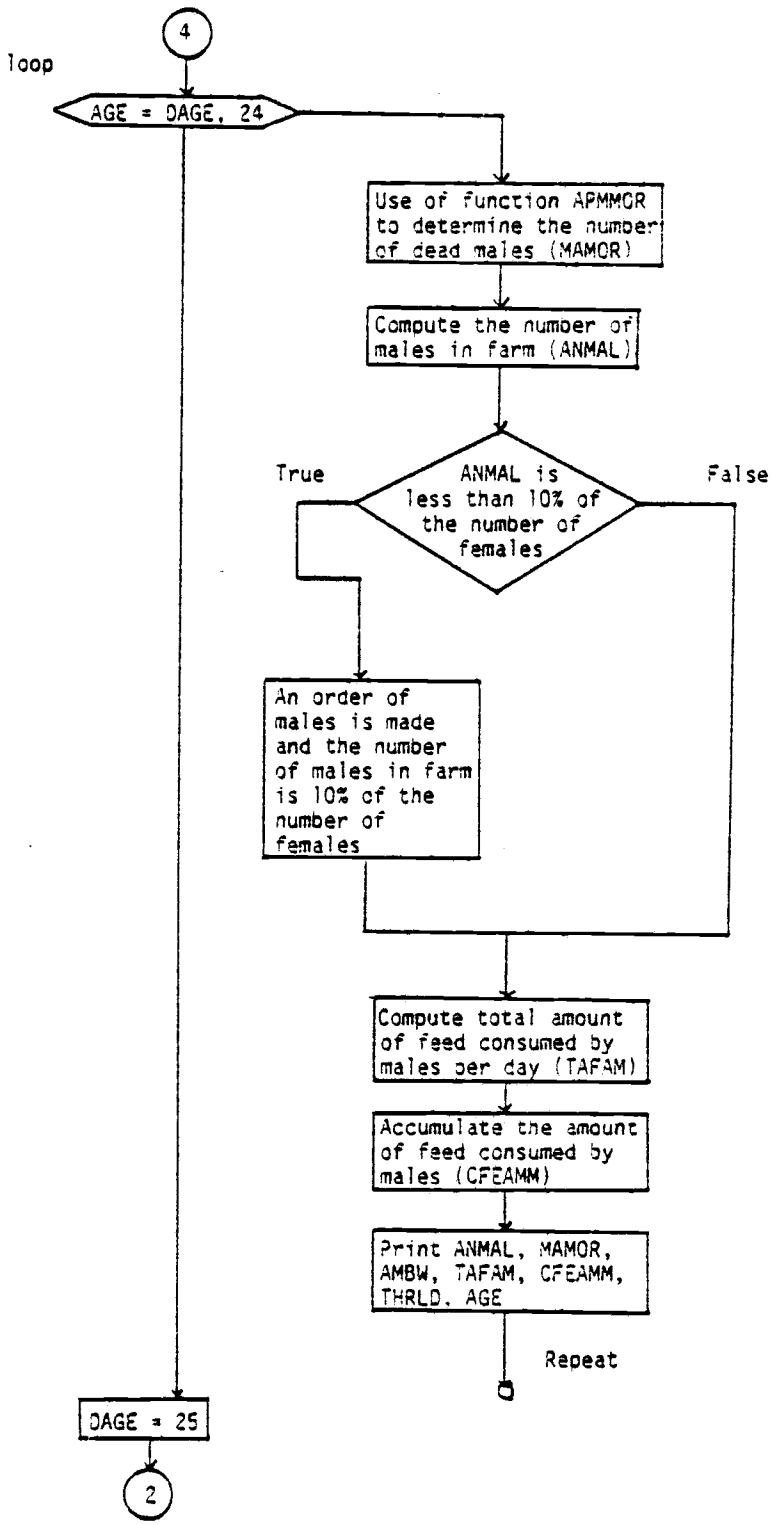

4
loop
AGE = DAGE, 24
Use of function APMMOR to determine the number of dead males (MAMOR)
Compute the number of males in farm (ANMAL)
True
ANMAL is less than 10% of the number of females
False
An order of males is made and the number of males in farm is 10% of the number of females
Compute total amount of feed consumed by males per day (TAFAM)
Accumulate the amount of feed consumed by males (CFEAMM)
Print ANMAL, MAMOR, AMBW, TAFAM, CFEAMM, THRLD, AGE
Repeat
DAGE = 25
2

Fig. 3 (cont.)

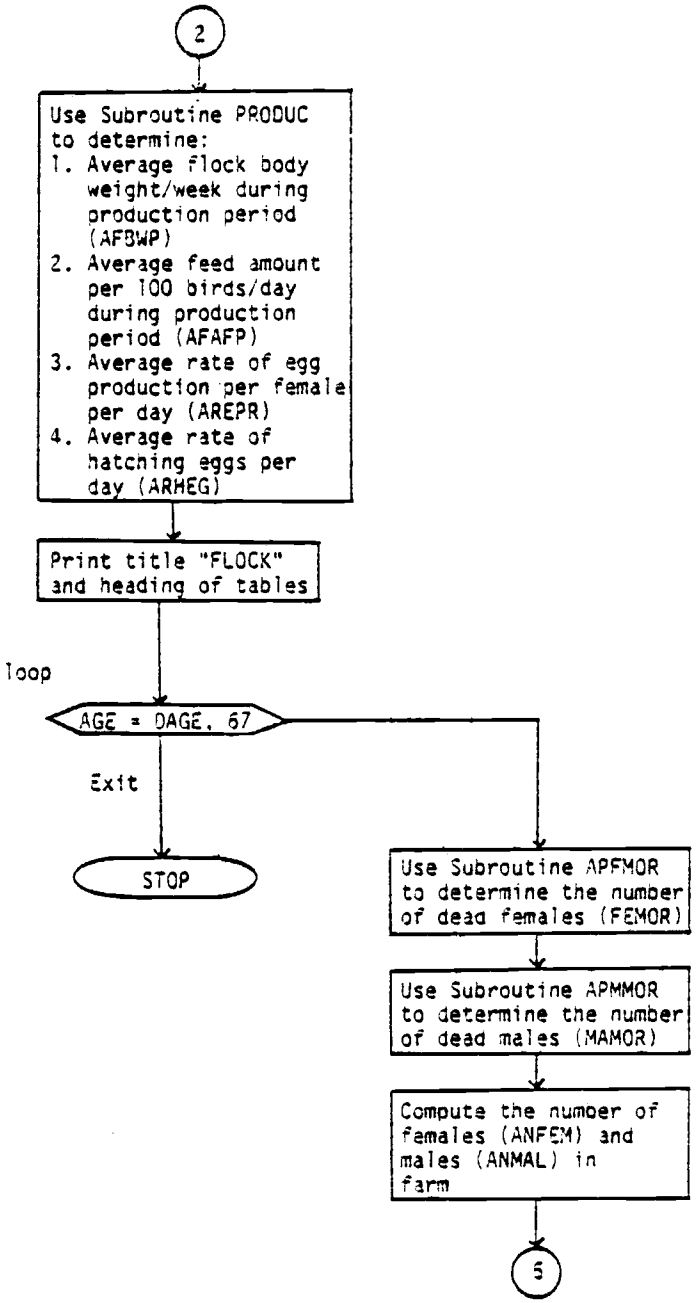

2
Use Subroutine PRODUC to determine:
1. Average flock body weight/week during production period (AFBWP)
2. Average feed amount per 100 birds/day during production period (AFAFP)
3. Average rate of egg production per female per day (AREPR)
4. Average rate of hatching eggs per day (ARHEG)
Print title "FLOCK" and heading of tables
loop
AGE = DAGE, 67
Exit
STOP
Use Subroutine APFMOR to determine the number of dead females (FEMOR)
Use Subroutine APMMOR to determine the number of dead males (MAMOR)
Compute the numoer of females (ANFEM) and males (ANMAL) in farm
5

Fig. 3 (cont.)

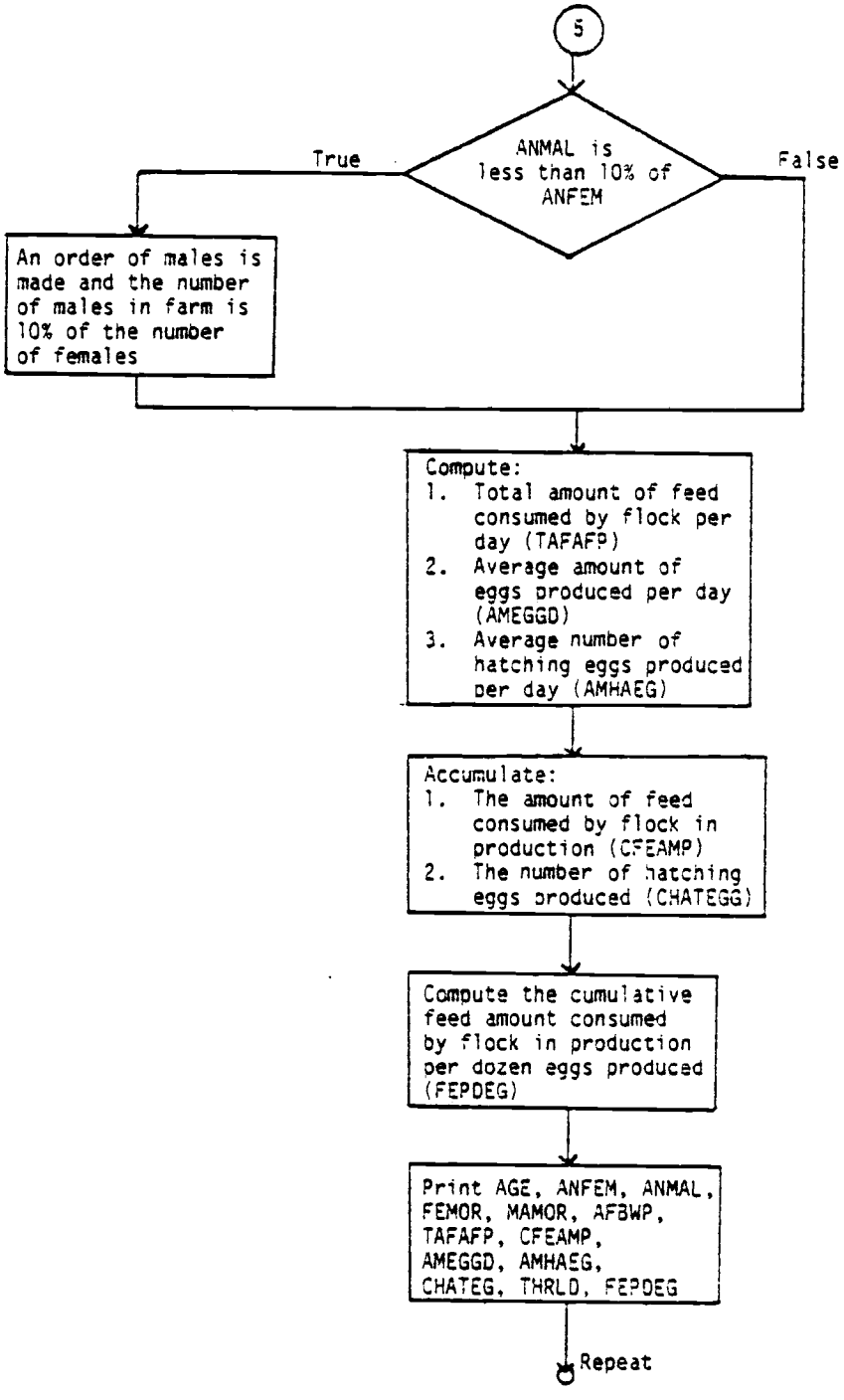
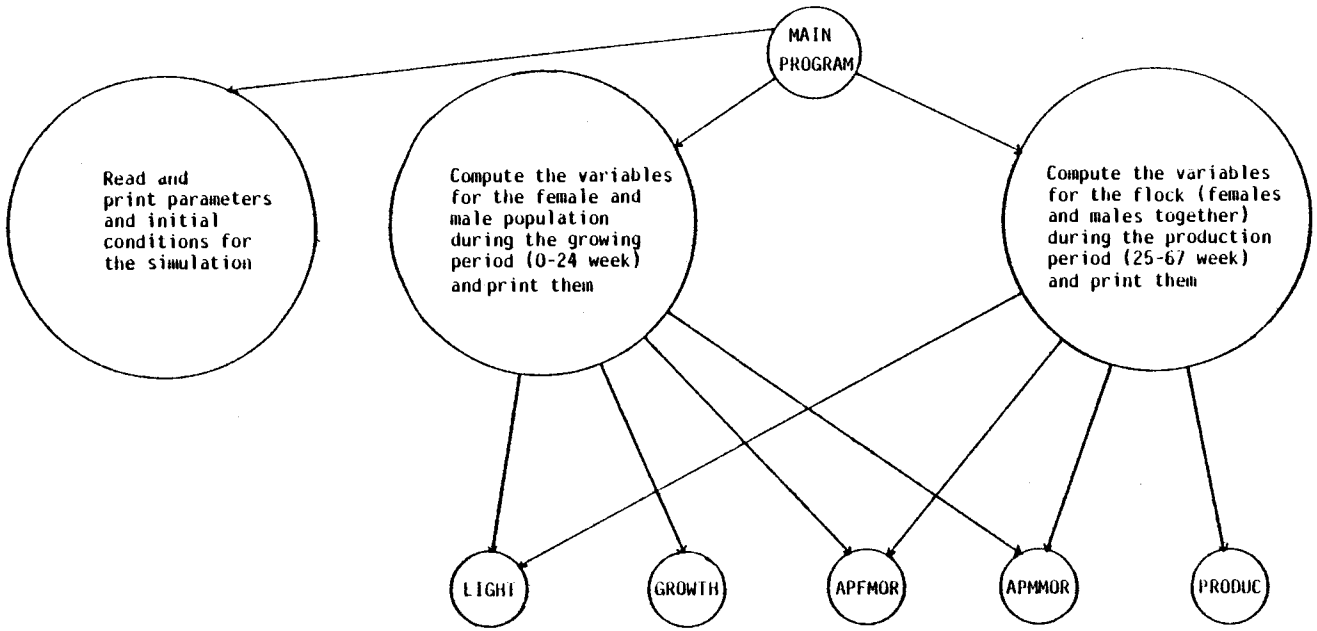

5
ANMAL is less than 10% of ANFEM
True
False
An order of males is made and the number of males in farm is 10% of the number of females
Compute:
1. Total amount of feed consumed by flock per day (TAFAFP)
2. Average amount of eggs produced per day (AMEGGD)
3. Average number of hatching eggs produced per day (AMHAEG)
Accumulate:
1. The amount of feed consumed by flock in production (CFEAMP)
2. The number of hatching eggs produced (CHATEGG)
Compute the cumulative feed amount consumed by flock in production per dozen eggs produced (FEPDEG)
Print AGE, ANFEM, ANMAL, FEMOR, MAMOR, AFBWP, TAFAFP, CFEAMP, AMEGGD, AMHAEG, CHATEG, THRLD, FEPDEG
Repeat

Fig. 3 (cont.)



Subroutine LIGHT : computes total hours of required light per day and average hours of daylight for the lighting program

Subroutine GROWTH : computes the recommended average body weight, and feed amount per 100 birds per day for females and males during the growing period

Function APFMOR : computes the average percentage of female mortality each week during the life of the flock

Function APMMOR : computes the average percentage of male mortality each week during the life of the flock

Subroutine PRODUC : computes the recommended average flock body weight, average feed amount per 100 birds per day, average rate of egg production, and average rate of hatching eggs during the production period

Figure 4. Program System Chart

CHAPTER 4

EXAMPLES OF THE SIMULATION

The simulation program has been developed as a management tool which is able to provide values which can be expected concerning the performance of the farm. Some of those values are calculated on a weekly basis like, for example, the recommended average body weight, the number of dead birds, the cumulative amount of feed consumed and the total hours of required light, while there are others which are calculated on a daily basis like, for example, the total amount of feed consumed, the total number of egg production, and the total number of hatching egg production. All these values represent very useful information to the management which could foresee some problems as consequences of not having the necessary means to meet the needs of the flock.

In order to visualize what the simulation can do to facilitate the control of the farm, a brief review of the actual procedure followed in the farm in Venezuela is described next.

The first steps are common for both the real and the simulated cases. These are the identification of the male and female breeds in order to determine the recommended growth rates and production standards already available for those breeds, and to establish the number of males and females to be raised in the farm. These last values are already determined to some extent by the capacity of the farm, which is fixed. In both procedures management plays a very important role in the choosing of the feeding programs and the sanitation program to be put into practice.

In the actual procedure there are forms to be filled by the worker in charge of each flock. The forms have three sets of values already printed which are the recommended average body weight of the bird, the percentage of daily egg production per female, and the percentage of daily hatching egg production. Besides the values described, the forms have to be filled in with the following weekly values for male and female populations during the growing period: average body weight, number of birds at the end of each week, number of dead birds, percentage mortality, cumulative percentage mortality, feed consumed, and cumulative feed consumed. During the production period the males and females are together and the information required during the growing period is still recorded plus the following values: egg production per week, cumulative number of eggs produced, hatching egg production per week, percentage of daily hatching egg production and cumulative feed amount per dozen eggs.

There is a considerable amount of work involved in the process of filling the forms because all the information and calculations are handled by workers who are in charge of more than one flock. But what is more important is that those forms are used not only to keep records of the farm performance but as the only way to control the flock by comparing the values of the actual farm with those of older forms.

The first example presents the usefulness of the simulation when the management of the farm is making the decision concerning the number of birds (males and females) to be raised in the farm and the feeding and lighting programs to be used. For that purpose

information such as expected egg production, feed to be consumed by the flock, and expected mortality among the flock, will allow management to weigh the alternatives and to choose the one that best fits the conditions avilable in the farm. The simulation program will provide that information during the flock's life.

The second and third examples show the usefulness of the simulation when the decision concerning the number of birds to be raised in the farm has been already made and what concerns management is the expected farm performance from any age of the flock's life on.

The following inputs are used to produce the results of the simulation for the three examples

INPUTS

Male Breed MBREED = 1 (Arbor Acres)

Female Breed: FBREED = 1 (Arbor Acres)

Male Feeding Program: FEEPRM = 1 (limited every day)

Female Feeding Program: FEEPRF = 1 (limited every day)

Location of the farm: LATFA = 18 (degrees)

Month when flock was hatched: MOFLHA = 10 (October)

Number of males arriving at the farm: MARR = 859

Number of females arriving at the farm: FARR = 5480

The first example involves the simulation of the farm from the first week. The data of growth rate and production measures were provided by Arbor Acres Farms Inc (see Appendix 2). Subroutine LIGHT determined the lighting program to be used by the farm and the functions APMMOR and APFMOR calculated the average percentage of mortality for the male and female populations.

The results provided by the simulation are shown in Table 1 for the female population during the growing period, in Table 2 for the male population during the growing period, and in Table 3 for the flock (males and females together) during the production period. These results can be used by the manager, who for example wants to know beforehand what the requirements are to obtain a good performance of the farm. These outputs tell the manager the amount of feed and light that should be available to the flock, the storage space required for the egg production, the labor that will be necessary to handle the expected production, etc. This means that the manager will start to raise the flock having a good idea of what to expect.

The second example shows the results of the simulation when it starts at the sixteenth week of the flock's life. The manager would want to do this when, for example, there has been an epidemic among the flock and a considerable number of males and females have died, then the manager wants to know the new values that could be expected regarding the performance of the farm. Additional inputs were necessary for this example.

ADDITIONAL INPUTS

Number of males at the end of the 15th week: ANMAL(15) = 650

Number of females at the end of the 15th week: ANFEM(15) = 4500

Cumulative amount of feed consumed for males up to the 15th week: CFEAMM(15) = 4560.55 Kgs.

Cumulative amount of feed consumed for females up to the 15th week: CFEAMF(15) = 30230.38 Kgs.

The results of the simulation program are shown in Table 4 for the female population during the growing period, in Table 5 for the male population during the growing period, and in Table 6 for the flock during the production period. These results will allow the manager to update the information he had regarding the performance of the farm. For example, the amount of feed required by the flock before the epidemic was larger than the one required now, then these outputs permit the manager to reduce the amount of feed to be ordered for the future. The manager will be aware of the new egg production that should be expected from the farm.

The third example presents how the simulation program works when the desired age to start it is the 36th week of the flock's life. This example shows the case when a considerable number of females have died while the number of males in the farm is greater than was expected. This implies a variation in the performance of the farm and the manager needs the new values regarding the new performance of the farm. Additional inputs were necessary for this example.

ADDITIONAL INPUTS

Number of males at the end of the 35th week: ANMAL(35) = 490

Number of females at the end of the 35th week: ANFEM(35) = 3490

Cumulative amount of feed consumed for the flock up to the 35th week: CHATEG(35) = 150225

Number of eggs produced in the 35th week: AMHAEG(35) = 2020

Total number of birds in production at the end of the 35th week: ANFLO (35) = 3950

The results generated by the simulation are shown in Table 7 for the flock during the production period. These results, as those obtained from the second example, allow the manager to update the information he had regarding the performance of the farm. There are new values of feed required by flock and for the rest of the variables, of which the manager should be aware.

From the results of the examples it can be seen how the simulation program provides the information needed by the management to make decisions. The most important feature of the simulation is that the results are calculated taking into account the mortality among the flock. It should be pointed out that some of the results are given on a daily basis in order to facilitate its uses. For example, the feed amount is expressed in Kilogram per day which gives the management a valuable tool to know the availability of feed in the farm during the flock's life and enables it to know if the flock is overeating or not.

The simulation also controls the number of males and females in the farm in such a way that when the number of males is less than ten percent of the number of females an asterisk is shown at the beginning of the weekly information indicating that an order of males has been made to balance the losses in the male population.

Management plays the most important role in the farm but with the use of the simulation program, there will be a better tool to monitor and control the performance of the farm.

Tables 1, 2, 3. Results of example 1.

Table 1

Results of the Simulation for the female population in Example 1.

DESIRED AGE FOR THE SIMULATION = 1 WEEK

** F E M A L E S **

FEMALE BREED = 1 LOCATION OF FARM =1

NUMBER OF FEMALES ARRIVING TO FARM = 5480 LATITUD WHERE FARM IS = 18

MONTH WHEN FLOCK WAS HATCHED = 10 FEEDING PROGRAM = 1

AVERAGE HOURS OF DAYLIGHT =12.10

AGE (WK)	AMOUNT BIRDS END OF WK	MORTALITY (AMOUNT)	AVERAGE BODY WEIGHT (KG)	FEED AMOUNT(KG)	CUMULATIVE FEED AMOUNT(KG)	REQUIRED LIGHT(HR)
1	5333	147	MIN.	FULL FD	FULL FEED	NOL
2	5242	91	MIN.	FULL FD	1365.25	NOL
3	5235	7	.465	188.71	2686.23	NOL
4	5225	10	.958	251.23	4440.19	NOL
5	5212	13	.651	282.15	6420.24	NOL
6	5197	15	.744	307.51	8572.80	NOL
7	5181	16	.837	317.32	10791.92	NOL
8	5163	18	.930	331.58	13113.01	NOL
9	5144	19	1.024	340.76	15498.31	NOL
10	5124	20	1.115	349.79	17946.86	NOL
11	5104	20	1.210	358.68	20457.62	NOL
12	5083	21	1.300	372.59	23065.76	NOL
13	5061	22	1.395	381.23	25734.33	NOL
14	5039	22	1.485	389.70	28462.21	NOL
15	5017	22	1.580	398.08	31248.78	NOL
16	4994	23	1.670	411.39	34123.54	NOL
17	4971	23	1.765	419.50	37065.01	NOL
18	4948	23	1.860	427.51	40057.55	NOL
19	4925	23	1.955	435.42	43105.52	NOL
20	4901	24	2.050	448.18	46242.75	NOL
21	4877	24	2.140	455.79	49433.30	NOL
22	4853	24	2.235	463.32	52675.50	13
23	4829	24	2.325	475.59	56005.66	13
24	4805	24	2.420	482.90	59385.96	13

Table 2

Results of the Simulation for the male population in Example 1.

** M A L E S **

MALE BREED = 1

NUMBER OF MALES ARRIVING TO FARM = 859

FEEDING PROGRAM = 1

AGE (WK)	AMOUNT BIRDS END OF WK	MORTALITY (AMOUNT)	AVERAGE BODY WEIGHT (KG)	FEED AMOUNT(KG)	CUMULATIVE FEED AMOUNT(KG)	REQUIRED LIGHT(HR)
1	809	50	MIN.	FULL FD	FULL FEED	NOL
2	782	27	MIN.	FULL FD	231.37	NOL
3	778	4	MIN.	30.11	442.12	NOL
4	773	5	MIN.	38.90	714.42	NOL
5	768	5	MIN.	43.67	1020.14	NOL
6	762	6	.929	48.00	1356.14	NOL
7	756	6	1.045	49.15	1700.19	NOL
8	749	7	1.161	50.65	2054.75	NOL
9	742	7	1.277	52.06	2419.14	NOL
10	734	8	1.415	53.88	2795.71	NOL
11	726	8	1.533	54.68	3178.49	NOL
12	717	9	1.650	56.27	3572.34	NOL
13	708	9	1.769	57.00	3971.35	NOL
14	699	9	1.887	58.75	4382.76	NOL
15	689	10	2.000	59.42	4798.60	NOL
16	679	10	2.122	60.29	5220.62	NOL
17	669	10	2.240	60.77	5646.01	NOL
18	659	10	2.359	62.22	6081.53	NOL
19	649	10	2.477	62.61	6519.76	NOL
20	638	11	2.594	63.28	6962.71	NOL
21	627	11	2.712	63.80	7409.31	NOL
22	615	12	2.873	63.95	7856.99	13
23	605	11	2.993	64.37	8307.59	13
24	594	11	3.113	64.74	8760.73	13

* THE TOTAL NUMBER OF MALES IS LESS THAN TEN PERCENT OF THE TOTAL NUMBER OF FEMALES, THEN CERTAIN NUMBER OF MALES HAS TO BE ORDERED

Table 3
Results of the Simulation for the flock in Example 1

DESIRED AGE FOR THE SIMULATION = 1 WEEK

** F L O C K **

FEEDING PROGRAM = 1

AGE (WKS)	AMOUNT FEMALE	AMOUNT MALE	MORTALITY FEM	MORTALITY MAL	AVERAGE BODY WEIGHT (KG)	FEED PER DAY (KG)	CUMULATIVE FEED (KG)	PRODUCTION EGGS/DAY	HATCHING EGGS/DAY	CUMULATIVE HATCHING EGG	LIGHT/ DAY(HRS)	CUMULATIVE FEED/DOZ-EGG
25	4781	503	24	11	2.520	750.56	5309.92	239	0	0	13	38.89
26	4757	572	24	11	2.628	801.92	10923.34	951	713	4991	13	15.74
27	4733	561	24	11	2.730	844.65	16835.87	1799	1483	14812	13	10.50
28	4709	550	24	11	2.790	886.75	23043.88	2598	2124	29688	13	9.88
29	4685	539	24	11	2.860	888.88	29289.26	3373	2867	49749	13	8.48
30	4661	528	24	11	2.920	875.82	35336.48	3729	3287	72198	14	8.53
31	4637	518	24	10	2.980	869.16	41418.58	3849	3349	95641	14	9.37
32	4613	508	24	10	3.030	863.46	47462.74	3829	3378	119231	14	10.60
33	4589	498	24	10	3.030	857.77	53467.11	3763	3311	142486	14	12.07
34	4565	488	24	10	3.030	852.07	59431.62	3698	3328	165784	14	13.66
35	4541	478	24	10	3.030	846.98	65837.92	3678	3318	188874	14	15.12
36	4517	468	24	10	3.030	795.51	70886.58	3614	3253	211645	14	16.68
37	4493	458	24	10	3.030	790.12	76137.36	3549	3194	234883	14	18.22
38	4469	449	24	9	3.030	784.73	81638.58	3531	3178	256249	14	19.77
*39	4445	445	24	9	3.030	779.58	87647.82	3467	3846	277851	14	21.33
*40	4421	442	24	9	3.120	775.87	92512.47	3484	3838	299861	14	23.88
*41	4397	440	24	9	3.120	770.79	97987.97	3342	2941	319648	14	24.88
*42	4373	437	24	9	3.120	746.98	103122.26	3288	2886	339858	14	26.78
*43	4349	435	24	9	3.120	740.74	108307.44	3218	2832	359674	14	28.57
*44	4325	433	24	9	3.120	736.74	113464.59	3157	2778	379128	14	30.51
*45	4301	430	24	9	3.120	732.73	118593.71	3097	2694	397978	14	32.51
*46	4278	428	23	9	3.120	728.67	123693.73	3037	2642	416472	14	34.57
*47	4255	426	23	9	3.120	724.72	128766.88	2979	2592	434616	14	36.69
*48	4232	423	23	9	3.120	720.87	133812.92	2962	2577	452655	14	38.81
*49	4209	421	23	8	3.120	716.87	138831.81	2904	2497	470134	14	40.97
*50	4186	419	23	8	3.120	671.35	143938.46	2846	2440	487270	14	42.79
*51	4163	416	23	8	3.120	667.73	148204.53	2789	2371	503867	14	45.09
*52	4140	414	23	8	3.270	663.56	152852.22	2732	2322	520121	14	47.46
*53	4117	412	23	8	3.270	660.33	157474.53	2676	2240	535857	14	49.92
*54	4094	409	23	8	3.270	656.71	162071.46	2620	2281	551264	14	52.46
*55	4071	407	23	8	3.270	652.54	166642.81	2565	2129	566167	14	55.18
*56	4048	405	23	7	3.270	649.31	171187.18	2510	2058	580573	14	57.83
*57	4026	403	22	7	3.270	645.69	175706.97	2456	1989	594496	14	60.65
*58	4004	400	22	7	3.270	622.27	180082.89	2442	1970	608342	14	63.82
*59	3982	398	22	7	3.270	618.76	184394.23	2389	1911	621719	14	65.43
*60	3960	396	22	7	3.270	615.39	188781.96	2336	1869	634082	14	68.46
*61	3938	394	22	6	3.270	612.02	192986.68	2284	1884	647438	14	71.61
*62	3916	392	22	6	3.270	608.65	197246.61	2232	1763	659771	14	74.88
*63	3894	389	22	6	3.270	605.27	201483.52	2181	1701	671678	14	78.27
*64	3872	387	22	6	3.270	601.76	205695.85	2130	1661	683385	14	81.88
*65	3850	385	22	5	3.270	598.39	209884.58	2079	1601	694512	14	85.68
*66	3828	383	22	5	3.270	595.02	214049.78	2029	1562	705446	14	89.32
*67	3806	381	22	5	3.270	591.65	218191.22	1979	1484	715834	14	93.32

* THE TOTAL NUMBER OF MALES IS LESS THAN TEN PERCENT OF THE TOTAL NUMBER OF FEMALES, THEN CERTAIN NUMBER OF MALES HAS TO BE ORDERED

ALL THE VALUES SHOWN ON TABLES ARE GIVEN PER WEEK WITH THE FOLLOWING EXCEPTIONS = FEED AMOUNT PER DAY, EGG PRODUCTION PER DAY, AMOUNT OF HATCHING EGG PER DAY, LIGHT PER DAY

Tables 4, 5, 6. Results of example 2.

Table 4
Results of the simulation for the female population in Example 2.

INITIAL CONDITIONS FOR THE SIMULATION

AGE = 16

NUMBER OF FEMALES = 4500

CUMULATIVE FEED AMOUNT FOR FEMALES = 30230.39

NUMBER OF MALES = 650

CUMULATIVE FEED AMOUNT FOR MALES = 4560.55

** F E M A L E S **

FEMALE BREED = 1 LOCATION OF FARM = 1

NUMBER OF FEMALES ARRIVING TO FARM = 5480 LATITUD WHERE FARM IS = 18

MONTH WHEN FLOCK WAS HATCHED = 10 FEEDING PROGRAM = 1

AVERAGE HOURS OF DAYLIGHT = 12.10

AGE (WK)	AMOUNT BIRDS END OF WK	MORTALITY (AMOUNT)	AVERAGE BODY WEIGHT (KG)	FEED AMOUNT(KG)	CUMULATIVE FEED AMOUNT(KG)	REQUIRED LIGHT(HR)
16	4480	20	1.670	369.60	32313.38	NOL
17	4459	21	1.765	375.32	35447.62	NOL
18	4438	21	1.860	383.47	38131.94	NOL
19	4417	22	1.955	390.54	40369.75	NOL
20	4396	21	2.050	401.95	43679.38	NOL
21	4375	21	2.140	408.83	46541.17	NOL
22	4354	22	2.235	419.63	49490.55	13
23	4332	22	2.325	426.69	52437.39	13
24	4310	22	2.420	433.20	55469.79	13

Table 5

Results of the Simulation for the male population in Example 2.

** M A L E S **

MALE BREED = 1

NUMBER OF MALES ARRIVING TO FARM = 659

FEEDING PROGRAM = 1

AGE (WK)	AMOUNT BIRDS END OF WK	MORTALITY (AMOUNT)	AVERAGE BODY WEIGHT (KG)	FEED AMOUNT(KG)	CUMULATIVE FEED AMOUNT(KG)	REQUIRED LIGHT(HR)
16	641	9	2.122	56.88	4958.68	NDL
17	632	9	2.240	57.37	5360.26	NDL
18	622	10	2.359	58.78	5771.69	NDL
19	612	10	2.477	59.09	6185.32	NDL
20	602	10	2.594	59.67	6603.01	NDL
21	592	10	2.712	60.20	7024.41	NDL
22	582	10	2.873	60.38	7447.10	13
23	572	10	2.993	60.82	7872.63	13
24	562	10	3.113	61.20	8301.26	13

* THE TOTAL NUMBER OF MALES IS LESS THAN TEN PERCENT OF THE TOTAL NUMBER OF FEMALES, THEN CERTAIN NUMBER OF MALES HAS TO BE ORDERED

Table 6
Results of the Simulation for the flock in Example 2.

FEEDING PROGRAM = 1

AGE (WK)	AMOUNT FEMALE	AMOUNT MALE	MORTALITY FEM	MORTALITY MAL	AVERAGE BODY WEIGHT (KG)	FEED PER DAY (KG)	CUMULATIVE FEED (KG)	PRODUCTION EGGS/DAY	HATCHING EGGS/DAY	CUMULATIVE HATCHING EGG	LIGHT/ DAY(HR)	CUMULATIVE FEED/DOZ-EGG
25	4288	552	22	10	2.520	684.52	4791.61	214	0	0	13	38.38
26	4266	542	22	10	2.620	723.58	9856.67	853	643	4480	13	15.34
27	4244	532	22	10	2.730	762.07	15191.15	1613	1258	13286	13	10.56
28	4222	522	22	10	2.790	799.98	20791.01	2322	1904	26614	13	9.06
29	4200	512	22	10	2.860	794.62	26353.35	3024	2570	44604	13	8.45
30	4178	502	22	10	2.920	789.26	31878.17	3342	2874	64722	14	8.58
31	4156	492	22	10	2.980	783.90	37365.47	3449	3051	85729	14	9.43
32	4134	482	22	10	3.030	778.54	42815.25	3431	3019	106662	14	10.67
33	4112	472	22	10	3.030	773.18	48227.51	3372	2967	127631	14	12.15
34	4090	462	22	10	3.030	767.82	53602.25	3313	2982	148509	14	13.75
35	4068	453	22	9	3.030	721.49	58652.69	3295	2966	169267	14	15.22
36	4046	444	22	9	3.030	716.58	63668.74	3237	2913	189959	14	16.71
37	4024	435	22	9	3.030	711.67	68650.40	3179	2861	209685	14	18.34
38	4003	426	21	9	3.030	706.75	73597.66	3162	2846	229607	14	19.90
39	3982	417	21	9	3.030	702.00	78511.63	3106	2764	248955	14	21.47
40	3961	408	21	9	3.120	697.24	83392.32	3050	2715	267960	14	23.22
41	3940	400	21	8	3.120	692.49	88239.73	2994	2635	286405	14	25.03
42	3919	392	21	8	3.120	668.36	92918.25	2939	2586	304907	14	26.85
*43	3898	390	21	8	3.120	663.69	97565.51	2885	2539	322280	14	28.72
*44	3877	388	21	8	3.120	660.35	102137.97	2838	2498	339710	14	30.65
*45	3856	386	21	8	3.120	656.81	106705.64	2776	2415	356615	14	32.65
*46	3835	384	21	8	3.120	653.27	111358.52	2723	2369	373198	14	34.72
*47	3814	381	21	8	3.120	649.73	115906.60	2670	2323	389459	14	36.84
*48	3793	379	21	8	3.120	646.03	120428.81	2655	2310	405629	14	38.77
*49	3772	377	21	8	3.120	642.49	124926.22	2603	2239	421302	14	40.73
*50	3751	375	21	7	3.120	601.61	129137.46	2551	2194	436660	14	42.95
*51	3730	373	21	7	3.120	598.27	133325.35	2499	2124	451528	14	45.26
*52	3709	371	21	7	3.270	594.94	137489.89	2448	2081	466095	14	47.64
*53	3689	369	20	7	3.270	591.60	141631.09	2398	2014	480193	14	50.10
*54	3669	367	20	7	3.270	588.41	145749.96	2348	1972	493997	14	52.65
*55	3649	365	20	7	3.270	585.22	149846.50	2299	1908	507353	14	55.28
*56	3629	363	20	7	3.270	582.03	153920.71	2250	1845	520268	14	58.00
*57	3609	361	20	6	3.270	578.84	157972.59	2201	1783	532749	14	60.84
*58	3589	359	20	6	3.270	557.79	161877.09	2189	1773	545160	14	63.21
*59	3569	357	20	6	3.270	554.69	165759.95	2141	1713	557151	14	65.63
*60	3549	355	20	6	3.270	551.60	169621.17	2094	1675	568876	14	68.26
*61	3529	353	20	6	3.270	548.51	173460.75	2047	1637	580495	14	71.01
*62	3509	351	20	5	3.270	545.42	177278.70	2000	1560	591253	14	75.09
*63	3489	349	20	5	3.270	542.33	181075.01	1954	1524	601923	14	78.51
*64	3469	347	20	5	3.270	539.24	184849.68	1908	1488	612339	14	82.05
*65	3450	345	19	5	3.270	536.15	188602.72	1863	1435	622384	14	85.74
*66	3431	343	19	5	3.270	533.20	192335.10	1818	1400	632184	14	89.57
*67	3412	341	19	4	3.270	530.25	196046.83	1774	1331	641501	14	93.56

* THE TOTAL NUMBER OF MALES IS LESS THAN TEN PERCENT OF THE TOTAL NUMBER OF FEMALES, THEN CERTAIN NUMBER OF MALES HAS TO BE ORDERED

ALL THE VALUES SHOWN ON TABLES ARE GIVEN PER WEEK WITH THE FOLLOWING EXCEPTIONS = FEED AMOUNT PER DAY, EGG PRODUCTION PER DAY, AMOUNT OF HATCHING EGG PER DAY, LIGHT PER DAY

Table 7. Results of example 3.

Table 7
Results of the Simulation for the flock in Example 3.

INITIAL CONDITIONS FOR THE SIMULATION

AGE = 36

NUMBER OF FEMALES = 3490

NUMBER OF MALES = 490

CUMULATIVE FEED AMOUNT IN PRODUCTION = 68837.50

CUMULATIVE HATCHING EGGS = 150225

AVERAGE NUMBER OF BIRDS IN FLOCK = 3980

AVERAGE AMOUNT OF EGGS PRODUCED PER DAY = 2020

** F L O C K **

FEEDING PROGRAM = 1

AGE (WK)	AMOUNT FEMALE	AMOUNT MALE	MORTALITY FEM	MORTALITY MAL	AVERAGE BODY WEIGHT (KG)	FEED PER DAY (KG)	CUMULATIVE FEED (KG)	PRODUCTION EGGS/DAY	HATCHING EGGS/DAY	CUMULATIVE HATCHING EGG	LIGHT/ DAY(HR)	CUMULATIVE FEED/DOZ-EGG
36	3471	483	19	10	3.030	630.93	72453.31	2777	2499	167718	14	25.89
37	3453	473	18	10	3.030	626.23	76836.94	2728	2455	184903	14	23.93
38	3435	463	18	10	3.030	621.98	81189.51	2714	2443	202604	14	25.58
39	3417	453	18	10	3.030	617.26	85511.02	2665	2372	218608	14	27.25
40	3399	443	18	9	3.120	612.52	89831.45	2617	2329	234911	14	29.15
41	3381	432	18	9	3.120	608.64	94061.93	2570	2262	250745	14	31.09
42	3363	423	18	9	3.120	587.20	98172.35	2522	2219	266278	14	33.05
43	3345	414	18	9	3.120	583.04	102253.65	2475	2178	281524	14	35.68
44	3327	405	18	9	3.120	579.89	106305.86	2429	2138	296490	14	37.16
45	3309	397	18	8	3.120	574.73	110328.95	2382	2072	310594	14	39.31
46	3291	389	18	8	3.120	570.72	114324.82	2337	2033	325225	14	41.53
47	3273	381	18	8	3.120	566.72	118291.66	2291	1993	339176	14	43.82
48	3255	373	18	8	3.120	562.72	122238.67	2279	1983	353057	14	45.85
49	3237	366	18	7	3.120	558.71	126141.06	2234	1921	366504	14	47.92
50	3219	359	18	7	3.120	522.44	129798.10	2189	1883	379685	14	50.31
51	3201	352	18	7	3.120	518.31	133429.77	2145	1823	392446	14	52.78
52	3183	345	18	7	3.270	515.19	137036.07	2101	1786	404542	14	55.33
53	3165	338	18	7	3.270	511.56	140616.99	2057	1728	417044	14	57.97
54	3148	332	17	6	3.270	507.94	144172.53	2015	1693	429895	14	60.70
55	3131	326	17	6	3.270	504.68	147704.73	1973	1638	440361	14	63.49
56	3114	320	17	6	3.270	501.27	151213.59	1931	1583	451442	14	66.40
57	3097	314	17	6	3.270	497.93	154699.10	1889	1530	462152	14	69.42
58	3080	309	17	5	3.270	479.25	158153.81	1879	1522	472806	14	71.91
*59	3063	306	17	5	3.270	476.15	161386.90	1838	1470	483096	14	74.43
*60	3046	305	17	5	3.270	473.34	164700.31	1797	1438	493162	14	77.67
*61	3029	303	17	5	3.270	470.82	167956.02	1757	1388	502878	14	81.03
*62	3012	301	17	5	3.270	468.15	171273.84	1717	1356	512370	14	84.52
*63	2995	300	17	5	3.270	465.48	174531.37	1677	1308	521526	14	88.15
*64	2978	298	17	4	3.270	462.95	177772.81	1638	1278	530472	14	91.93
*65	2961	296	17	4	3.270	460.20	180993.95	1599	1231	539089	14	95.85
*66	2944	294	17	4	3.270	457.61	184197.21	1560	1281	547496	14	99.96
*67	2927	293	17	4	3.270	454.54	187381.78	1522	1142	555490	14	104.23

* THE TOTAL NUMBER OF MALES IS LESS THAN TEN PERCENT OF THE TOTAL NUMBER OF FEMALES, THEN CERTAIN NUMBER OF MALES HAS TO BE ORDERED

ALL THE VALUES SHOWN ON TABLES ARE GIVEN PER WEEK WITH THE FOLLOWING EXCEPTIONS = FEED AMOUNT PER DAY, EGG PRODUCTION PER DAY, AMOUNT OF HATCHING EGG PER DAY, LIGHT PER DAY

CONCLUSIONS AND RECOMMENDATIONS

Based on the results obtained from the application of the simulation program it can be concluded that:

1) It is possible to consider a Broiler Breeder Farm as a system. Such a view makes it easier to visualize the existing relationships between the different elements of the farm and allows us to identify the most significant variables in its performance.

2) The objective of the thesis was achieved since the simulation program can be used as a control device providing answers to key questions regarding the performance of the farm, such as:

- during the growing period
  - On how many hours of light should the birds be raised?
  - What is the proper body weight that the birds should achieve?
  - How should mortality affect the flocks during the production period?
  - When should the flock reach peak production?
  - How many hours of light should the flock be provided during the production period?
  - How should mortality affect the flock?
  - What should the proper feed conversion be?
  - How should the overall performance (egg production and hatching egg production) be?
  - How much feed should be consumed per dozen eggs?

3) The simulation program has been developed using modular units such as subroutines and functions. This gives flexibility to the simulation since each module can be modified and tested separately.

4) The simulation program is, at the same time, a model of the system and therefore it allows management to see how different operational policies could affect the real system by applying them on the model, in that way the real system is not disturbed.

5) Even though the simulation program was developed based on some information collected from Valencia, Venezuela, only a few changes regarding the mortality rate among the flock and some operational policies are necessary to generalize the use of the simulation program to any breed and to any farm.

Future refinement of this management tool for more effective use should include the following.

1) A check should be made of the assumption under which the simulation program was developed in order to have reliable results. This assumption was that good poultry husbandry is being practiced in the farm.

2) A more detailed statistical analysis of the existing mortality among the flock should be conducted. For such a purpose, the collection of more data becomes essential.

3) An improvement of the present simulation program takes into account the different variables involved in the simulation. For such a purpose, a statistical study of each one of these variables is necessary, as well as the creation of a feedback in the simulation which will allow output information to be fed

back in the form of input to the simulation for consideration. The new input could bring about changes in the program or in future output.

4) A creation of files containing all the necessary data for the simulation. The use of data files will allow the manager to share them among different programs. The means used to store all data by the present simulation program are subroutines due to the fact that only one breed was used in the simulation which implies a small amount of data.

The simulation presented in this thesis represents a step forward in the development of management tools whose ease of use and flexibility make their applications feasible under a wide variety of circumstances. The simulation will allow the Broiler Breeder Farm Management in Venezuela to make decisions based on reliable information regarding the performance of the farm.

GLOSSARY OF SIMULATION PARAMETERS AND VARIABLES

Term	Definition	Reference
AFAF	recommended average feed amount (Kg) per 100 females/day during the growing period	p. 29
AFAFS	all possible values of AFAF for a selected breed	p. 25
AFAFP	recommended average feed amount (Kg) per 100 birds/day during the production period	p. 31
AFAFPS	all possible values of AFAFP for a selected breed	p. 25
AFAM	recommended average feed amount (Kg) per 100 males/day during the growing period	p. 31
AFAMS	all possible values of AFAM for a selected breed	p. 25
AFBW	recommended average female body weight (Kg)/ week during the growing period	p. 29
AFBWS	all possible values of AFBW for a selected breed	p. 25
AFBWP	recommended average flock body weight (Kg)/ week during the production period	p. 31
AFBWPS	all possible values of AFBWP for a selected breed	p. 25
AGE	Age of the flock (week)	p. 33
AHDL	average hours of daylight (length of day) for a specific lighting program	p. 28
AMBW	recommended average male body weight (Kg)/ week during the growing period	p. 29
AMBWS	all possible values of AMBW for a selected breed	p. 25
AMEGGD	average number of egg production/day	p. 32
AMHAEG	average number of hatching egg production/day	p. 32
ANFEM	total number of females at the end of each week	p. 29

Term	Definition	Reference
ANFLO	total number of birds (males and females) at the end of each week during the production period	p. 31
ANMAL	total number of males at the end of each week	p. 30
APFMOR	average percentage of female mortality/week	p. 27
APMMOR	average percentage of male mortality/week	p. 27
AREPR	recommended average rate of egg production per female/day	p. 32
AREPRS	all possible values of AREPR for a selected breed	p. 26
ARHEG	recommended average rate of hatching egg production/day	p. 32
ARHEGS	all possible values of ARHEG for a selected breed	p. 26
CFEAMF	cumulative amount of feed consumed by females (Kg)/week during the growing period	p. 30
CFEAMM	cumulative amount of feed consumed by males (Kg)/ week during the growing period	p. 31
CFEAMP	cumulative amount of feed consumed by the flock (males and females) (Kg)/week during the production period	p. 32
CHATEG	cumulative number of hatching eggs produced/week	p. 32
DAGE	age at which the simulation should start	p. 33
FARR	number of females arriving at the farm	p. 25
FBREED	female breed	p. 23
FEEPRF	female feeding program	p. 24
FEEPRM	male feeding program	p. 24
FEMOR	number of dead females/week	p. 29
FEPDEG	cumulative amount of feed consumed by the flock in production/dozen eggs produced per week	p. 33
LATFA	latitude where farm is located	p. 24

Term	Definition	Reference
LOCFA	location of the farm (north or south of the equator	p. 23
MAMOR	number of dead males/week	p. 30
MARR	number of males arriving at the farm	p. 25
MBREED	male breed	p. 23
MH	indicator of the season when flock was hatched	p. 24
MOFLHA	month when flock was hatched	p. 23
NDL	indicator of the use of natural day	p. 28
TAFAF	total amount of feed consumed by females (Kg)/day during the growing period	p. 29
TAFAFP	total amount of feed consumed by flock (Kg)/ day during the production period	p. 31
TAFAM	total amount of feed consumed by males (Kg)/ day during the growing period	p. 30
THRLD	total hours of required light/day (natural and artificial)	p. 28

GLOSSARY OF TERMS

Breed: 1) To produce offspring by hatching or gestation; to bear and nourish young. 2) A group of domestic animals which have similar characteristics.

Broiler: A young chicken that is raised for its meat.

Brood: To sit on or incubate eggs in order to hatch them; to cover or care for young.

Cockerel: A young rooster.

Hatch: To produce young from eggs by incubation.

Hatchability: Ability to hatch; the likelihood that an egg will hatch successfully; the proportion of eggs which can be expected to hatch successfully.

Incubate: To sit upon eggs in order to hatch them; to maintain eggs under conditions favorable for hatching or development.

Poultry: Birds that are raised for their meat and eggs.

Pullet: A young hen.

Simulation: A process of step-by-step solution. The instructions used to calculate the next time step are called a simulation model.

Ovum: An unfertilized female sex cell, a single large immobile cell, the nucleus of which contains half the number of chromosomes of a normal body cell.

Embryo: The fertilized ovum; a cell formed by the union of male and female chromosomes.

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APPENDICES

APPENDIX 1

NUTRIENT RECOMMENDATIONS FOR SELECTED BREEDS

	CHICK STARTER		BREEDER DEVELOPER		BREEDER	
Crude Protein, %	18.0-20.0		14.5-15.5		15.5-17.0	
Calories, Metabolizable						
per lb.	1200-1325		1200-1300		1225-1350	
per kg.	2640-2915		2640-2860		2695-2970	
Fat, %	3.0-4.0		3.0-4.0		3.0-4.0	
Linoleic Acid, %	1.0-1.5		1.0-1.5		1.0-1.5	
Minerals						
Calcium, %, min.-max.	0.90-1.1		0.85-1.2		2.75-3.25	
Phosphorus, %, min.-max.						
available	0.45-0.50		0.38-0.50		0.50-0.55	
total	0.55-0.70		0.50-0.70		0.65-0.75	
Soduim, %, min.-max.	0.18-0.22		0.18-0.25		0.16-0.25	
Salt, %, min.-max.	0.30-0.45		0.30-0.50		0.30-0.60	
Trace Minerals (To be Added)	Mg./lb.	Mg./kg.	Mg./lb.	Mg./kg.	Mg./lb.	Mg./kg.
Manganese	25	55	25	55	27.3	60
Zinc	20	44	20	44	25	55
Iron	10	22	10	22	10	22
Iodine	0.2	0.44	0.2	0.44	0.23	0.5
Copper	2	4.4	2	4.4	2.25	5
Selenium	0.045	0.099	0.045	0.099	0.045	0.099
Vitamins (To be Added)	per/lb.	per/kg.	per/lb.	per/kg.	per/lb.	per/kg.
Vitamin A (I.U.)	3000	6600	3000	6600	4000	8800
Vitamin D_3 (I.U.)	1250	2750	1250	2750	1250	2750
Vitamin E (I.U.)	5.0	11.0	5.0	11.0	7.0	15.4
Vitamin K_3 (mg.)	1.0	2.2	1.0	2.2	0.5	1.1
Thiamine (mg.)	0.5	1.1	0.5	1.1	0.5	1.1
Riboflavin (mg.)	2.5	5.5	2.5	5.5	4.5	9.9
d-Pantothenic Acid (mg.)	5.0	11.0	5.0	11.0	6.0	13.2
Niacin (Mg.)	12	26.4	12	26.4	10.0	22.0
Pyridoxine (mg.)	0.5	1.1	0.5	1.1	3.0	6.6
Biotin (mg.)	0.05	0.11	0.04	0.088	.05	0.11
Choline (mg.)	300	660	300	660	300	600
Vitamin B_{12} (mg.)	0.005	0.011	0.005	0.011	0.005	0.011
Folic Acid (mg.)	0.2	0.44	0.2	0.44	0.3	0.66
Antioxidant						
Ethoxyquin (mg.) or equivalent	55	120	55	120	55	120
Amino Acids, % – Minimum**	CHICK STARTER		BREEDER DEVELOPER		BREEDER	
Arginine	0.95-1.20		0.90-1.0		0.95-1.00	
Lysine	0.90-1.00		0.60-0.65		0.70-0.80	
Methionine	0.36-0.40		0.30-0.33		0.31-0.33	
Methionine + Cystine	0.68-0.75		0.50-0.58		0.55-0.60	
Tryptophan	0.19-0.21		0.17-0.19		0.17-0.19	
Threonine	0.75-0.85		0.60-0.70		0.65-0.70	
Isoleucine	0.75-0.85		0.60-0.70		0.65-0.70	

* The nutrient information supplied in this table, while not representing the total nutrient requirement of the breeder, includes nutrients for which requirement data are established and which should be included in setting up nutrient parameters for formulating high performing breeder feeds.

** The amino acids are those most likely to be of concern in practical diets. Amino acid minimum requirements are expressed as a percentage of the diet assuming energy levels in the 1200-1350 calorie/lb. range. For each amino acid the lower minimum value relates to the lower energy level range.

1) Nutrient Recommendations for Arbor Acres Broiler Breeders. Source: Broiler Breeder Female. Feeding and Management. 1981.
Arbor Acres Farm, Inc.
Technical Service Department
Glastonbury, Connecticut USA

	Starter Diet[1]	Grower Diet[1]	Breeder Diet
Age in Weeks	0-3	4-22	23-70
Protein %	17-19	14-15.5	15-17
Calories/pounds (M.E.)	1,275-1,325	1,275-1,325	1,275-1,350
Calories/kilograms (M.E.)	2,805-2,915	2,805-2,915	2,805-2,970
Fat %	3-4	3-4	3-4
Fiber %	3-4	3-4	3-4
Linoleic Acid %	.50	.50	1.00
Amino Acids			
Arginine %	1.15	.84	.80
Glycine and/or Serine %	1.00	.70	.00
Histidine %	.40	.28	.22
Isoleucine %	.75	.53	.60
Leucine %	1.40	.97	1.20
Lysine %	.95	.67	.75
Methionine %	.40	.25	.32
Methionine-Cystine %	.75	.50	.60
Phenylalanine %	.70	.49	.50
Phenylalanine-Tyrosine %	1.30	.92	.87
Threonine %	.70	.49	.40
Tryptophan %	.20	.14	.14
Valine %	.80	.60	.60
Minerals			
Calcium %	.85	.85	.85-3.00[2]
Phosphorus			
Total %	.68	.65	.60
Available %	.44	.40	.40
Sodium %	.19	.19	.17

	Starter Diet[1]	Grower Diet[1]	Breeder Diet
Age in Weeks	0-3	4-22	23-70
Trace Minerals (Minimum Supplemental Levels)[3]			
Manganese gram/ton[4]	50	50	50
Zinc gram/ton	50	50	50
Iron gram/ton	40	40	40
Copper gram/ton	4.00	4.00	4.00
Iodine gram/ton	.80	.80	.80
Selenium gram/ton	.09	.09	.09
Vitamins (Minimum Supplemental Levels)			
Vitamin A IU[5] ton	6,000,000	6,000,000	6,000,000
Vitamin D_3 IU ton	2,000,000	1,500,000	2,000,000
Vitamin E IU/ton	6,000	6,000	10,000
Vitamin K gram/ton	2.00	2.00	2.00
Pyridoxine gram/ton	.00	.00	.50
Riboflavin gram/ton	4.00	4.00	4.00
Pantothenic Acid gram/ton	6.00	6.00	6.00
Niacin gram/ton	20	20	20
Choline gram ton	250	250	250
Folic Acid gram/ton	.25	.25	.50
B_{12} milligram/ton	8.00	8.00	10.00
Biotin gram/ton	.00	.00	.50

2) Cobb Broiler Breeder Nutrient Level Guide.
Source: Cobb Breeder Management Guide, 1981.
Cobb Incorporated.
Concord, Massachusetts 01742.

Nutrients	Chick Starter (0-5 wk)		Grower/ Developer (5-22 wk)	Breeder (after 22 wk)		
				Moderate Climate		Warm Climate
	A	B	C	D	E	F
a) Basic Specifications:						
Crude Protein %	19-20	18	16	16.7	16	17.4
Met. Energy kcal/kg	2970	2860	2805	2860	2750	2750
Met. Energy kcal/lb	1350	1300	1275	1300	1250	1250
Calcium %	0.90	0.85	1.10	2.90	2.80	3.10
Available Phosphorus %	0.45	0.43	0.55	0.47	0.45	0.49
Crude Fat %	3-4	3-4	3-4	3-4	3-4	3-4
Crude Fiber %	2.5-3	2.5-3	3-5	3-5	3-5	3-5
Linoleic Acid %	1.4	1.4	1.3	1.3	1.3	1.4
b) Amino Acids: (as % of diet)						
Lysine	1.05	0.95	0.77	0.80	0.77	0.83
Methionine	0.42	0.38	0.33	0.34	0.32	0.35
Cystine	0.34	0.31	0.26	0.27	0.26	0.28
Methionine and Cystine	0.76	0.69	0.59	0.61	0.58	0.63
Tryptophan	0.21	0.19	0.17	0.18	0.17	0.19
Arginine	1.10	0.99	0.88	0.84	0.80	0.89
Leucine	1.40	1.26	1.12	1.25	1.20	1.31
Isoleucine	0.80	0.72	0.64	0.84	0.80	0.89
Phenylalanine	0.70	0.63	0.56	0.77	0.74	0.80
Phenylalanine and Tyrosine	1.40	1.26	1.12	1.10	1.06	1.15
Threonine	0.70	0.63	0.56	0.62	0.59	0.64
Valine	0.86	0.77	0.69	0.72	0.69	0.75
Histidine	0.40	0.36	0.32	0.33	0.32	0.35
c) Minerals: (for trace elements, please refer to the premix specifications)						
Sodium %	0.15	0.15	0.15	0.12	0.12	0.13
Chloride %	0.15	0.15	0.15	0.14	0.14	0.15
Salt (% added) %	0.20-0.25	0.20-0.25	0.20-0.25	0.20-0.25	0.20-0.25	0.20-0.25
Potassium %	0.40	0.39	0.38	0.39	0.37	0.37
Magnesium ppm	535	515	505	515	495	495

3) Suggested Ration Specifications for Shaver Starbro Broiler Breeders.
Source: Shaver Starbro Parent Management Guide, 1981.
Shaver Poultry Breeding Farms Limited.
P.O. Box 400, Cambridge, Ontario, Canada N1R 5V9

*Diets A and B are suggested for areas where high energy rations are more economical than medium energy diets.

STARTER RATION (0 to 4 weeks)		PULLET DEVELOPER (4 to 22 weeks)		BREEDER RATION (After 22 weeks)	
Protein %	18-20	Protein %	14.5-15.5	Protein %	15.5-16
M.E. Calories/lb	1250-1300	M.E. Calories/lb	1250-1350	M.E. Calories/lb	1275-1350
M.E. Calories/kg	2750-2860	M.E. Calories/kg	2750-2970	M.E. Calories/kg	2805-2970
Fat, %	3-4	Fat, %	3-4	Fat, %	3-4
Fiber, %	3.5-5.0	Fiber, %	4.6	Fiber, %	3-5
Calcium, %	0.9	Calcium, %	0.9	Calcium, %	3.2
Phosphorous, % av	0.5	Phosphorous, % av	0.5	Phosphorous, % av	0.45
Salt, %	0.5	Salt, %	0.5	Salt, %	0.5
Copper, mg/lb	2.5	Copper, mg/lb	2.5	Copper, mg/lb	3
Iodine, mg/lb	0.3	Iodine, mg/lb	0.2	Iodine, mg/lb	0.2
Iron, mg/lb	42	Iron, mg/lb	25	Iron, mg/lb	10
Manganese, mg/lb	32	Manganese, mg/lb	30	Manganese, mg/lb	40
Selenium, mg/lb	0.06	Selenium, mg/lb	0.06	Selenium, mg/lb	0.06
Zinc, mg/lb	25	Zinc, mg/lb	20	Zinc, mg/lb	30
Vitamin A, I.U./lb.	5000	Vitamin A, I.U./lb.	5000	Vitamin A, I.U./lb.	4000
Vitamin D3, I.C.U./lb	1000	Vitamin D3, I.C.U./lb	1000	Vitamin D3, I.C.U./lb	800
Vitamin E, I.U./lb.	10	Vitamin E, I.U./lb.	5	Vitamin E, I.U./lb.	8
Vitamin K, mg/lb	1	Vitamin K, mg/lb	1	Vitamin K, mg/lb	1
Biotin, mg/lb	0.06	Biotin, mg/lb	0.05	Biotin, mg/lb	0.1
Choline, mg/lb	250	Choline, mg/lb	2000	Choline, mg/lb	250
Folacin, mg/lb	0.5	Folacin, mg/lb	0.4	Folacin, mg/lb	0.4
Niacin, mg/lb	15	Niacin, mg/lb	15	Niacin, mg/lb	20
Pantothenic, mg/lb	5	Pantothenic, mg/lb	3	Pantothenic, mg/lb	4
Pyridoxine, mg/lb	1	Pyridoxine, mg/lb	1	Pyridoxine, mg/lb	1
Riboflavin, mg/lb	2.5	Riboflavin, mg/lb	2	Riboflavin, mg/lb	3
Thiamine, mg/lb	0.5	Thiamine, mg/lb	0.5	Thiamine, mg/lb	0.5
Vitamin B12, mg/lb	0.009	Vitamin B12, mg/lb	0.004	Vitamin B12, mg/lb	0.006
Antioxidant, mg/lb	56.8	Antioxidant, mg/lb	56.8	Antioxidant, mg/lb	56.8
Lysine, %	0.95	Lysine, %	0.5	Lysine, %	0.75
Methionine & Cystine, %	0.75	Methionine & Cystine, %	0.5	Methionine & Cystine, %	0.6
Linoleic Acid, %	1.4	Linoleic Acid, %	1.5	Linoleic Acid, %	1.5

It is difficult to prepare a nutritional guideline which will economically meet all of the nutrient requirements of breeders under many different management systems and environments. These nutrient level recommendations are intended as a general guideline. We suggest that you consult your state university or nutritionist for specific feed formulas which will be best suited to your climate and management system.

4) Recommended Nutrient Levels for Pilch Breeder Pullets.
Source: Managing Pilch Breeders - Broilers, 1981.
Pilch, Inc.
P.O. Box 4381 Amity Hill Road
Troutman, North Carolina 28166.

	STARTER RATION (0 to 2 Weeks)	PULLET DEVELOPER (2 to 22 Weeks)	BREEDER RATION (After 22 Weeks)
Protein, %	17	15-16	15.5-16
M.E. Calories/lb.	1250-1300	1275-1325	1275-1325
/kg.	2750-2860	2800-2915	2800-2915
Fat, %	3-4	3-4	3-4
Fiber, %	3.5-4	4-5	3-4
Linoleic Acid, %	1.4	1.5	1.5
AMINO ACIDS – %			
Arginine	1.05	0.88	0.96
Lysine	0.80	0.62	0.70
Histidine	0.35	0.32	0.32
Methionine	0.30	0.27	0.31
Methionine & Cystine	0.57	0.50	0.55
Tryptophan	0.20	0.17	0.17
Glycine	0.80	0.70	0.75
Leucine	1.20	1.05	1.16
Isoleucine	0.75	0.66	0.70
Phenylalanine	0.62	0.52	0.55
Phenylalanine & Tyrosine	1.30	1.05	1.10
Threonine	0.60	0.50	0.50
Valine	0.75	0.65	0.70

	STARTER & DEVELOPER		BREEDER	
MINERALS (Inorganic Elements)	Added Levels to Corn-Soy Ration	Approximate Total	Added Levels to Corn-Soy Ration	Approximate Total
Calcium, %	Var.	0.8 max.	Var.	2.8-3.0
Phosphorus, Available %	Var.	0.45-0.50	Var.	0.45-0.55
Salt, %	0.25	0.30-0.35	0.25	0.30-0.35
Sodium, %	–	0.20	–	0.20
Chloride, %	–	0.24	–	0.24
Potassium, %	–	0.6	–	0.6
Magnesium, mg/lb	–	250 (550)	–	250 (550)
Manganese, mg/lb	30 (66)	35 (77)	30 (66)	40 (88)
Zinc, mg/lb	23 (50)	36 (80)	23 (50)	36 (80)
Iron, mg/lb.	18 (40)	30 (66)	8 (18)	20 (44)
Copper, mg/lb.	2 (4)	5 (11)	2 (4)	5 (11)
Iodine, mg/lb	0.5 (1.1)	0.5 (1.1)	0.5 (1.1)	0.5 (1.1)
Molybdenum, mg/lb.	Var.	0.1 (0.2)	Var.	0.1 (0.2)
Selenium, mg/lb	0.045 (0.1)	0.07 (0.15)	0.045 (0.1)	0.07 (0.15)
VITAMINS				
Vitamin A, I.U./lb	5000 [11,000]	6800 [15,000]	5000 [11,000]	6800 [15,000]
Vitamin D_3, I.C.U./lb.	1000 [2,200]	1000 [2,200]	1500 [3,300]	1500 [3,300]
Vitamin E, I.U./lb	5 [11]	14 [31]	5 [11]	14 [31]
Vitamin K_3 (menadione), mg/lb.	0.33 (0.73)	0.33 (0.73)	0.33 (0.73)	0.33 (0.73)
Thiamine (B_1), mg/lb	1.0 (2.2)	1.5 (3.3)	1.0 (2.2)	1.5 (3.3)
Riboflavin (B_2), mg/lb	2.5 (5.5)	3.5 (7.7)	3.5 (7.7)	4.5 (9.9)
Pantothenic Acid, mg/lb	5.0 (11.0)	8.0 (17.6)	6.0 (13)	10.0 (22)
Niacin, mg/lb	12 (26)	24 (53)	12 (26)	24 (53)
Pyridoxine (B_6), mg/lb.	1.0 (2.2)	2.5 (5.5)	1.0 (2.2)	2.5 (5.5)
Choline, mg/lb	175 (385)	600 (1320)	175 (385)	600 (1320)
Folacin, mg/lb	0.25 (0.55)	0.60 (1.3)	0.25 (0.55)	0.60 (1.3)
Biotin, mcg/lb.	25 (55)	90 (200)	50 (110)	115 (250)
Vitamin B_{12}, mcg/lb	5 (11)	6 (13)	5 (11)	7 (15)
Antioxidant, Ethoxyquin or BHT, mg/lb.	55 (120)	55 (120)	55 (120)	55 (120)

[ ] = units/kg. ( ) = mg/kg or ppm % = ppm ÷ 10,000 ppm = % x 10,000
Var. = Add variable levels depending on ration ingredients.

5) Recommended Nutrient Levels for the Hubbard Breeder Pullet.
Source: Management Guide for the Hubbard Breeder Pullet, 1981-1982.
Hubbard Farms.
Research and Development.
Walpole, New Hampshire.

APPENDIX 2

FEEDING PROGRAMS

GROWING AND LAYING PROGRAMS

AVERAGE WEEKLY BODY WEIGHT

FOR FLOCKS HATCHED OCTOBER THRU MARCH (NORTH OF EQUATOR) FOR FLOCKS HATCHED APRIL THRU SEPTEMBER (SOUTH OF EQUATOR)							
AGE OF FLOCK		AVERAGE FLOCK BODY WEIGHT		APPROXIMATE FEED AMOUNT PER 100 BIRDS ON LIMITED EVERY DAY FEEDING PROGRAM			
				LBS.	KG.	CUMULATIVE	
WEEK	DAYS	LBS.	KG.			LBS.	KG.
1st	1–7	Min.	Min.		F U L L	F E E D	
2nd	8–14				F U L L	F E E D	
3rd	15–21	1.0–1.05	.453–.476	8.0	3.6	112.0	50.8
4th	22–28	1.2–1.26	.544–.571	10.5	4.8	185.5	84.1
5th	29–35	1.4–1.47	.635–.666	12.0	5.4	269.5	122.2
6th	36–42	1.6–1.68	.726–.762	13.0	5.9	360.5	163.5
7th	43–49	1.8–1.89	.816–.857	13.5	6.1	455.0	206.4
8th	50–56	2.0–2.10	.907–.952	14.0	6.4	553.0	250.8
9th	57–63	2.2–2.31	.998–1.05	14.5	6.6	654.5	296.9
10th	64–70	2.4–2.52	1.09–1.14	15.0	6.8	759.5	344.5
11th	71–77	2.6–2.73	1.18–1.24	15.5	7.0	868.0	393.7
12th	78–84	2.8–2.94	1.27–1.33	16.0	7.3	980.0	444.5
13th	85–91	3.0–3.15	1.36–1.43	16.5	7.5	1095.5	496.9
14th	92–98	3.2–3.36	1.45–1.52	17.0	7.7	1214.5	550.9
15th	99–105	3.4–3.57	1.54–1.62	17.5	7.9	1337.0	606.5
16th	106–112	3.6–3.78	1.63–1.71	18.0	8.2	1463.0	663.6
17th	113–119	3.8–3.99	1.72–1.81	18.5	8.4	1592.5	722.3
18th	120–126	4.0–4.20	1.81–1.91	19.0	8.6	1725.5	782.7
19th	127–133	4.2–4.41	1.91–2.00	19.5	8.8	1862.0	844.6
20th	134–140	4.4–4.62	2.00–2.10	20.0	9.1	2002.0	908.1
21st	141–147	4.6–4.83	2.09–2.19	20.5	9.3	2145.5	973.2
22nd	148–154	4.8–5.04	2.18–2.29	21.0	9.5	2292.5	1039.9
23rd	155–161	5.0–5.25	2.27–2.38	21.5	9.8	2443.0	1108.1
24th	162–168	5.2–5.46	2.36–2.48	22.0	10.0	2597.0	1178.0

*When using the "Skip-A-Day" feeding program, feed the amounts shown per 100 birds under the "Limited Every Day" schedule above during the first five weeks. The "Skip-A-Day" feeding program may begin at the 6th week of age by double feeding the feed amounts shown above under the "Limited Every Day" column.

FOR FLOCKS HATCHED APRIL THRU SEPTEMBER (NORTH OF EQUATOR) FOR FLOCKS HATCHED OCTOBER THRU MARCH (SOUTH OF EQUATOR)							
AGE OF FLOCK		AVERAGE FLOCK BODY WEIGHT		APPROXIMATE FEED AMOUNT PER 100 BIRDS ON LIMITED EVERY DAY FEEDING PROGRAM			
				LBS.	KG.	CUMULATIVE	
WEEK	DAYS	LBS.	KG.			LBS.	KG.
1st	1–7	Min.	Min.		F U L L	F E E D	
2nd	8–14				F U L L	F E E D	
3rd	15–21	1.10–1.16	.498–.526	9.0	4.1	119.0	54.0
4th	22–28	1.33–1.40	.603–.635	11.0	5.0	196.0	88.9
5th	29–35	1.56–1.64	.707–.743	12.5	5.7	283.5	128.6
6th	36–42	1.79–1.88	.811–.852	13.5	6.1	378.0	171.5
7th	43–49	2.02–2.12	.916–.961	14.0	6.4	476.0	215.9
8th	50–56	2.25–2.36	1.02–1.07	15.0	6.8	581.0	263.5
9th	57–63	2.48–2.60	1.12–1.18	15.5	7.0	689.5	312.8
10th	64–70	2.71–2.85	1.23–1.29	16.0	7.3	801.5	363.6
11th	71–77	2.94–3.09	1.33–1.40	16.5	7.5	917.0	415.9
12th	78–84	3.17–3.33	1.44–1.51	17.5	7.9	1039.5	471.5
13th	85–91	3.40–3.57	1.54–1.62	18.0	8.2	1165.5	528.7
14th	92–98	3.63–3.81	1.65–1.73	18.5	8.4	1295.0	587.4
15th	99–105	3.86–4.05	1.75–1.84	19.0	8.6	1428.0	647.7
16th	106–112	4.09–4.29	1.86–1.95	20.0	9.1	1568.0	711.2
17th	113–119	4.32–4.54	1.96–2.06	20.5	9.3	1711.5	776.3
18th	120–126	4.55–4.78	2.06–2.17	21.0	9.5	1858.5	843.0
19th	127–133	4.78–5.02	2.17–2.28	21.5	9.8	2009.0	911.3
20th	134–140	5.01–5.26	2.27–2.39	22.5	10.2	2166.5	982.7
21st	141–147	5.24–5.50	2.38–2.49	23.0	10.4	2327.5	1056.7
22nd	148–154	5.47–5.74	2.48–2.60	23.5	10.7	2492.0	1130.4
23rd	155–161	5.70–5.99	2.59–2.72	24.0	10.9	2660.0	1206.6
24th	162–168	5.93–6.23	2.69–2.83	25.0	11.3	2835.0	1285.9

*When using the "Skip-A-Day" feeding program, feed the amounts shown per 100 birds under the "Limited Every Day" schedule above during the first five weeks. The "Skip-A-Day" feeding program may begin at the 6th week of age by double feeding the feed amounts shown above under the "Limited Every Day" column.

1),2) Limited Every Day/Skip-A-Day Feeding Programs for Arbor Acres Broiler Breeder Female.

Source: Broiler Breeder Female. Feeding and Management. 1981. Arbor Acres Farm, Inc. Technical Service Department. Glastonbury, Connecticut USA

FLOCKS HATCHED OCTOBER THRU MARCH (NORTH OF EQUATOR) FLOCKS HATCHED APRIL THRU SEPTEMBER (SOUTH OF EQUATOR)								
AGE OF FLOCK		AVERAGE FLOCK BODY WEIGHT		APPROXIMATE FEED AMOUNTS PER 100 BIRDS ON SKIP TWO DAYS PER WEEK FEEDING PROGRAM			
				LBS.	KG.	CUMULATIVE	
WEEK	DAYS	LBS.	KG.			LBS.	KG.
1st	1–7						
2nd	8–14						
3rd	15–21	1.0–1.05	.453–.476				
4th	22–28	1.2–1.28	.544–.571				
5th	29–35	1.4–1.47	.635–.666				
6th	36–42	1.5–1.68	.725–.762	18.2	8.25	360.5	163.5
7th	43–49	1.8–1.89	.816–.857	18.9	8.57	455.0	206.4
8th	50–56	2.0–2.10	.907–.952	19.6	8.89	553.0	250.8
9th	57–63	2.2–2.31	.998–1.05	20.3	9.20	654.5	296.9
10th	64–70	2.4–2.52	1.09–1.14	21.0	9.52	759.5	344.5
11th	71–77	2.6–2.73	1.18–1.24	21.7	9.84	868.0	393.7
12th	78–84	2.8–2.94	1.27–1.33	22.4	10.16	980.0	444.5
13th	85–91	3.0–3.15	1.36–1.43	23.1	10.47	1095.5	496.9
14th	92–98	3.2–3.36	1.45–1.52	23.8	10.79	1214.5	550.9
15th	99–105	3.4–3.57	1.54–1.62	24.5	11.11	1337.0	606.5
16th	106–112	3.6–3.78	1.63–1.71	25.2	11.43	1463.0	663.6
17th	113–119	3.8–3.99	1.72–1.81	25.9	11.75	1592.5	722.3
18th	120–126	4.0–4.20	1.81–1.91	26.6	12.06	1725.5	782.7
19th	127–133	4.2–4.41	1.91–2.00	27.3	12.38	1862.0	844.6
20th	134–140	4.4–4.62	2.00–2.10	28.0	12.70	2002.0	908.1
21st	141–147	4.6–4.83	2.09–2.19	28.7	13.02	2145.5	973.2
22nd	148–154	4.8–5.04	2.18–2.29	29.4	13.34	2292.5	1039.9
23rd	155–161	5.0–5.25	2.27–2.38	30.1	13.66	2443.0	1108.1
24th	162–168	5.2–5.46	2.35–2.48	30.8	13.97	2597.0	1178.0

*When using the "Skip Two Days Per Week" feeding program, feed the amounts shown per 100 birds under the "Limited Every Day" schedule for the first five weeks as outlined in programs 1 and 2 on the facing page.

FOR FLOCKS HATCHED APRIL THRU SEPTEMBER (NORTH OF EQUATOR) FOR FLOCKS HATCHED OCTOBER THRU MARCH (SOUTH OF EQUATOR)							
AGE OF FLOCK		AVERAGE FLOCK BODY WEIGHT		APPROXIMATE FEED AMOUNTS PER 100 BIRDS ON SKIP TWO DAYS PER WEEK FEEDING PROGRAM			
				LBS.	KG.	CUMULATIVE	
WEEK	DAYS	LBS.	KG.			LBS.	KG.
1st	1–7						
2nd	8–14						
3rd	15–21	1.10–1.16	.498–.562				
4th	22–28	1.33–1.40	.503–.635				
5th	29–35	1.56–1.64	.707–.743				
6th	36–42	1.79–1.88	.811–.852	18.9	8.57	378.0	171.5
7th	43–49	2.02–2.12	.916–.961	19.6	8.89	476.0	215.9
8th	50–56	2.25–2.36	1.02–1.07	21.0	9.52	581.0	263.5
9th	57–63	2.48–2.60	1.12–1.18	21.7	9.84	689.5	312.8
10th	64–70	2.71–2.85	1.23–1.29	22.4	10.16	801.5	363.6
11th	71–77	2.94–3.09	1.33–1.40	23.1	10.47	917.0	415.9
12th	78–84	3.17–3.33	1.44–1.51	24.5	11.11	1039.5	471.5
13th	85–91	3.40–3.57	1.54–1.62	25.2	11.43	1165.5	528.7
14th	92–98	3.63–3.81	1.65–1.73	25.9	11.75	1295.0	587.4
15th	99–105	3.86–4.05	1.75–1.84	26.6	12.06	1428.0	647.7
16th	106–112	4.09–4.29	1.86–1.95	28.0	12.70	1568.0	711.2
17th	113–119	4.32–4.54	1.96–2.06	28.7	13.02	1711.5	776.3
18th	120–126	4.55–4.78	2.06–2.17	29.4	13.34	1858.5	843.0
19th	127–133	4.78–5.02	2.17–2.28	30.1	13.66	2009.0	911.3
20th	134–140	5.01–5.26	2.27–2.39	31.5	14.28	2166.5	982.7
21st	141–147	5.24–5.50	2.38–2.49	32.2	14.60	2327.5	1055.7
22nd	148–154	5.47–5.74	2.48–2.60	32.9	14.92	2492.0	1130.4
23rd	155–161	5.70–5.99	2.59–2.72	33.6	15.24	2660.0	1206.6
24th	162–168	5.93–6.23	2.69–2.83	35.0	15.87	2835.0	1285.9

*When using the "Skip Two Days Per Week" feeding program, feed the amounts shown per 100 birds under the "Limited Every Day" schedule for the first five weeks as outlined in programs 1 and 2 on the facing page.

3)4) Skip Two Days per Week Feeding Program for Arbor Acres Broiler Breeder Female.
Source: Broiler Breeder Female. Feeding and Management. 1981.
Arbor Acres Farm, Inc. Technical Service Department.
Glastonbury, Connecticut USA

FOR FLOCKS HATCHED: APRIL THRU SEPTEMBER (NORTH OF EQUATOR) FOR FLOCKS HATCHED: OCTOBER THRU MARCH (SOUTH OF EQUATOR)									
AGE OF FLOCK		AVERAGE MALE BODY WEIGHT		APPROXIMATE FEED AMOUNTS PER 100 BIRDS ON FEED DAYS					
				*SKIP EVERY OTHER DAY		LIMITED EVERY DAY		CUMULATIVE	
WEEK	DAYS	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.
1	1-7			*	*				
2	8-14			*	*	FULL	FEED	FULL	FEED
3	15-21			*	*	9.0-10.0	4.1-4.5	119.0-140.0	54.0-63.5
4	22-28			*	*	11.0-12.0	5.0-5.4	196.0-224.0	88.9-101.6
5	29-35			*	*	12.5-13.5	5.7-6.1	283.5-318.5	128.2-144.4
6	36-42	2.82	1.280	27-30	12.2-13.6	13.5-15.0	6.1-6.8	378.0-423.5	171.4-192.1
7	43-49	3.07	1.390	28-31	12.7-14.1	14.0-15.5	6.4-7.0	476.0-532.0	215.9-241.3
8	50-56	3.33	1.510	30-33	13.6-15.0	15.0-16.5	6.8-7.5	581.0-647.5	263.5-293.7
9	57-63	3.56	1.610	31-34	14.1-15.4	15.5-17.0	7.0-7.7	689.5-766.5	312.7-347.7
10	64-70	3.90	1.770	32-36	14.5-16.3	16.0-18.0	7.3-8.2	801.5-892.5	363.5-404.8
11	71-77	4.16	1.880	33-37	15.0-16.8	16.5-18.5	7.5-8.4	917.0-1022.0	415.9-463.5
12	78-84	4.42	2.000	35-39	15.9-17.7	17.5-19.5	7.9-8.8	1039.5-1158.5	471.4-525.4
13	85-91	4.68	2.120	36-40	16.3-18.1	18.0-20.0	8.2-9.1	1165.5-1298.5	528.6-588.9
14	92-98	4.94	2.240	37-42	16.8-19.0	18.5-21.0	8.4-9.5	1295.0-1445.5	587.3-655.5
15	99-105	5.20	2.360	38-43	17.2-19.5	19.0-21.5	8.6-9.7	1428.0-1596.0	647.8-723.8
16	106-112	5.46	2.470	40-45	18.1-20.4	20.0-22.5	9.1-10.2	1568.0-1753.5	711.1-795.3
17	113-119	5.72	2.600	41-46	18.6-20.9	20.5-23.0	9.3-10.4	1711.5-1914.5	776.2-868.3
18	120-126	5.98	2.710	42-48	19.1-21.8	21.0-24.0	9.5-10.9	1858.5-2082.5	842.9-944.5
19	127-133	6.24	2.830	43-49	19.5-22.2	21.5-24.5	9.8-11.1	2009.0-2254.0	911.2-1022.3
20	134-140	6.50	2.950	45-51	20.4-23.1	22.5-25.5	10.2-11.6	2166.5-2432.5	982.5-1103.2
21	141-147	6.76	3.060	46-52	20.9-23.6	23.0-26.0	10.4-11.8	2327.5-2614.5	1055.6-1185.8
22	148-154	7.13	3.230	47-53	21.3-24.0	23.5-26.5	10.7-12.0	2492.0-2800.0	1130.2-1270.0
23	155-161	7.39	3.350	48-54	21.8-24.5	24.0-27.0	10.9-12.2	2660.0-2989.0	1206.4-1355.6
24	162-168	7.66	3.470	50-56	22.7-25.4	25.0-28.0	11.3-12.7	2835.0-3185.0	1285.8-1444.5

FOR FLOCKS HATCHED: OCTOBER THRU MARCH (NORTH OF EQUATOR) FOR FLOCKS HATCHED: APRIL THRU SEPTEMBER (SOUTH OF EQUATOR)									
AGE OF FLOCK		AVERAGE MALE BODY WEIGHT		APPROXIMATE FEED AMOUNTS PER 100 BIRDS ON FEED DAYS					
				*SKIP EVERY OTHER DAY		LIMITED EVERY DAY		CUMULATIVE	
WEEK	DAYS	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.
1	1-7			*	*				
2	8-14			*	*	FULL	FEED	FULL	FEED
3	15-21			*	*	8.0-9.0	3.6-4.1	112.0-133.0	50.8-60.3
4	22-28			*	*	10.5-11.5	4.8-5.2	185.5-213.5	84.1-96.8
5	29-35			*	*	12.0-13.0	5.4-5.9	269.5-304.5	122.3-138.1
6	36-42	2.05	.929	26-29	11.8-13.2	13.0-14.5	5.9-6.6	360.5-406.0	163.5-184.1
7	43-49	2.30	1.045	27-30	12.2-13.6	13.5-15.0	6.1-6.8	455.0-511.0	206.4-231.8
8	50-56	2.56	1.181	28-31	12.7-14.1	14.0-15.5	6.4-7.0	553.0-619.5	250.8-281.0
9	57-63	2.82	1.277	29-32	13.2-14.5	14.5-16.0	6.6-7.3	654.5-731.5	296.9-331.8
10	64-70	3.12	1.415	30-34	13.6-15.4	15.0-17.0	6.8-7.7	759.5-850.5	344.5-385.7
11	71-77	3.38	1.533	31-35	14.1-15.9	15.5-17.5	7.0-7.9	868.0-973.0	393.7-441.3
12	78-84	3.64	1.650	32-38	14.5-16.4	16.0-18.0	7.3-8.2	980.0-1099.0	444.5-498.4
13	85-91	3.90	1.769	33-37	15.0-16.8	16.5-18.5	7.5-8.4	1095.5-1228.5	496.9-557.2
14	92-98	4.16	1.887	34-39	15.4-17.7	17.0-19.5	7.7-8.9	1214.5-1365.0	550.9-619.1
15	99-105	4.42	2.000	35-40	15.9-18.2	17.5-20.0	7.9-9.1	1337.0-1505.0	606.5-682.6
16	106-112	4.68	2.122	36-41	16.3-18.6	18.0-20.5	8.2-9.3	1463.0-1648.5	663.6-747.7
17	113-119	4.94	2.240	37-42	16.8-19.1	18.5-21.0	8.4-9.5	1592.5-1795.5	722.3-814.3
18	120-126	5.20	2.359	38-44	17.2-20.0	19.0-22.0	8.6-10.0	1725.5-1949.5	782.7-884.2
19	127-133	5.46	2.477	39-45	17.7-20.4	19.5-22.5	8.8-10.2	1862.0-2107.0	844.6-955.6
20	134-140	5.72	2.594	40-46	18.1-20.9	20.0-23.0	9.1-10.4	2002.0-2268.0	908.1-1028.8
21	141-147	5.98	2.712	41-47	18.6-21.4	20.5-23.5	9.3-10.7	2145.5-2432.5	973.2-1103.2
22	148-154	6.34	2.873	42-48	19.1-21.8	21.0-24.0	9.5-10.9	2292.5-2600.5	1039.9-1179.4
23	155-161	6.60	2.993	43-49	19.5-22.3	21.5-24.5	9.8-11.1	2443.0-2772.0	1108.1-1257.2
24	162-168	8.86	3.113	44-50	20.0-22.7	22.0-25.0	10.0-11.4	2597.0-2947.0	1178.0-1336.6

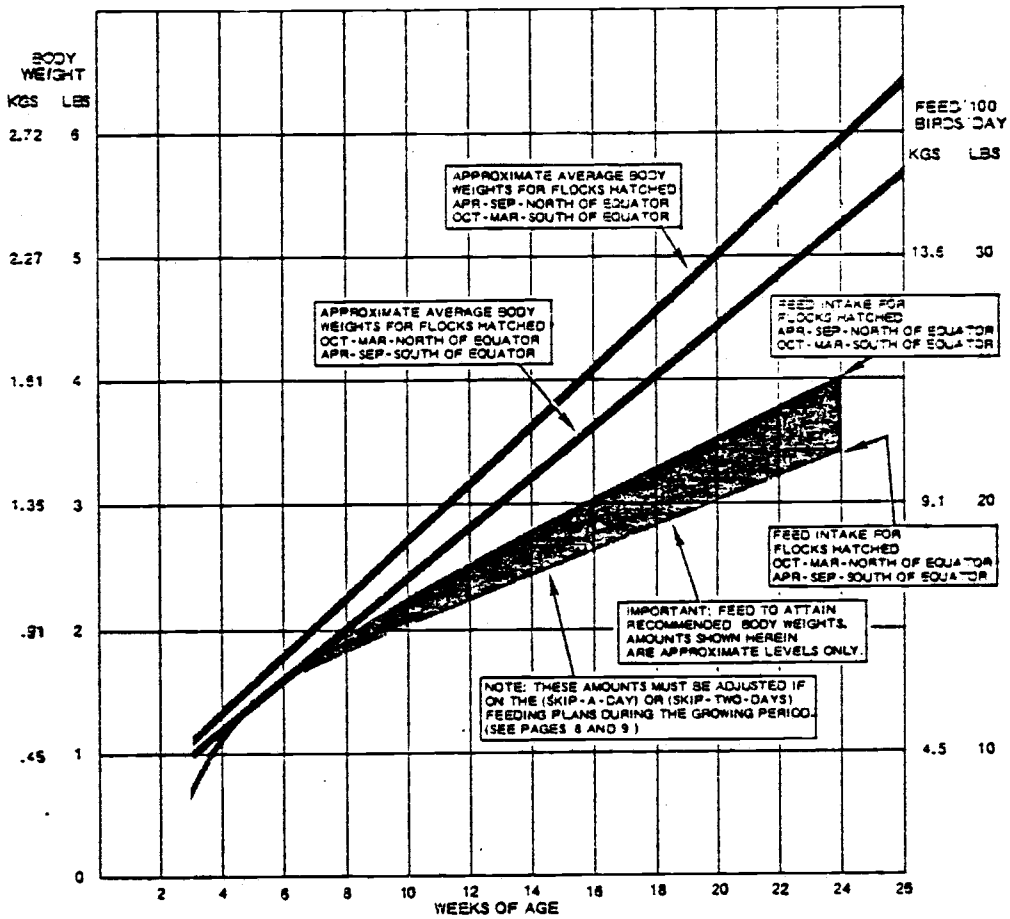
5),6) Feeding Programs for Arbor Acres Broiler Breeder Male.

Source: Broiler Breeder Male. Feeding and Management. 1981. Arbor Acres Farm, Inc. Technical Service Department. Glastonbury, Connecticut USA

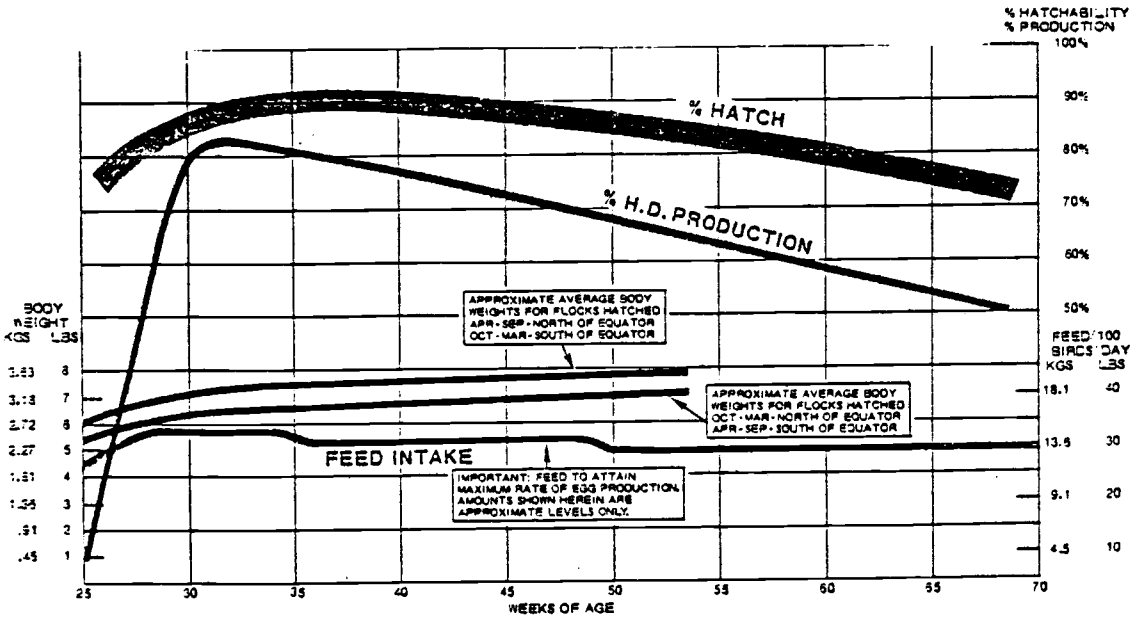
Week Of Age	Week Of Prod.	% H.D. Prod.	Cum. H.E. Prod. H.H.	% Hatch	APPROXIMATE FEED PER 100 BIRDS PER DAY		AVERAGE BODY WEIGHTS FLOCKS HATCHED			
							North of Equator—Oct.-Mar. South of Equator—Apr.-Sep.		North of Equator—Apr.-Sep. South of Equator—Oct.-Mar.	
					LBS.	KG.	LBS.	KG.	LBS.	KG.
25	1	5	0	–	28–34	12.7–15.4	5.43–5.70	2.46–2.58	6.16–6.47	2.79–2.93
25	2	20	0	75	30–36	13.6–16.3	5.66–5.91	2.56–2.68	6.39–6.68	2.90–3.03
27	3	38	1	78	32–38	14.5–17.2	5.89–6.13	2.67–2.78	6.62–6.88	3.00–3.12
28	4	55	4	82	34–40	15.4–18.1	6.05–6.28	2.74–2.83	6.79–7.03	3.08–3.19
29	5	72	8	85	34–40	15.4–18.1	6.20–6.39	2.81–2.90	6.95–7.16	3.15–3.24
30	6	80	14	86	34–40	15.4–18.1	6.35–6.51	2.88–2.95	7.10–7.28	3.22–3.30
31	7	83	19	87	34–40	15.4–18.1	6.50–6.66	2.94–3.02	7.25–7.43	3.28–3.37
32	8	83	25	88	34–40	15.4–18.1	6.60–6.77	2.99–3.07	7.35–7.53	3.33–3.41
33	9	82	30	88	34–40	15.4–18.1				
34	10	81	35	90	34–40	15.4–18.1				
35	11	81	41	90	32–38	14.5–17.2				
36	12	80	46	90	32–38	14.5–17.2				
38	14	79	56	90	32–38	14.5–17.2				
40	16	77	67	89	32–38	14.5–17.2	6.80–6.97	3.08–3.16	7.55–7.74	3.42–3.51
42	18	75	76	88	32–36	14.5–16.3				
44	20	73	86	88	32–36	14.5–16.3				
46	22	71	95	87	32–36	14.5–16.3				
48	24	70	104	87	32–36	14.5–16.3				
50	26	68	113	86	30–34	13.6–15.4				
52	28	66	122	85	30–34	13.6–15.4	7.10–7.30	3.22–3.31	7.75–7.84	3.51–3.55
54	30	64	130	84	30–34	13.6–15.4				
56	32	62	138	82	30–34	13.6–15.4				
58	34	61	145	81	30–32	13.6–14.5				
60	36	59	153	80	30–32	13.6–14.5				
62	38	57	160	79	30–32	13.6–14.5				
64	40	55	167	78	30–32	13.6–14.5				
66	42	53	174	77	30–32	13.6–14.5				
68	44	51	180	75	30–32	13.6–14.5				
	63% Av. Prod.		85.5% Average Hatch							

7) Production Standards, Body Weight Guide and Suggested Feed Amounts for Arbor Acres Broiler Breeders.

Source: Broiler Breeder Female. Feeding and Management. 1981.
Arbor Acres Farm, Inc.
Technical Service Department
Glastonbury, Connecticut USA



8) Growth Standards for Arbor Acres Broiler Breeder Female - Growing Period -
Source: Broiler Breeder Female. Fedding and Management. 1981.
Arbor Acres Farm, Inc.
Technical Service Department.
Glastonbury, Connecticut USA



9) Growth and Production standards for Arbor Acres Broiler Breeder Female. - Production Period -
Source: Broiler Breeder Female. Feeding and Management. 1981. Arbor Acres Farm, Inc. Technical Service Department. Glastonbury, Connecticut USA

FEMALE BODY WEIGHT GUIDE (1)

AGE IN WEEKS	AUG. - JAN. HATCHES* POUNDS	AUG. - JAN. HATCHES* KILOS	FEB. - JULY HATCHES* POUNDS	FEB. - JULY HATCHES* KILOS	ESTIMATED FEED PER 100 BIRDS POUNDS	ESTIMATED FEED PER 100 BIRDS KILOS	ESTIMATED FEED PER BIRD OUNCES	ESTIMATED FEED PER BIRD GRAMS
0	(2)	(2)	(2)	(2)	Full Feed	Full Feed	Full Feed	Full Feed
1					" "	" "	" "	" "
2					" "	" "	" "	" "
3	.95	.43	.95	.43	8-10	3.6-4.5	1.3-1.6	36-45
4	1.20	.54	1.20	.54	20(4)	9.1 (4)	3.2 (4)	91 (4)
5	1.45 (3)	.66 (3)	1.45 (3)	.66 (3)	21-22	9.5-10.0	3.4-3.5	95-100
6	1.65	.75	1.65	.75	21-23	9.5-10.5	3.4-3.7	95-105
7	1.80	.82	1.90	.86	22-24	10.0-10.8	3.5-3.8	100-108
8	1.95	.88	2.10	.95	22-24	10.0-10.8	3.5-3.8	100-108
9	2.10	.95	2.30	1.04	23-25	10.5-11.4	3.7-4.0	105-114
10	2.30	1.04	2.50	1.13	24-26	10.8-11.8	3.8-4.2	108-118
11	2.50	1.13	2.70	1.23	24-26	10.8-11.8	3.8-4.2	108-118
12	2.70	1.22	2.90	1.32	26-30	11.8-13.6	4.2-4.8	118-136
13	2.90	1.32	3.10	1.41	26-30	11.8-13.6	4.2-4.8	118-136
14	3.10	1.40	3.30	1.50	28-32	12.7-14.5	4.5-5.1	127-145
15	3.30	1.50	3.50	1.59	28-32	12.7-14.5	4.5-5.1	127-145
16	3.45	1.55	3.70	1.68	29-33	13.2-15.0	4.6-5.3	132-150
17	3.65	1.66	3.90	1.77	29-33	13.2-15.0	4.6-5.3	132-150
18	3.85	1.75	4.10	1.86	30-35	13.6-15.9	4.8-5.6	136-159
19	4.05	1.84	4.30	1.95	32-38	14.5-17.3	5.1-6.1	145-173
20	4.25	1.93	4.50	2.04	32-38	14.5-17.3	5.1-6.1	145-173
21	4.50	2.04	4.75	2.16	34-40	15.4-18.2	5.4-6.4	154-182
22	4.70	2.13	5.00	2.27	40-46	18.2-20.9	6.4-7.4	182-209
23	5.00 (5)	2.27 (5))	5.25 (5)	2.38 (5)	22-28	10.0-12.7	3.5-4.5	100-127
24	5.20	2.36	5.50	2.63	26-30	11.8-13.6	4.2-4.8	118-136

STARTER — DEVELOPER — BREEDER

SHIFT-A-DAY — DAILY

* NORTHERN HEMISPHERE

10) Growing Program for Cobb Female Breeder Flocks.
Source: Cobb Broiler Breeder Management Guide, 1981.
Cobb Incorporated.
Concord, Massachusetts 01742.

Laying Program for Cobb Female Breeder Flocks

FEMALE BODY WEIGHT GUIDE (1)

AGE IN WEEKS	AUG. - JAN. HATCHES* POUNDS	AUG. - JAN. HATCHES* KILOS	FEB. - JULY HATCHES* POUNDS	FEB. - JULY HATCHES* KILOS	ESTIMATED BREEDER FEED (2) PER 100 BIRDS PER DAY POUNDS	ESTIMATED BREEDER FEED (2) PER 100 BIRDS PER DAY KILOS	*TOTAL EGG PRODUCTION (HEN DAY)
25	5.50 (3)	2.49 (3)	6.00	2.72	28-31 (4)	12.7-14.1 (4)	5
26	5.75	2.61	6.25	2.84	30-32	13.6-14.5	20
27	5.95	2.70	6.40	2.90	31-34	14.1-15.5	35
28	6.15	2.79	6.55	2.97	32-35	14.5-15.9	50
29	6.35	2.58	6.75	3.06	32-36	14.5-16.3	65
30	6.40	2.90	6.80	3.08	32-36	14.5-16.3	78
31	6.45	2.93	6.85	3.11	32-36	14.5-16.3	82
32	6.55	2.97	6.90	3.13	32-36	14.5-16.3	83
33	6.55	2.97	6.90	3.13	32-36	14.5-16.3	83
34	6.60	2.99	6.95	3.15	32-36	14.5-16.3	82
35	6.60	2.99	6.95	3.15	32-36	14.5-16.3	81
36	6.65	3.02	7.00	3.18	32-36	14.5-16.3	80
37	6.65	3.02	7.00	3.20	32-36	14.5-16.3	79
38	6.70	3.04	7.10	3.20	32-36	14.5-16.3	78
39	6.70	3.04	7.10	3.20	32-36	14.5-16.3	77
40	6.80	3.08	7.15	3.24	31.5-35.5	14.3-16.1	76
42	6.85	3.11	7.20	3.27	31.5-35.5	14.3-16.1	74
44	6.85	3.11	7.25	3.29	31.5-35.5	14.3-16.1	72
46	6.90	3.13	7.25	3.29	31.5-35.5	14.3-16.1	70
48	6.90	3.13	7.30	3.31	31.0-35.0	14.1-15.9	68
50	6.95	3.15	7.30	3.31	31.0-35.0	14.1-15.9	66
52	6.95	3.15	7.35	3.31	30.5-34.5	13.9-15.7	64
54	7.00	3.18	7.35	3.33	30.5-34.5	13.9-15.7	62
56	7.05	3.20	7.35	3.33	30.5-34.5	13.9-15.7	60
58	7.05	3.20	7.40	3.36	30.5-34.0	13.9-15.4	58
60	7.10	3.22	7.40	3.36	30.5-33.5	13.9-15.2	56
62	7.10	3.22	7.40	3.36	30.0-33.0	13.6-15.0	54
64	7.15	3.24	7.45	3.38	30.0-32.5	13.6-14.8	51
66	7.15	3.24	7.45	3.38	30.0-32.5	13.6-14.8	47
68	7.20	3.27	7.45	3.38	30.0-32.0	13.6-14.5	45
70	7.20	3.27	7.45	3.38	30.0-32.0	13.6-14.5	44

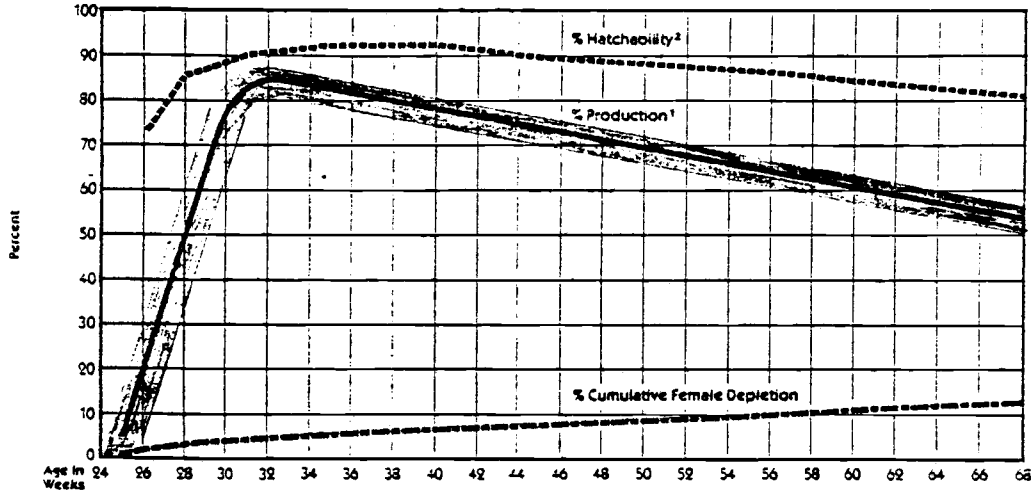
* NORTHERN HEMISPHERE

11) Laying Program for Cobb Female Breeder Flocks.
Source: Cobb Broiler Breeder Management Guide, 1981.
Cobb Incorporated.
Concord, Massachusetts 01742.

Age In Weeks	Birds On Hand Males	Females	Egg Production Estimate Percent	Total Eggs Per Week	Estimated Hatching Eggs Percent	Hatching Eggs Per Week	Accumulated Hatching Eggs	Estimated Straight Run Hatching Percent	Chicks Per Week Straight Run
25	105	1000	5	350	0	0	0	0	0
26	103	995	20	1393	30	418	418	72	300[1]
27	101	990	35	2425	70	1697	2115	78	1323
28	99	985	50	3447	80	2758	4873	84	2316
29	97	980	65	4459	85	3790	8663	86	3414
30	96	975	80	5460	90	4914	13577	88	4324
31	95	970	84	5703	92	5246	18823	90	4721
32	94	966	85	5747	94	5402	24225	90	4861
33	93	962	85	5723	95	5436	29661	91	4946
34	93	958	84	5633	95	5351	35012	91	4869
35	92	954	83	5542	95	5264	40276	92	4842
36	92	950	82	5453	95	5180	45456	92	4765
37	91	947	81	5369	95	5100	50556	92	4692
38	91	944	80	5286	95	5021	55577	92	4619
39	90	941	80	5269	96	5058	60635	92	4653
40	90	938	78	5121	96	4916	65551	91	4473
41	89	935	78	5105	96	4900	70451	91	4459
42	89	933	77	5028	96	4827	75278	91	4392
43	88	931	77	5018	96	4817	80095	90	4335
44	88	929	76	4949	96	4744	84839	90	4269
45	87	927	75	4866	96	4672	89511	90	4204
46	87	925	75	4856	96	4662	94173	89	4149
47	86	923	74	4781	96	4589	98762	89	4084
48	86	921	73	4706	96	4518	103280	89	4021
49	85	919	72	4631	96	4446	107726	88	3912
50	85	917	71	4557	96	4375	112101	88	3850
51	84	915	70	4483	96	4304	116405	88	3787
52	84	913	69	4409	95	4189	120594	87	3644
53	83	911	68	4336	95	4119	124713	87	3583
54	83	909	67	4263	95	4050	128763	87	3523
55	82	908	66	4195	95	3985	132748	86	3427
56	82	907	65	4126	95	3920	136668	86	3371
57	81	906	64	4058	95	3855	140523	86	3315
58	81	905	63	3991	94	3751	144274	86	3225
59	80	904	62	3923	94	3687	147961	85	3133
60	80	903	61	3855	94	3624	151585	85	3080
61	79	902	60	3738	94	3561	155146	84	2991
62	79	900	59	3717	93	3456	158602	84	2903
63	78	899	58	3649	93	3394	161996	83	2817
64	78	898	57	3583	93	3332	165328	83	2765
65	77	897	56	3516	93	3270	168598	82	2681
66	77	896	55	3449	92	3173	171771	82	2601
67	76	895	54	3383	92	3112	174883	81	2520
68	76	894	53	3316	92	3051	177934	80	2440
Total				190,910		177,934			156,599
Average Per Pullet Housed				190.9	93	177.9			156.5

1. Chicks hatched 3 weeks later

12) Production Guide Cobb Broiler Breeders.
Source: Cobb Broiler Breeder Management Guide, 1981.
Cobb Incorporated.
Concord, Massachusetts 01742.



13) Cobb Breeder Performance Chart.
Source: Cobb Breeder Management Guide, 1981.
Cobb Incorporated.
Concord, Massachusetts 01742.

Age in Weeks	Days of Age	Metric: Female Body Weight Targets(x) (Flock Average) Min. (g)	Max. (g)	Average Male Body Weight (g)	(xx) Feed Allowance Guideline (g/bird)	Programme
	(x)					
0	1- 7					Full* Feed
1	8- 14					
2	15- 21					
3	22- 28	320	450	420	Max.	Cont. Daily Feed.
4	29- 35	430	590	520	43 g	
5	36- 42	540	780	620	86- 95	Skip-a-Day (every other day) Feeding
6	43- 49	640	670	720	91-100	
7	50- 56	730	870	850	95-104	
8	57- 63	820	950	1000	100-109	
9	64- 70	910	1050	1130	109-118	
10	71- 77	1000	1140	1260	113-122	
11	78- 84	1090	1230	1390	118-127	
12	85- 91	1180	1320	1530	122-132	
13	92- 98	1270	1410	1660	127-140	
14	99-105	1360	1500	1800	132-145	
15	106-112	1450	1600	1940	136-150	
16	113-119	1540	1700	2080	145-159	
17	120-126	1630	1800	2230	150-163	
18	127-133	1720	1890	2380	159-176	
19	134-140	1800	1950	2540	167-186	
20	141-147	1880	2060	2700	177-195	
21	148-154	1960	2150	2900	186-204	
22	155-161	2040	2240	3100	190-209	
23	162-168	2250	2460	3300	104-118	Daily

Age in Weeks	Imperial: Female Body Weight Targets(x) (Flock Average) Min. (lb)	Max. (lb)	Average Male Body Weight (lb)	(xx) Feed Allowance Guideline (lb/100 birds)	Programme
0					Full* Feed
1					
2					
3	0.70	1.10	0.80	Max.	Cont. Daily Feed
4	0.95	1.50	1.10	9.5 lb	
5	1.20	1.70	1.35	19-21	Skip-a-Day (every other day) Feeding
6	1.40	1.90	1.65	20-22	
7	1.60	1.90	1.85	21-23	
8	1.80	2.10	2.20	22-24	
9	2.00	2.30	2.50	24-26	
10	2.20	2.50	2.80	25-27	
11	2.40	2.70	3.05	26-28	
12	2.60	2.90	3.35	27-29	
13	2.80	3.10	3.65	28-31	
14	3.00	3.30	3.97	29-32	
15	3.20	3.55	4.25	30-33	
16	3.40	3.75	4.60	32-35	
17	3.60	3.95	4.95	33-36	
18	3.80	4.15	5.25	35-39	
19	3.95	4.35	5.60	37-41	
20	4.15	4.55	5.95	39-43	
21	4.30	4.75	6.40	41-45	
22	4.50	4.95	6.85	42-46	
23	4.95	5.40	7.30	23-26	Daily

14) Growth Rate Targets and Feeding Guidelines for Starbro Parent Breeders (Males grown with Females).
Source: Shaver Starbro Parent Management Guide, 1981.
Shavor Poultry Breeding Farms Limited.
P.O. Box 400, Cambridge, Ontario, Canada N1R 5V9

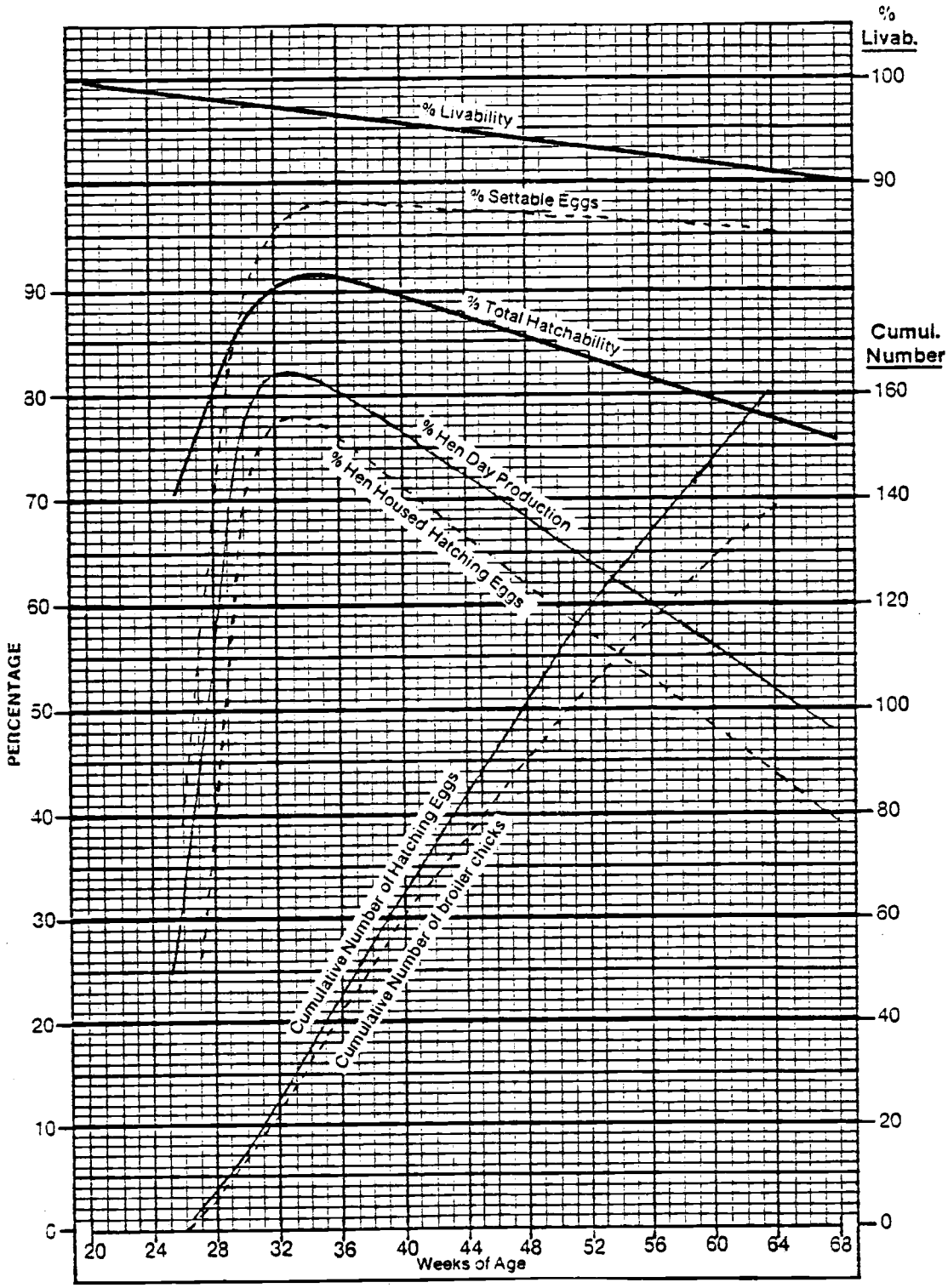
BODY WEIGHT TARGETS & FEEDING GUIDELINES
*STARBRO PARENT BREEDERS (24-64 WEEKS)

Age in Weeks	Days of Age	Metric					Imperial				
		Female Body Weight Targets (Flock Average)		Average Male Body Weight (g)	Feed Allow-ance Guide-line (g/bird)	Programme	Female Body Weight Targets (Flock Average)		Average Male Body Weight (lb)	Feed Allow-ance Guide-line lb/100 birds)	Programme
		Min. (g)	Max. (g)				Min. (lb)	Max. (lb)			
23	162-168	2250	2450	3300	104-118	Controlled feeding according to production rate and environmental temperature	4.95	5.40	7.30	23.0-26.0	Controlled feeding according to production rate and environmental temperature
24	169-175	2380	2550	3500	104-122		5.20	5.65	7.70	23.0-27.0	
25	176-182	2460	2660	3680	109-132		5.40	5.85	8.10	24.0-29.0	
26	183-189	2560	2760	3870	113-150		5.65	6.10	8.50	25.0-33.0	
27	190-196	2640	2840	3960	122-154		5.80	6.25	8.75	27.0-34.0	
28	197-203	2710	2910	4060	136-159		5.95	6.40	8.95	30.0-35.0	
29	204-210	2770	2970	4110	145-163		6.10	6.55	9.05	32.0-36.0	
30	211-217	2830	3030	4170	150-163		6.25	6.70	9.20	33.0-36.0	
31	218-224	2880	3080	4190	154-167		6.35	6.80	9.25	34.0-37.0	
32	225-231	2920	3120	4220	154-167		6.45	6.85	9.30	34.0-37.0	
33	232-238	2940	3140	4230	154-167		6.50	6.90	9.30	34.0-37.0	
34	239-245	2960	3160	4240	154-167		6.55	6.95	9.35	34.0-37.0	
35	246-252	2980	3180	4250	154-167		6.60	7.00	9.35	34.0-37.0	
36	253-259	3000	3200	4260	154-167		6.60	7.00	9.40	34.0-37.0	
37	260-266	3000	3200	4270	154-167		6.60	7.00	9.40	34.0-37.0	
38	267-273	3010	3210	4280	152-165		6.65	7.05	9.45	33.5-36.5	
39	274-280	3010	3210	4290	150-163		6.65	7.05	9.45	33.0-36.0	
40	281-287	3020	3220	4300	147-161		6.65	7.10	9.50	32.5-35.5	
44	309-315	3030	3230	4350	145-159		6.70	7.10	9.60	32.0-35.0	
48	337-343	3040	3240	4400	143-156		6.70	7.15	9.70	31.5-34.5	
52	365-371	3050	3250	4450	141-154		6.70	7.15	9.80	31.0-34.0	
56	393-399	3060	3260	4490	138-152		6.75	7.20	9.90	30.5-33.5	
60	421-427	3070	3270	4520	136-150		6.75	7.20	9.95	30.0-33.0	
63-64	442-448	3080	3280	4550	134-147		6.80	7.25	10.00	29.5-32.5	

15) Body Weight Targets and Feeding Guidelines for Starbro Parent Breeders.
Source: Shaver Starbro Parent Management Guide, 1981.
Shaver Poultry Breeding Farms Limited.
P.O. Box 400, Cambridge, Ontario, Canada N1R 5V9

Age in Wk	% Prod. H.O. Basis	% Prod. H.H. Basis	Eggs/Wk per H.H.	Cum. = Eggs per H.H.	% H.E.	H.E. per Wk per H.H.	Cum. H.E. per H.H.	Potential % Hatch	Broiler Chicks Hatched per Wk per H.H.	Cum. = Broiler Chicks Hatched per H.H.
24										
25	18.0	17.9	1.25							
26	32.0	31.8	2.22	3.5	33.0	.87		70.0	.61	
27	43.0	42.7	2.99	6.5	50.0	1.79	2.7	76.0	1.36	1.9
28	56.0	55.6	3.89	10.4	72.0	2.80	5.5	83.0	2.32	4.3
29	70.0	69.0	4.83	15.2	85.0	4.11	9.6	85.0	3.49	7.8
30	80.0	78.8	5.52	20.7	90.0	4.97	14.5	87.0	4.32	12.1
31	82.0	80.8	5.65	26.4	92.0	5.21	19.7	88.0	4.58	16.7
32	82.0	80.8	5.65	32.0	94.5	5.35	25.1	89.0	4.76	21.5
33	81.5	79.7	5.58	37.6	93.0	5.35	30.5	89.5	4.79	26.2
34	80.5	78.7	5.51	43.1	97.0	5.34	35.8	90.0	4.81	31.0
35	79.5	77.7	5.44	48.5	97.5	5.30	41.1	90.5	4.80	35.8
36	78.5	76.7	5.37	54.0	93.0	5.25	46.3	91.0	4.79	40.6
37	77.5	75.2	5.25	59.3	98.0	5.15	51.5	90.5	4.66	45.3
38	76.5	74.2	5.25	64.5	93.0	5.09	56.6	90.0	4.58	49.9
39	75.5	73.2	5.18	69.7	98.0	5.02	61.6	89.5	4.50	54.4
40	74.5	72.2	5.11	74.8	98.0	4.96	66.6	89.0	4.42	58.8
41	73.5	70.9	4.95	79.8	93.0	4.86	71.4	88.5	4.30	63.1
42	72.5	69.8	4.89	84.7	93.0	4.79	76.2	88.0	4.22	67.3
43	71.5	68.8	4.82	89.5	93.0	4.73	80.9	87.5	4.14	71.5
44	70.5	67.8	4.75	94.2	97.5	4.64	85.6	87.0	4.04	75.5
45	69.5	66.4	4.65	98.9	97.5	4.53	90.1	86.5	3.92	79.4
46	68.5	65.4	4.58	103.5	97.5	4.46	94.6	86.0	3.84	82.3
47	67.5	64.5	4.51	108.0	97.0	4.40	99.0	85.5	3.76	87.0
48	66.5	63.5	4.45	112.5	97.0	4.32	103.3	85.0	3.67	90.7
49	65.0	61.6	4.31	116.7	97.0	4.18	107.5	84.5	3.53	94.2
50	64.0	60.6	4.24	121.0	97.0	4.11	111.6	84.0	3.45	97.6
51	63.0	59.7	4.18	125.2	97.0	4.05	115.6	83.5	3.38	101.0
52	62.0	58.7	4.11	129.3	97.0	3.98	119.6	83.0	3.30	104.3
53	61.0	57.3	4.01	133.3	97.0	3.89	123.5	82.5	3.21	107.6
54	60.5	56.9	3.98	137.3	96.5	3.84	127.3	82.0	3.15	110.7
55	59.5	56.0	3.92	141.2	96.5	3.78	131.1	81.5	3.08	113.8
56	58.5	55.0	3.85	145.0	96.5	3.72	134.8	81.0	3.01	116.8
57	57.5	53.6	3.75	148.8	96.5	3.62	138.5	80.5	2.91	119.7
58	56.5	52.7	3.69	152.5	96.0	3.55	142.0	80.0	2.84	122.5
59	55.5	51.8	3.62	156.0	96.0	3.49	145.5	79.5	2.77	125.3
60	54.5	51.0	3.57	159.7	96.0	3.43	148.9	79.0	2.71	128.0
61	54.0	49.9	3.49	163.2	95.5	3.33	152.3	78.5	2.61	130.6
62	53.0	49.0	3.43	166.6	95.5	3.28	155.6	78.0	2.56	133.2
63	52.0	48.0	3.36	170.0	95.0	3.20	158.8	77.5	2.48	135.6
64	51.0	47.0	3.29	173.2	95.0	3.13	161.9	77.0	2.41	138.1

16) Potential Performance Starbro Parent Female.
Source: Shaver Starbro Parent Management Guide, 1981.
Shaver Poultry Breeding Farms Limited.
P.O. Box 400, Cambridge, Ontario, Canada N1R 5V9



17) Performance Objectives for Starbro Broiler Breeders.
Source: Shaver Starbro Parent Management Guide, 1981.
Shaver Poultry Breeding Farms Limited.
P.O. Box 400, Cambridge, Ontario, Canada N1R 5V9

Age Weeks	Age in Days	Feed/Bird/Day Grams	Feed/100/Day Pounds	Cum. Feed Per Bird Lbs.	Optimum Body Wt. Grams	Optimum Body Wt. Pounds
1	0-7	11	2.6	.18		
2	8-14	23	5	.53		
3	15-21	34	7.5	1.06		
		START SKIP-A-DAY FEED				
4	22-28	41	9	1.69	540	1.19
5	29-35	41	9	2.32	641	1.41
6	36-42	59	13	3.23	742	1.63
7	43-49	59	13	4.14	820	1.80
8	50-56	61	13.5	5.08	898	1.98
9	57-63	61	13.5	6.02	980	2.16
10	64-70	64	14	7.00	1061	2.34
11	71-74	64	14	7.98	1140	2.51
12	78-84	66	14.5	8.99	1225	2.70
13	85-91	68	15	10.04	1300	2.86
14	92-98	73	16	11.16	1374	3.03
15	99-105	77	17	12.35	1470	3.24
16	106-112	82	18	13.61	1568	3.45
17	113-119	86	19	14.94	1660	3.66
18	120-126	91	20	16.34	1756	3.87
19	127-133	95	21	17.81	1835	4.04
20	134-140	100	22	19.35	1916	4.22
21	141-147	104	23	20.96	2030	4.47
22	148-155	109	24	22.64	2142	4.72
23	156-163	113	25	24.39	2250	4.96

On Skip-A-Day — Double the amount of feed shown. Feed this amount every other day.

Feed suggested is for a guide only. Actual feed given should be the amount needed to maintain weights shown up to 23 weeks.

Beginning the eighth week on off feed days give 1½ pounds (681 grams) of oats per 100 birds. If no oats are used increase feed by this amount.

18) Feed and Weight Guide for Pilch Broiler Breeder Females.
- Growing period -
Source: Managing Pilch Breeders - Broilers, 1981.
Pilch, Inc.
P.O. Box 4381 Amity Hill Road
Troutman, North Carolina 28166.

Age In Weeks	Breeder Feed Bird/Day-Grams	Breeder Lbs/100/Day	Age In Weeks	Bird/Day Grams	Lbs/100 Per Day
23	113	25	43	145	32
24	118	26	44	144	31¾
25	122	27	45	143	31½
26	132	29	46	142	31¼
27	141	31	47	141	31
28	150	33	48	140	30¾
29	155	34	49	138	30½
30	155	34	50	138	30½
31	155	34	51	138	30½
32	155	34	52	138	30½
33	155	34	53	138	30½
34	155	34	54	138	30½
35	155	34	55	137	30¼
36	153	33¾	56	137	30¼
37	152	33½	57	137	30¼
38	151	33¼	58	137	30¼
39	150	33	59	136	30
40	149	32¾	60	136	30
41	148	32½	61	136	30
42	147	32¼	62	136	30

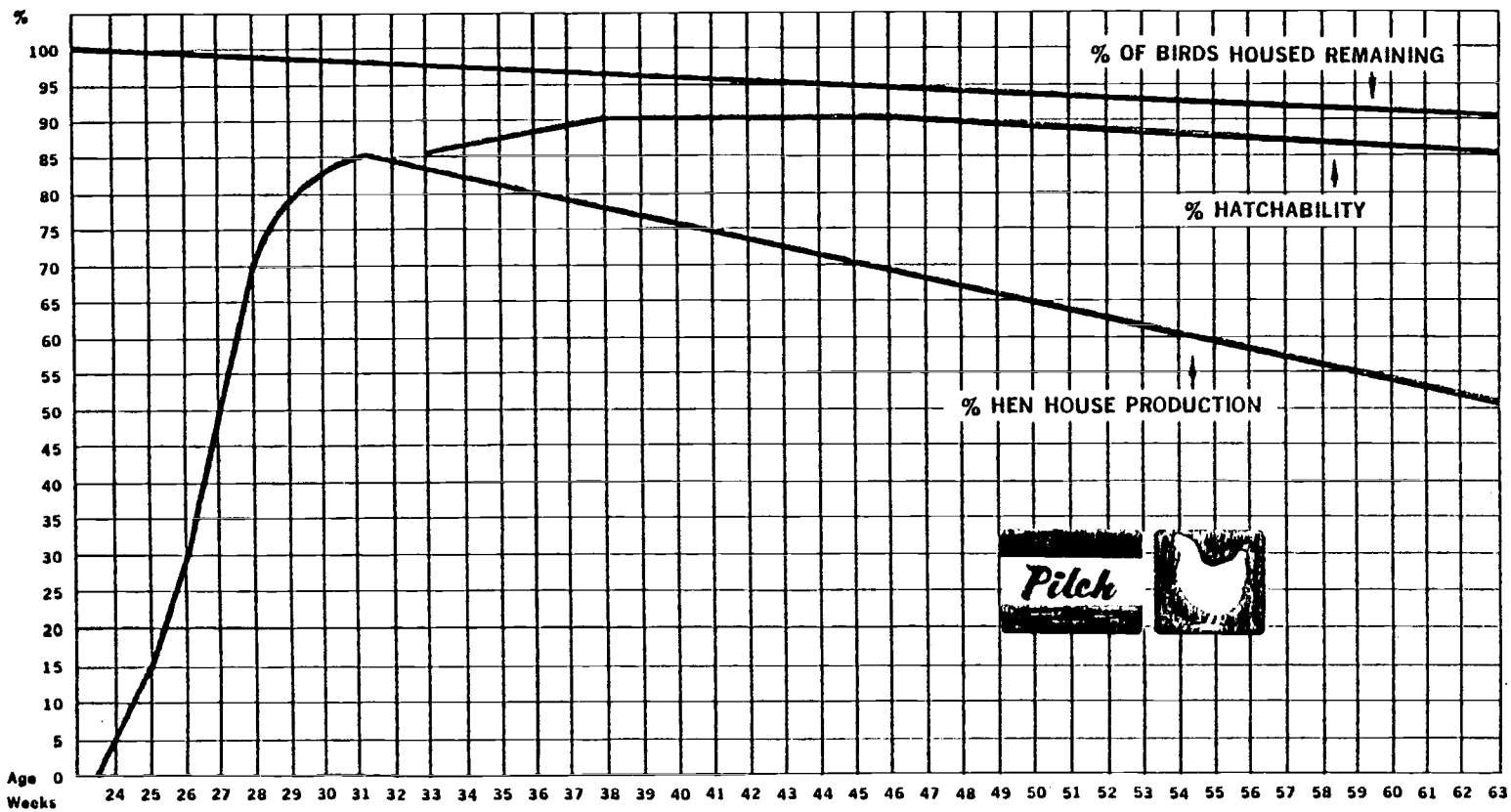
19) Feed and Weight Guide for Pilch Broiler Breeder Females - Laying Period -
Source: Managing Pilch Breeders - Broilers, 1981.
Pilch, Inc.
P.O. Box 4381 Amity Hill Road
Troutman, North Carolina 28166.

Age In Weeks	Production %	Total Eggs P/Wk.	Total Eggs Cum.	Hatching Eggs P/Wk.	Hatching Eggs Cum.	Body Weight Grams Females	Body Weight Grams Males
24	5	.4	.4				
25	13	.9	1.3				
26	25	1.7	3.0	1.2	1.2	2460	2951
27	50	3.5	6.5	1.5	2.7		
28	65	4.6	11.1	3.3	6.0		
29	78	5.5	16.6	4.4	10.4		
30	81	5.7	22.3	4.8	15.2	2680	3540
31	82	5.7	28.0	5.2	20.4		
32	83	5.8	33.8	5.4	25.8		
33	82	5.7	39.5	5.5	31.3		
34	81	5.7	45.2	5.5	36.8	2890	3950
35	80	5.6	50.8	5.5	42.3		
36	79	5.5	56.3	5.4	47.7		
37	78	5.5	61.8	5.4	53.1		
38	77	5.4	67.2	5.3	58.4	3000	4176
39	76	5.3	72.5	5.2	63.6		
40	74	5.2	77.7	5.1	68.7		
41	73	5.1	82.8	5.0	73.7		
42	72	5.0	87.8	4.9	78.6	3050	4360
43	71	5.0	92.8	4.9	83.5		
44	70	4.9	97.7	4.8	88.3		
45	68	4.7	102.4	4.6	92.9	3090	4450
46	67	4.7	107.1	4.6	97.5		
47	66	4.6	111.4	4.5	102.0		
48	65	4.5	116.2	4.4	106.4		
49	64	4.5	120.7	4.4	110.8		
50	63	4.4	125.1	4.3	115.1	3120	4550
51	62	4.3	129.4	4.2	119.3		
52	61	4.3	133.7	4.2	123.5		
53	60	4.2	137.9	4.1	127.6		
54	59	4.1	142.0	4.0	131.6	3150	4620
55	58	4.1	146.1	4.0	135.6		
56	57	4.0	150.1	3.9	139.5		
57	56	3.9	154.0	3.7	143.2		
58	55	3.8	157.8	3.6	146.8	3180	4670
59	54	3.8	161.6	3.6	150.4		
60	53	3.7	165.3	3.5	153.9		
61	52	3.6	168.9	3.4	157.3		
62	51	3.6	172.5	3.4	160.7	3210	4700
63	50	3.5	176.0	3.3	164.0		

20) Average Performance per Hen Housed for Pilch Broiler Breeders.
Source: Managing Pilch Breeders - Broilers, 1981.
Pilch, INc.
P.O. Box 4381 Amity Hill Road
Troutman, North Carolina 28166.

Age in Weeks	Weeks in Production	% Hatch	Chicks/Hen	Cum. Chicks/Hen
26	3	75	.75	.75
27	4	77	1.15	1.90
28	5	81	2.67	4.57
29	6	83	3.65	8.22
30	7	85	4.08	12.30
31	8	86	4.47	16.77
32	9	87	4.70	21.47
33	10	87	4.78	26.25
34	11	88	4.84	31.09
35	12	88	4.84	35.93
36	13	89	4.81	40.74
37	14	89	4.81	45.55
38	15	88	4.66	50.21
39	16	88	4.57	54.78
40	17	88	4.49	59.27
41	18	87	4.35	63.62
42	19	87	4.26	67.88
43	20	87	4.26	72.14
44	21	86	4.12	76.26
45	22	86	3.95	80.21
46	23	86	3.95	84.16
47	24	85	3.82	87.98
48	25	85	3.74	91.72
49	26	85	3.74	95.46
50	27	85	3.65	99.11
51	28	84	3.52	102.63
52	29	84	3.52	106.15
53	30	84	3.44	109.59
54	31	84	3.36	112.95
55	32	83	3.32	116.27
56	33	83	3.23	119.50
57	34	83	3.07	122.57
58	35	82	2.95	125.52
59	36	82	2.95	128.47
60	37	81	2.83	131.30
61	38	81	2.75	134.05
62	39	80	2.72	136.77
63	40	80	2.64	139.41

21) Average Performance per Hen Housed for Pilch Broiler Breeders.
Source: Managing Pilch Breeders - Broilers, 1981.
Pilch, INc.
P.O. Box 4381 Amity Hill Road
Troutman, North Carolina 28166.



22) Performance Standards for Pilch Broiler Breeders.
Source: Managing Pilch Breeders -Broilers, 1981.
Pilch, Inc.
P.O. Box 4381 Amity Hill Road
Troutman, North Carolina 28166.

Age in Wks.	Age in Days	Feeding Rate per 100 Birds lb.		Feeding Rate per Bird gm.	
0	0-6	FF (2.5 Daily)		FF (11 Daily)	
1	7	FF (4.0 Daily)		FF (18 Daily)	
2	14	7-8	Daily	30-35	Daily
3	21*	9-10	Daily	40-45	Daily
		18-20	Every	80-90	Every
4	28	20-21		90-95	
5	35	20-21	Other	90-95	Other
6	42	21-22		95-100	
7	49	21-23	Day	95-105	Day
8	56	22-25		100-115	
9	63	23-26		105-120	
10	70	24-28		110-125	
11	77	25-29		115-130	
12	84	27-31		120-140	
13	91	28-33		125-150	
14	98	29-35		130-160	
15	105	30-36		135-165	
16	112	31-38		140-175	
17	119	32-40		145-180	
18	126	33-42		150-190	
19	133	34-44		155-200	
20	140	36-46		165-210	
21	147	38-48		170-220	
22	154	40-50		180-225	
23	161	44-54		200-245	
24	168	25-29	Daily	115-130	Daily
25	175	28-32		125-145	
26	182	30-34		135-165	
27-36	189-252	34-36		155-165	
37-68	259-476	Gradually Reduce Feed Intake to 30-33 @ 56 Wks.		Gradually Reduce Feed Intake to 135-150 @ 56 Wks.	

*Feed every other day when 10 lb. (45 gm.) is consumed within 5 hrs.

23) Feeding Recommendations for Hubbard Breeder Female.
Source: Management Guide for the Hubbard Breeder pullet, 1981-1982.
Hubbard Farms. Research and Development.
Walpole, New Hampshire.

		Pounds			
		Avg. Female Body Wt. lb.		Avg. Hubbard Male Body Wt. lb.	
Age in Weeks	Age in Days	Aug.-Dec. Hatches	Jan.-July Hatches	Aug.-Dec. Hatches	Jan.-July Hatches
0	1	0.09	0.09	0.09	0.09
1	7	0.25	0.25	0.27	0.27
2	14	0.50	0.50	0.55	0.55
3	21	0.75	0.75	0.86	0.86
4	28	1.00*	1.00*	1.20*	1.20*
5	35	1.20	1.20	1.50	1.50
6	42	1.40	1.40	1.75	1.75
7	49	1.60	1.60	2.00	2.00
8	56	1.80	1.80	2.25	2.25
9	63	2.00	2.05	2.50	2.50
10	70	2.20	2.30	2.75	2.75
11	77	2.40	2.55	3.00	3.00
12	84	2.65	2.75	3.30	3.30
13	91	2.85	3.00	3.50	3.60
14	98	3.10	3.25	3.80	3.90
15	105	3.30	3.45	4.05	4.25
16	112	3.50	3.70	4.35	4.60
17	119	3.70	3.95	4.60	4.85
18	126	3.90	4.20	4.85	5.10
19	133	4.10	4.45	5.10	5.40
20	140	4.35	4.70	5.40	5.70
21	147	4.55	5.00	5.65	6.00
22	154	4.75	5.25	5.90	6.30
23	161	5.00	5.50	6.15	6.65
24	168	5.60*	6.10*	7.15*	7.70*
25	175	5.90	6.40	7.50	8.15
26	182	6.20	6.60	7.85	8.50
27	189	6.40	6.80	8.20	8.70
28	196	6.55	6.90	8.50	8.95
30	210	6.80	7.05	8.90	9.25
32	224	6.95	7.15	9.25	9.50
36	252	7.05	7.25	9.70	10.00
40	280	7.10	7.35	10.00	10.30
68**	476	7.65	7.90	10.50	10.75

Body weights are for off-feed day weights from 4 thru 23 weeks for females and males and are midday weights after 24 weeks.

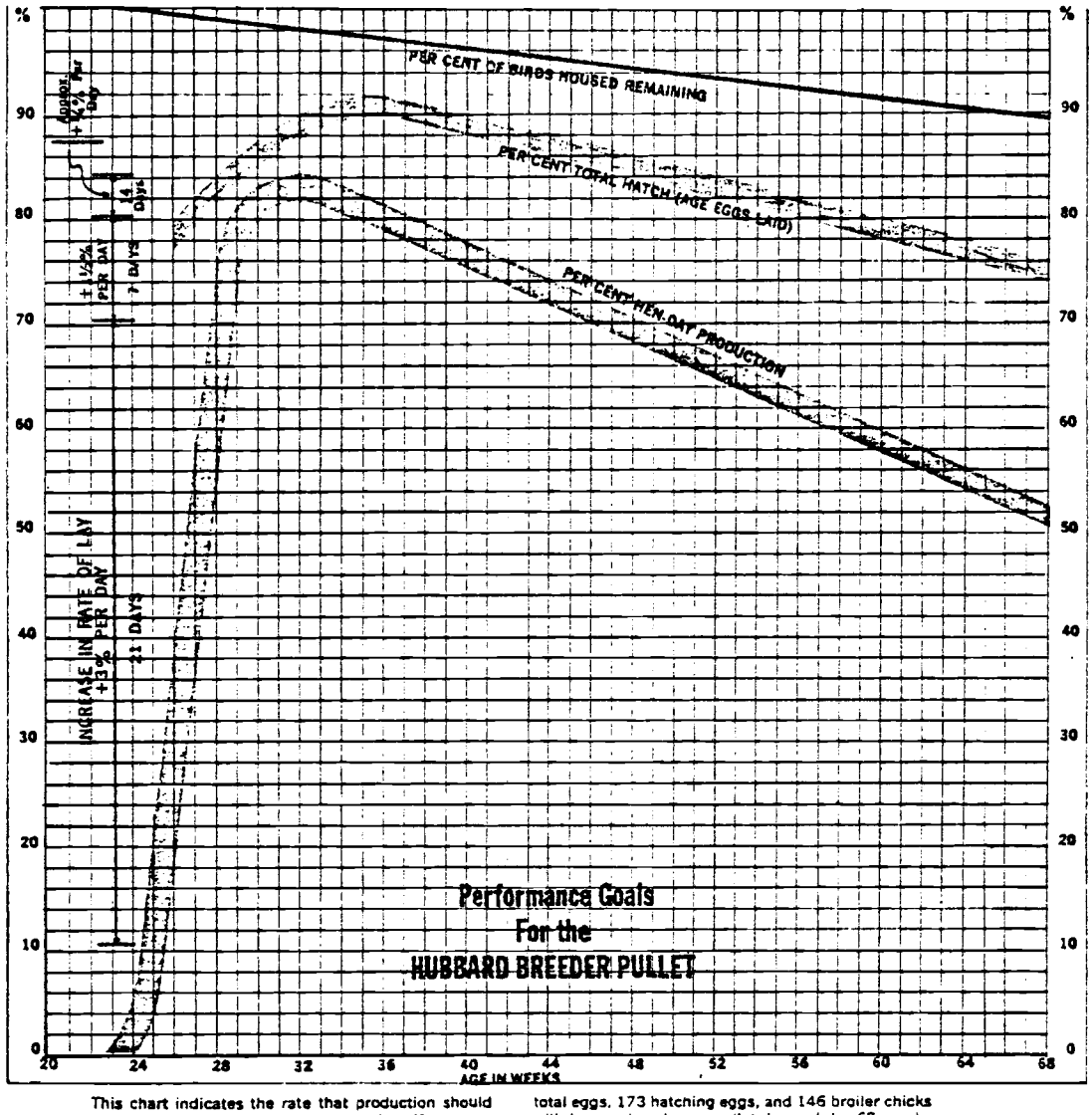
***Final weights are for average chicken house body weights. Plant weights should average 5 to 6% below the 68 week weight above.*

24) Recommended Body Weights for Hubbard Breeder Female.
Source: Management Guide for the Hubbard Breeder Pullet, 1981-1982.
Hubbard Farms. Research and Development.
Walpole, New Hampshire.

Age	Hatching Eggs Per Hen Housed	% Hatch	Weekly Broiler Chicks
26	.65		
27	1.84		
28	2.96		
29	4.15	77	.50
30	4.80	81	1.49
31	5.05	82	2.42
32	5.30	83	3.44
33	5.48	85	4.08
34	5.33	87	4.39
35	5.26	88	4.66
36	5.19	89	4.88
37	5.11	90	4.80
38	5.04	91	4.79
39	4.97	91	4.72
40	4.92	91	4.65
41	4.86	90	4.54
42	4.78	90	4.47
43	4.71	90	4.43
44	4.66	89	4.33
45	4.58	89	4.30
46	4.52	88	4.14
47	4.45	87	4.05
48	4.37	87	3.98
49	4.30	86	3.88
50	4.22	86	3.83
51	4.15	85	3.71
52	4.06	85	3.65
53	3.99	84	3.54
54	3.91	83	3.44
55	3.83	83	3.37
56	3.76	82	3.27
57	3.67	82	3.20
58	3.58	81	3.10
59	3.47	81	3.04
60	3.36	80	2.94
61	3.29	80	2.86
62	3.22	79	2.74
63	3.12	79	2.65
64	3.04	78	2.56
65	2.94	78	2.51
66	2.87	77	2.40
67	2.80	77	2.34
68	2.73	76	2.23
69		76	2.18
70		75	2.10
71		75	2.05
43 Wks.	173 Hatching Eggs Per Hen Housed	84.4%	146 Broiler Chicks

Production Goals for the Hubbard Breeder Female.

Source: Management Guide for the Hubbard Breeder Pullet, 1981-1982. Hubbard Farms. Research and Development. Walpole, New Hampshire.



This chart indicates the rate that production should increase from 10% to peak production. If the performance curves are equalled, approximately 183 total eggs, 173 hatching eggs, and 146 broiler chicks will be produced per pullet housed to 68 weeks of age.

26) Performance Goals for Hubbard Breeder Female.
Source: Management Guide for the Hubbard Breeder Pullet, 1981-1982.
Hubbard Farms.
Research and Development.
Walpole, New Hampshire.

APPENDIX 3

LIGHTING PROGRAM

Suggested Lighting Program for Conventional (Windowed) Poultry Houses, 0°-29° Latitude

TABLE I

South of Equator / Month Floor Hatched	North of Equator / Month Floor Hatched	WEEKS OF AGE 1-13	14	16	18	20	22	24	26	28	30-60
JUL	JAN	Use Natural Day to 22 Weeks					14 HRS				
AUG	FEB	Use Natural Day to 20 Weeks			14 HRS						
SEP	MAR	Use Natural Day to 18 Weeks			13 HRS			14 HRS			
OCT	APR	12 HRS		13 HRS			14 HRS				
NOV	MAY	12 HRS		13 HRS			14 HRS				
DEC	JUN	12 HRS		13 HRS			14 HRS				
JAN	JUL	12 HRS		13 HRS			14 HRS				
FEB	AUG	12 HRS		13 HRS			14 HRS				
MAR	SEP	12 HRS		13 HRS			14 HRS				
APR	OCT	Use Natural Day to 22 Weeks					13 HRS				14 HRS
MAY	NOV	Use Natural Day to 28 Weeks								14 HRS	
JUN	DEC	Use Natural Day to 28 Weeks							14 HRS		

Suggested Lighting Program for Conventional (Windowed) Poultry Houses, 30°-39° Latitude

TABLE II

South of Equator / Month Floor Hatched	North of Equator / Month Floor Hatched	WEEKS OF AGE 1-13	14	16	18	20	22	24	26	28	30-60
JUL	JAN	Use Natural Day to 22 Weeks					15 HRS				
AUG	FEB	Use Natural Day to 20 Weeks				15 HRS					
SEP	MAR	14 HRS					15 HRS				
OCT	APR	14 HRS					15 HRS				
NOV	MAY	12 HRS			14 HRS					15 HRS	
DEC	JUN	12 HRS		13 HRS		14 HRS				15 HRS	
JAN	JUL	12 HRS		13 HRS		14 HRS				15 HRS	
FEB	AUG	12 HRS		13 HRS		14 HRS				15 HRS	
MAR	SEP	12 HRS		13 HRS		14 HRS				15 HRS	
APR	OCT	Use Natural Day to 22 Weeks					14 HRS			15 HRS	
MAY	NOV	Use Natural Daylight to 28 Weeks									15 HRS
JUN	DEC	Use Natural Daylight to 28 Weeks									15 HRS

Suggested Lighting Program for Conventional (Windowed) Poultry Houses, 40°-45° Latitude

TABLE III

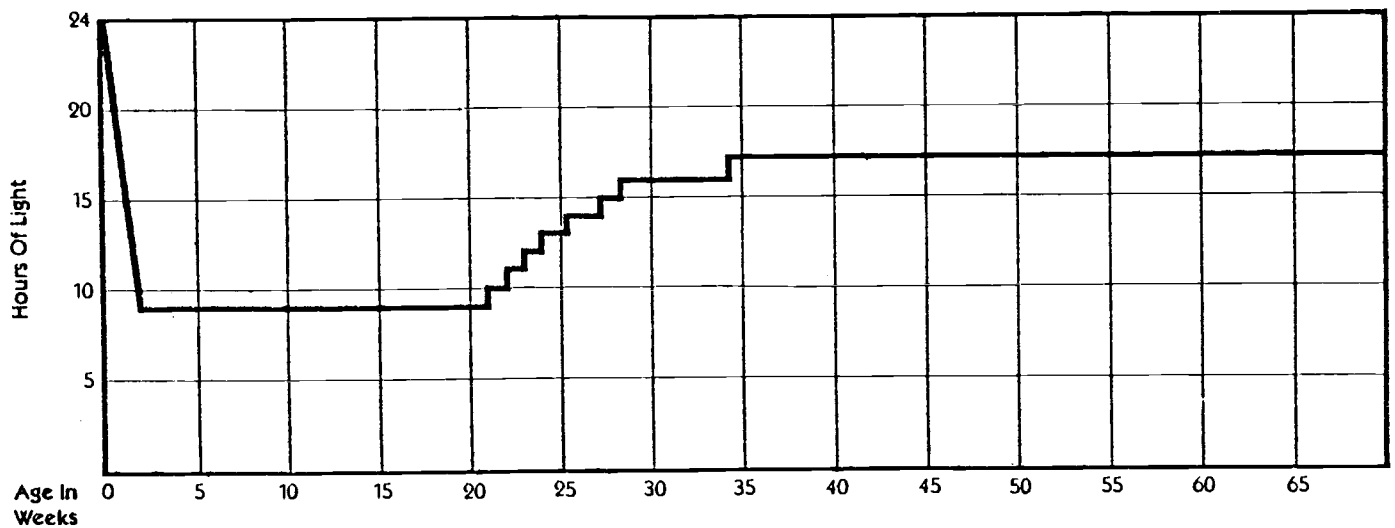
South of Equator / Month Floor Hatched	North of Equator / Month Floor Hatched	WEEKS OF AGE 1-13	14	16	18	20	22	24	26	28	30-60
JUL	JAN	Use Natural Day to 22 Weeks					16 HRS				
AUG	FEB	Use Natural Day to 20 Weeks				16 HRS					
SEP	MAR	15 HRS					16 HRS				
OCT	APR	15 HRS					16 HRS				
NOV	MAY	14 HRS			15 HRS					16 HRS	
DEC	JUN	13 HRS		14 HRS		15 HRS				16 HRS	
JAN	JUL	12 HRS		13 HRS		14 HRS		15 HRS		16 HRS	
FEB	AUG	12 HRS		13 HRS		14 HRS		15 HRS		16 HRS	
MAR	SEP	12 HRS		13 HRS		14 HRS		15 HRS		16 HRS	
APR	OCT	Use Natural Day to 22 Weeks					14 HRS		15 HRS	16 HRS	
MAY	NOV	Use Natural Daylight to 28 Weeks									16 HRS
JUN	DEC	Use Natural Daylight to 28 Weeks									16 HRS

Suggested Lighting Program for Conventional (Windowed) Poultry Houses, 46°-55° Latitude

TABLE IV

South of Equator / Month Floor Hatched	North of Equator / Month Floor Hatched	WEEKS OF AGE 1-13	14	16	18	20	22	24	26	28	30-60
JUL	JAN	Use Natural Day to 22 Weeks					17 HRS				
AUG	FEB	Use Natural Day to 20 Weeks				17 HRS					
SEP	MAR	17 HRS					17 HRS				
OCT	APR	9 HRS					17 HRS				
NOV	MAY	15 HRS				16 HRS		17 HRS			
DEC	JUN	12 HRS		13 HRS		14 HRS		15 HRS		16 HRS	17 HRS
JAN	JUL	12 HRS		13 HRS		14 HRS		15 HRS		16 HRS	17 HRS
FEB	AUG	10 HRS		11 HRS		12 HRS		13 HRS		14 HRS	15 HRS	16 HRS	17 HRS	17 HRS
MAR	SEP	10 HRS		11 HRS		12 HRS		13 HRS		14 HRS	15 HRS	16 HRS	17 HRS	17 HRS
APR	OCT	Use Natural Daylight to 30 Weeks of Age									17 HRS
MAY	NOV	Use Natural Daylight to 30 Weeks of Age									17 HRS
JUN	DEC	Use Natural Daylight to 28 Weeks of Age								17 HRS	17 HRS	17 HRS

1) Lighting Program for Arbor Acres Broiler Breeders.
   Source: Broiler Breeder Female. Feeding and Management. 1981.
   Arbor Acres Farm, Inc.
   Technical Service Department
   Glastonbury, Connecticut USA



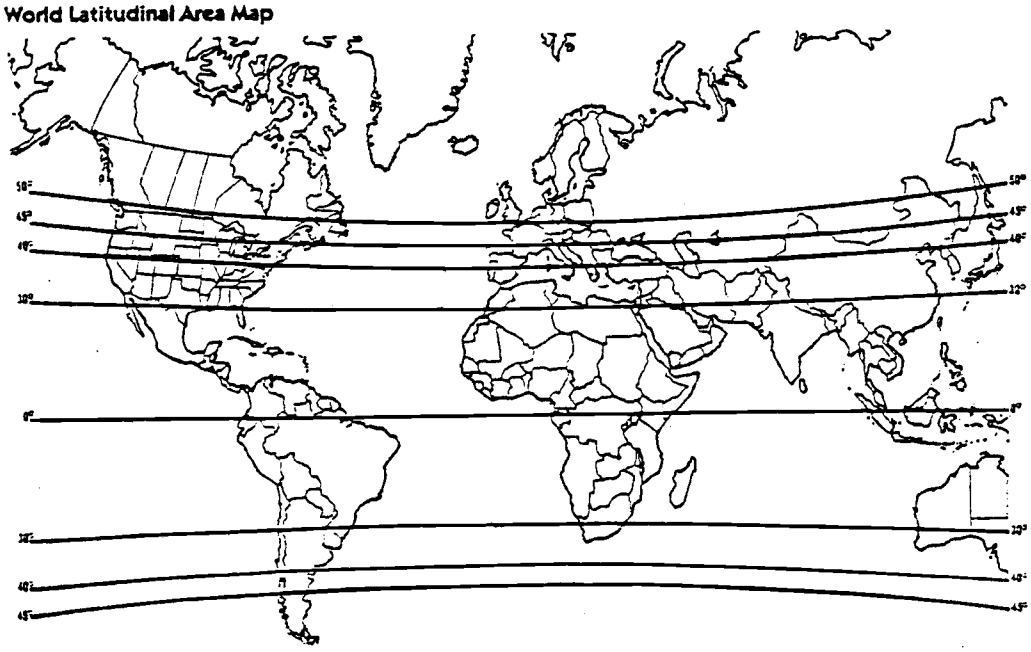
2) Grower Lighting Program Guide for Environment Controlled (Windowless) Houses for Cobb Broiler Breeders.
Source: Cobb Breeder Management Guide, 1981
Cobb Incorporated
Concord, Massachusetts 01742.

Cobb Layer Lighting Program Guide
for 30°-39° North Latitude Area

	Age In Weeks												
Hatching Month		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Natural Day Length	1	10:00	10:50	11:50	13:00	14:00	14:30	14:00	13:00	12:00	11:15	10:15	9:45
Month Artificial Lights Start		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Natural Day Length	18	14:00	14:30	14:00	13:00	12:00	11:15	10:15	9:45	10:00	10:50	11:50	13:00
Total Lighting (Natural Day Plus Artificial Lights)	18	N[1]	N	14:00	14:00	14:00	13:00	13:00	13:00	13:00	N	N	N
	20	N	15:00	15:00	14:30	14:30	14:00	14:00	14:00	14:00	N	N	N
	23	15:00	15:30	16:00	15:30	15:30	15:00	15:00	15:00	15:00	14:00	N	N
	28	16:00	16:00	16:30	16:00	16:00	16:00	16:00	16:00	16:00	15:00	15:00	15:00
	34	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:00	16:00	16:00

1. N= Natural Day Length

World Latitudinal Area Map



3) Cobb Layer Lighting Programs.
Source: Cobb Breeder Management Guide, 1981.
Cobb Incorporated.
Concord, Massachusetts 01742.

Cobb Layer Lighting Program Guide for 40°-45° North Latitude Area

	Age In Weeks											
Hatching Month		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Natural Day Length	1	9:00	10:20	11:40	13:20	14:40	15:30	15:00	13:50	12:20	10:50	9:20	8:40
Month Artificial Lights Start		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Natural Day Length	18	14:40	15:30	15:00	13:50	12:20	10:50	9:20	8:40	9:00	10:20	11:40	13:20
Total Lighting (Natural Day Plus Artificial Lights)	18	N[1]	N	15:00	15:00	13:00	13:00	13:00	13:00	13:00	N	N	N
	20	N	15:30	15:00	15:00	14:30	14:00	14:00	14:00	14:00	13:00	N	N
	23	15:30	16:00	16:00	16:00	15:30	15:00	15:00	15:00	15:00	15:00	N	N
	28	16:00	16:30	16:30	16:30	16:00	16:00	16:00	16:00	16:00	16:00	16:00	16:30
	34	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30

1. N - Natural Day Length

Cobb Layer Lighting Program Guide for 45°-50° North Latitude Area

	Age In Weeks											
Hatching Month		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Natural Day Length	1	8:20	10:00	11:30	14:00	15:20	16:20	15:50	14:30	12:15	10:30	9:20	8:00
Month Artificial Lights Start		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Natural Day Length	18	15:20	16:20	15:50	14:30	12:15	10:30	9:20	8:00	8:20	10:00	11:30	14:00
Total Lighting (Natural Day Plus Artificial Lights)	18	N[1]	N	16:00	15:00	14:00	13:00	13:00	13:00	13:00	N	N	N
	20	N	16:00	16:00	15:00	14:30	14:00	14:00	14:00	14:00	13:00	N	N
	23	16:30	16:30	16:30	16:00	15:00	15:00	15:00	15:00	15:00	14:00	N	N
	28	17:00	17:00	17:00	16:30	16:00	16:00	16:00	16:00	16:00	15:00	16:00	16:30
	34	17:00	17:00	17:00	16:30	16:30	16:30	16:30	16:30	16:30	16:00	16:30	17:00

1. N - Natural Day Length

4) Cobb Layer Lighting Programs.
Source: Cobb Breeder Management Guide, 1981.
Cobb Incorporated.
Concord, Massachusetts 01742.

Cobb Layer Lighting Program Guide for 40°-45° South Latitude Area

	Age In Weeks												
Hatching Month		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Natural Day Length	1	15:00	13:50	12:20	10:50	9:20	8:40	9:00	10:20	11:40	13:20	14:40	15:30
Month Artificial Lights Start		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Natural Day Length	18	9:20	8:40	9:00	10:20	11:40	13:20	14:40	15:30	15:00	13:50	12:20	10:50
Total Lighting (Natural Day Plus Artificial Lights)	18	13:00	13:00	13:00	N[1]	N	N	N	N	15:00	15:00	14:00	13:00
	20	14:00	14:00	14:00	N	N	N	N	15:30	15:00	15:00	14:30	14:00
	23	15:00	15:00	15:00	15:00	N	N	15:30	16:00	16:00	16:00	15:30	15:00
	28	16:00	16:00	16:00	16:00	16:00	16:00	16:00	16:30	16:30	16:30	16:00	16:00
	34	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30	16:30

1. N Natural Day Length

Cobb Layer Lighting Program Guide for 30°-39° South Latitude Area

	Age In Weeks												
Hatching Month		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Natural Day Length	1	14:10	13:10	12:20	11:15	10:15	9:45	10:00	10:50	11:50	13:00	14:00	14:30
Month Artificial Lights Start		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Natural Day Length	18	10:15	9:45	10:00	10:50	11:50	13:00	14:00	14:30	14:10	13:10	12:20	11:15
Total Lighting (Natural Day Plus Artificial Lights)	18	13:00	13:00	13:00	N[1]	N	N	N	N	14:30	14:00	14:00	13:00
	20	14:00	14:00	14:00	N	N	N	N	15:00	15:00	14:30	14:30	14:00
	23	15:00	15:00	15:00	15:00	N	N	15:00	15:30	16:00	15:30	15:30	15:00
	28	16:00	16:00	16:00	16:00	15:00	15:00	16:00	16:00	16:30	16:00	16:00	16:00
	34	16:30	16:30	16:30	16:30	16:00	16:00	16:30	16:30	16:30	16:30	16:30	16:30

1. N Natural Day Length

5) Cobb Layer Lighting Programs.
Source: Cobb Breeder Management Guide, 1981.
Cobb Incorporated.
Concord, Massachusetts 01742.

Light Programme for Conventional Windowed or Open-Sided Houses
Latitude: 10° N or S

Hatch Date Northern Hemisphere Southern Hemisphere	At 18 Weeks of Age			Total Daylength: Artificial and/or Natural Light									
	Date	Natural Daylength	*	1-3 Days	4 Days to 133 Days	19 wk	20 wk	21 wk	22 wk	23 wk	29 wk	31 wk	32 wk	52 wk
Jan. 15 July 15	May 21 Nov. 18	12:36	I	23 h	12½ h constant light	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h
Feb. 15 Aug. 15	June 21 Dec. 19	12:40	I	23 h	12¾ h constant light	15 h	15 h	15 h	16 h	16 h	16 h	16¾ h	17 h	17 h
Mar. 15 Sept. 15	July 19 Jan. 19	12:36	D	23 h	12½ h to 14 weeks 14-18 weeks: Daylight	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h
Apr. 15 Oct. 15	Aug. 19 Feb. 18	12:22	D	23 h	12½ h to 10 weeks 10-18 weeks: Daylight	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h
May 15 Nov. 15	Sept 19 Mar. 21	12:06	D	23 h	Daylight	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h
June 15 Dec. 15	Oct. 19 Apr. 20	11:51	D	23 h	Daylight	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h
July 15 Jan. 15	Nov. 18 May 21	11:37	D	23 h	Daylight	14 h	15 h	15 h	15 h	16 h	16 h	15½ h	16 h	*17 h
Aug. 15 Feb. 15	Dec. 19 June 21	11:30	D	23 h	Daylight	14 h	14 h	14 h	15 h	15 h	15 h	15½ h	16 h	*17 h
Sept. 15 Mar. 15	Jan. 19 July 19	11:34	I	23 h	Daylight	14 h	14 h	14 h	15 h	15 h	15 h	15½ h	16 h	*17 h
Oct. 15 Apr. 15	Feb. 18 Aug. 19	11:47	I	23 h	12 h constant light	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h
Nov. 15 May 15	Mar. 21 Sept. 19	12:05	I	23 h	12 h constant light	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h
Dec. 15 June 15	Apr. 20 Oct. 19	12:21	I	23 h	12½ h constant light	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h

Hours: Mins.

*Increasing = I
Decreasing = D

*After 52 weeks of age, the increase of daylength by one hour is optional

6) Lighting Programs for Starbro Broiler Breeders.
Source: Shaver Starbro Parent Management Guide, 1981.
Shaver Poultry Breeding Farms Limited.
P.O. Box 400, Cambridge, Ontario, Canada N1R 5V9

Light Programme for Conventional Windowed or Open-Sided Houses
Latitude: 20° N or S

Hatch Date Northern Hemisphere Southern Hemisphere	At 18 Weeks of Age			Total Daylength: Artificial and or Natural Light									
	Date	Natural Daylength	*	1-3 Days	4 Days to 133 Days	19 wk	20 wk	21 wk	22 wk	23 wk	28 wk	31 wk	32 wk	52 wk
Jan. 15 July 15	May 21 Nov. 18	13:08	I	23 h	13 h constant light	15 h	15 h	15 h	15 h	16 h	16 h	16½ h	17 h	17 h
Feb. 15 Aug. 15	June 21 Dec. 19	13:20	I	23 h	13½ h constant light	—	16 h	16 h	15 h	16 h	16 h	16½ h	17 h	17 h
Mar. 15 Sept. 15	July 19 Jan. 19	13:08	D	23 h	13½ h to 14 weeks 14-18 weeks: Daylight	15 h	15 h	15 h	15 h	16 h	16 h	16½ h	17 h	17 h
Apr. 15 Oct. 15	Aug. 19 Feb. 18	12:37	D	23 h	13½ h to 10 weeks 10-18 weeks: Daylight	15 h	15 h	15 h	15 h	16 h	16 h	16½ h	17 h	17 h
May 15 Nov. 15	Sept 19 Mar. 21	12:04	D	23 h	Daylight	15 h	15 h	15 h	15 h	16 h	16 h	16½ h	17 h	17 h
June 15 Dec. 15	Oct. 19 Apr. 20	11:31	D	23 h	Daylight	14 h	14 h	14 h	15 h	15 h	15 h	15½ h	*16 h	17 h
July 15 Jan. 15	Nov. 18 May 21	11:05	D	23 h	Daylight	14 h	14 h	14 h	15 h	15 h	15 h	15½ h	*16 h	17 h
Aug. 15 Feb. 15	Dec. 19 June 21	10:54	D	23 h	Daylight	13 h	14 h	14 h	15 h	15 h	15 h	15½ h	*16 h	17 h
Sept. 15 Mar. 15	Jan. 19 July 19	11:02	I	23 h	Daylight	14 h	14 h	14 h	15 h	15 h	15 h	15½ h	*16 h	17 h
Oct. 15 Apr. 15	Feb. 18 Aug. 19	11:29	I	23 h	11½ h constant light	14 h	14 h	14 h	15 h	15 h	15 h	15½ h	*16 h	17 h
Nov. 15 May 15	Mar. 21 Sept. 19	12:05	I	23 h	12 h constant light	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h
Dec. 15 June 15	Apr. 20 Oct. 19	12:38	I	23 h	12½ h constant light	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h

Hours: Mins.

*Increasing = I
Decreasing = D

*After 52 weeks of age, the increase of daylength by one hour is optional.

7) Lighting Programs for Starbro Broiler Breeders.
Source: Shaver Starbro Parent Management Guide, 1981.
Shaver Poultry Breeding Farms Limited.
P.O. Box 400, Cambridge, Ontario, Canada N1R 5V9

Light Programme for Conventional Windowed or Open-Sided Houses
Latitude: 30° N or S

Hatch Date Northern Hemisphere / Southern Hemisphere	At 18 Weeks of Age			Total Daylength: Artificial and or Natural Light									
	Date	Natural Daylength	*	1-3 Days	4 Days to 133 Days	19 wk	20 wk	21 wk	22 wk	23 wk	28 wk	31 wk	32 wk	52 wk
Jan. 15 / July 15	May 21 / Nov. 19	13:46	I	23 h	13:45 h constant light	—	16 h	16 h	16 h	16 h	16 h	16 h	17 h	17 h
Feb. 15 / Aug. 15	June 21 / Dec. 19	14:05	I	23 h	14 h constant light	—	16 h	16 h	16 h	16 h	16 h	16 h	17 h	17 h
Mar. 15 / Sept. 15	July 19 / Jan. 19	13:51	D	23 h	14 h to 14 weeks 14-18 weeks: Daylight	—	16 h	16 h	16 h	16 h	16 h	16 h	17 h	17 h
Apr. 15 / Oct. 15	Aug. 19 / Feb. 18	13:09	D	23 h	14 h to 10 weeks 10-18 weeks: Daylight	15 h	15 h	15 h	16 h	16 h	16 h	16 h	17 h	17 h
May 15 / Nov. 15	Sept. 19 / Mar. 21	12:17	D	23 h	Daylight	15 h	15 h	15 h	15 h	16 h	16 h	16 h	17 h	17 h
June 15 / Dec. 15	Oct. 19 / Apr. 22	11:19	D	23 h	Daylight	14 h	14 h	14 h	15 h	15 h	15 h	15 h	16 h	*17 h
July 15 / Jan. 15	Nov. 18 / May 21	10:37	D	23 h	Daylight	13 h	14 h	14 h	15 h	15 h	15 h	15 h	16 h	*17 h
Aug. 15 / Feb. 15	Dec. 19 / June 21	10:13	D	23 h	Daylight	13 h	14 h	14 h	15 h	15 h	15 h	15 h	16 h	*17 h
Sept. 15 / Mar. 15	Jan. 19 / July 19	10:29	I	23 h	Daylight	13 h	14 h	14 h	15 h	15 h	15 h	15 h	16 h	*17 h
Oct. 15 / Apr. 15	Feb. 18 / Aug. 19	11:12	I	23 h	11 h constant light	14 h	14 h	14 h	15 h	15 h	15 h	15 h	16 h	*17 h
Nov. 15 / May 15	Mar. 21 / Sept. 21	12:08	I	23 h	12 h constant light	15 h	15 h	15 h	16 h	16 h	16 h	16 h	17 h	17 h
Dec. 15 / June 15	Apr. 20 / Oct. 19	13:01	I	23 h	13 h constant light	16 h	16 h	16 h	16 h	16 h	16 h	16 h	17 h	17 h

Hours: Mins

*Increasing = I
Decreasing = D

*After 32 weeks of age, the increase of daylength by one hour is optional.

8) Lighting Programs for Starbro Broiler Breeders.
Source: Shaver Starbro Parent Management Guide, 1981.
Shaver Poultry Breeding Farms Limited.
P.O. Box 400, Cambridge, Ontario, Canada N1R 5V9

Light Programme for Conventional Windowed or Open-Sided Houses
Latitude: 40° N or S

Hatch Date Northern Hemisphere Southern Hemisphere	At 18 Weeks of Age			Total Daylength: Artificial and/or Natural Light										
	Date	Natural Daylength	*	1-3 Days	4 Days to 133 Days	19 wk	20 wk	21 wk	22 wk	23 wk	28 wk	31 wk	32 wk	52 wk
Jan. 15 July 15	May 21 Nov. 18	14:33	I	23 h	14½ h constant light	—	16 h	16 h	16 h	16 h	16 h	16½ h	17 h	17 h
Feb. 15 Aug. 15	June 21 Dec. 19	15:02	I	23 h	15 h constant light	—	16 h	16 h	16½ h	16½ h	16½ h	17 h	17 h	17 h
Mar. 15 Sept. 15	July 19 Jan. 19	14:39	D	23 h	14½ h to 14 weeks 14-18 weeks: Daylight	—	16 h	16 h	16 h	16 h	16 h	16½ h	17 h	17 h
Apr. 15 Oct. 15	Aug. 19 Feb. 18	13:37	D	23 h	14½ h to 10 weeks 10-18 weeks: Daylight	16 h	16 h	16 h	16 h	16 h	16 h	16½ h	17 h	17 h
May 15 Nov. 15	Sept. 19 Mar. 21	12:22	D	23 h	Daylight	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h
June 15 Dec. 15	Oct. 19 Apr. 20	10:58	D	23 h	Daylight	13 h	14 h	14 h	15 h	15 h	15 h	15½ h	16 h	17 h
July 15 Jan. 15	Nov. 18 May 21	9:55	D	23 h	Daylight	12 h	13 h	14 h	15 h	15 h	15 h	15½ h	16 h	17 h
Aug. 15 Feb. 15	Dec. 19 June 21	9:20	D	23 h	Daylight	12 h	13 h	14 h	15 h	15 h	15 h	15½ h	16 h	17 h
Sept. 15 Mar. 15	Jan. 19 July 19	9:45	I	23 h	Daylight	13 h	14 h	14 h	15 h	15 h	15 h	15½ h	16 h	17 h
Oct. 15 Apr. 15	Feb. 18 Aug. 19	10:49	I	23 h	10½ h constant light	14 h	14 h	14 h	15 h	15 h	15 h	15½ h	16 h	17 h
Nov. 15 May 15	Mar. 21 Sept. 21	12:09	I	23 h	12 h constant light	15 h	15 h	15 h	16 h	16 h	16 h	16½ h	17 h	17 h
Dec. 15 June 15	Apr. 20 Oct. 19	13:27	I	23 h	13½ h constant light	—	16 h	16 h	16 h	16 h	16 h	16½ h	17 h	17 h

Hours: Mins.

*Increasing = I
Decreasing = D

*After 52 weeks of age, the increase of daylength by one hour is optional.

9) Lighting Programs for Starbro Broiler Breeders.
Source: Shaver Starbro Parent Management Guide, 1981.
Shaver Poultry Breeding Farms Limited.
P.O. Box 400, Cambridge, Ontario, Canada N1R 5V9

Month Placed	Hours Of Daylight When Placed	Hours Of Daylight At 20 Wks.	Age At Lighting	Hours To Use At Lighting
January	10	14½	21 Wks.	15 Hrs.
February	10½	14½	21 Wks.	15 Hrs.
March	11½	14¼	20 Wks.	14½ Hrs.
April	12½ Lock in natural day length at 16 weeks.	13¼	18 Wks.	14 Hrs.
May	13½ Lock in natural day length at 14 weeks.	12	18 Wks.	14 Hrs.
June	14½ Lock in natural day length at 14 weeks.	10½	18 Wks.	14 Hrs.
July	14½ Lock in natural day length at 16 weeks.	10	18 Wks.	14 Hrs.
August	14	10	20 Wks.	14 Hrs.
September	13	10¼	20 Wks.	14 Hrs.
October	12	11½	21 Wks.	14 Hrs.
November	10½	12½	22 Wks.	14 Hrs.
December	10	13¾	22 Wks.	14½ Hrs.

10) Lighting Program for Pilch Broiler Breeders.
Source: Managing Pilch Breeders - Broilers, 1981.
Pilch, Inc.
P.O. Box 4381 Amity Hill Road
Troutman, North Carolina 28166.

Pullet Hatch Date (N. Hemisphere)	Growing Period Lighting Program	Approx. Date Pullets Are 18 Wks Old	Hours of Light Stimulation to Add At 18 Wks of Age
Jan. 1	Natural Daylight	May 5	1
Jan. 15	↓	May 20	1
Feb. 1		June 5	1½
Feb. 15		June 20	1½
Mar. 1	↓	July 5	1½
Mar. 15	Lock in Daylight	July 20	2
Apr. 1	Hrs When Pullets	Aug. 5	1½
Apr. 15	Reach 16 Wks	Aug. 20	1½
May 1	of Age (Mar. 15-	Sept. 5	1½
May 15	June 15 Hatches)	Sept. 20	1½
June 1	↓	Oct. 5	1½
June 15	↓	Oct. 20	1½
July 1	Lock in 12 Hrs of	Nov. 5	2½
July 15	Light on Oct. 1	Nov. 20	3
Aug. 1	↓	Dec. 5	3
Aug. 15	↓	Dec. 20	3
Sept. 1	↓	Jan. 5	3
Sept. 15	↓	Jan. 20	2½
Oct. 1	Use 12 Hrs of	Feb. 5	2
Oct. 15	Constant Light	Feb. 20	1½
Nov. 1	1-18 Wks (Oct. &	Mar. 5	1
Nov. 15	Nov. Hatches)	Mar. 20	1
Dec. 1	Natural Daylight	Apr. 5	1
Dec. 15	↓	Apr. 20	1

NOTE: *Additional light stimulation should be provided for all flocks by adding one half-hour every 2 weeks until 16 to 18 hours have been reached. Provide at least 2 additional hours of light stimulation after 18 weeks by adding one half-hour of light at 20, 22, 24 and 26 weeks.*

11) Lighting Program for Hubbard Boiler Breeders (Conventional windowed Houses).
Source: Management Guide for the Hubbard Breeder pullet, 1981-1982.
Hubbard Farms. Research and Development.
Walpole, New Hampshire.

APPENDIX 4

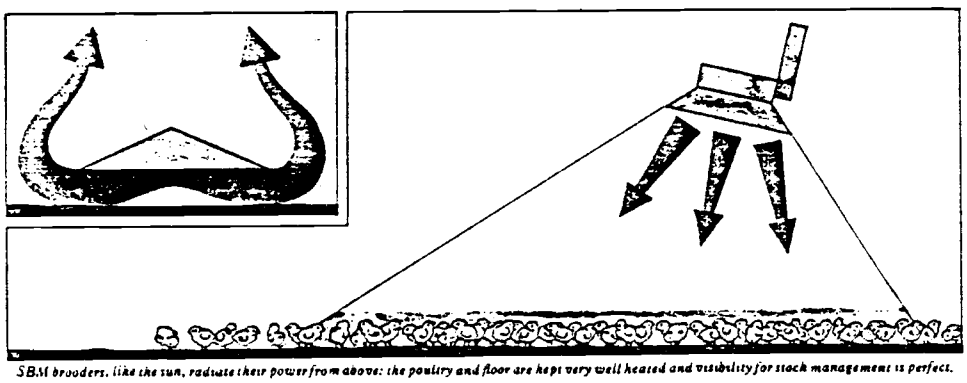
BROODERS

BROODING ARRANGEMENT

PRECISION DEBEAKING

PRODUCTION SYSTEM

SBM Brooders: downgoing heat.



SBM brooders, like the sun, radiate their power from above: the poultry and floor are kept very well heated and visibility for stock management is perfect.

SBM brooders: strong heating at floor level, low heat loss to the ambient air.

Energy savings

In intensive poultry growing facilities, the ambient air must be changed frequently to extract waste gases and provide the necessary oxygen for the animals breathing.

In this ventilation process, the higher the ambient air temperature, the higher the energy consumed.

SBM Brooders radiate their power like the sun, from above. The poultry at floor level, are precisely heated at brooding temperature while the ambient air in the growing facility remains at a lower adequate temperature. The visibility for stock management is perfect.

The energy savings may be as much as 10 to 25% plus.

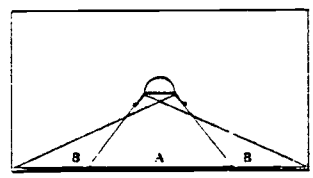
Better performance

The birds in a growing house require different amounts of heat depending on whether they are weak or strong, sleepy or actively moving.

If birds fail to find a comfortable temperature, they over-eat and become inefficient converters of feed.

The heat gradient pattern produced by SBM Brooders at floor level enables all the birds to locate, at any instant, the exact comfort zone which suits them individually.

SBM Brooders:
Feed conversion may be improved by 1 to 1.5% plus



SBM Brooders create a heat refuge on the floor (A) about ten feet in diameter, providing ample space for all the birds, surrounded by a transition zone (B) where the temperature falls off gradually.

Lower mortality and better visual inspection

SBM—the eye level brooder. They are placed about 5 feet off the floor, leaving an unobstructed view of the behavior of the birds making it easy to check their health. The heat refuge is large enough to prevent crowding.

The heat goes where it does the most good. The descending heat warms the floor environment more than the general air and keeps the litter dry and healthy.

SBM Brooders:
Mortality reduced by 1 to 2% of the total number of birds*

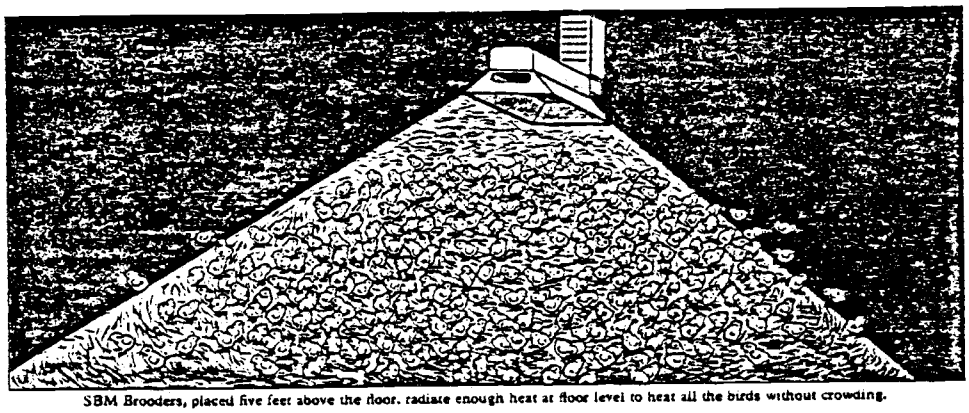
**When compared with most conventional heating systems, where the warm zone is too small and insufficiently heated and the ambient air is too hot. Substantiated by field tests in identical buildings with identical production conditions, climate, animals, feed, disease control etc.*

Your chicks are on the ground and that's where the heat should be found.

1)

Source: SBM Infrared Heating, Inc.
P.O. Box 3437 College Station
225 Industrial Drive,
Fredericksburg, Virginia 22401

SBM Brooders: powerful and efficient.



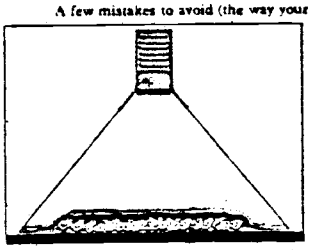
SBM Brooders, placed five feet above the floor, radiate enough heat at floor level to heat all the birds without crowding.

SBM Brooders:
Heating power at floor level for poultry

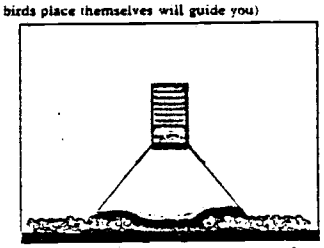
SBM Brooders should be placed about five feet off the floor, with the ambient air temperature adjusted to approximately 70°-80°F according to birds age and weather conditions. You will observe a very even spacing of birds on the floor, with a slightly lower density at the center of the warm area. In spite of the low power consumption of SBM Brooders, the heated area is large enough for all the birds, without crowding, and visibility under the Brooders is excellent. SBM Brooders are so effective that it's normal to operate two thirds of them in the spring and fall and only half in summer.

How to choose and install your SBM Brooders

A few mistakes to avoid (the way your birds place themselves will guide you)

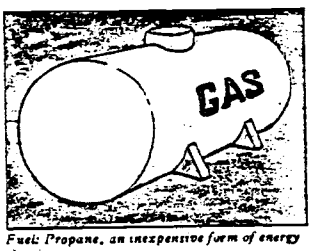


A. Correct use of SBM brooders and controls gives optimum brooding temperatures and economy of energy. If the birds crowd together in the center of the heat refuge they are being underheated.

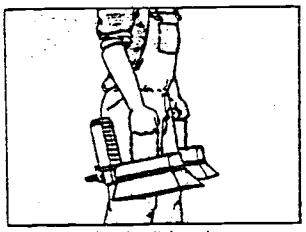


B. If the birds keep away from the heat refuge area, leaving it unoccupied, they are being overheated. Bird spacing and movement will guide you in regulating SBM controls for correct heating and maximum economy.

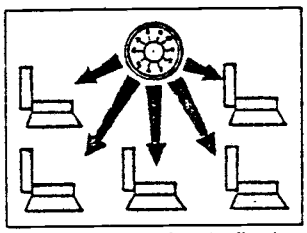
SBM brooders: simple to install and highly reliable.



Fuel: Propane, an inexpensive form of energy that is easy to store.



High-quality brooder, light and compact: one person can carry several at a time.



A single thermostat controls a series of brooders; an installation is easy to set up.

2)

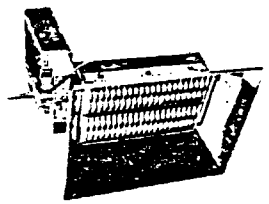
Source: SBM Infrared Heating, Inc.
P.O. Box 3437 College Station
225 Industrial Drive,
Fredericksburg, Virginia 22401

BEFORE INSTALLATION PLEASE READ THE ENTIRE INFORMATION SHEET CAREFULLY.

SBM
DOWNGOING HEAT

TECHNICAL INFORMATION

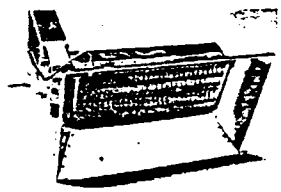
BROODERS FOR POULTRY



SUNNYBIRD 6

REF. 6DRPFS: Infrared LPG gas brooder, all stainless steel with air filter and flame safety device, complete with gas valve, two suspension chains, brackets and support plates.

Suitable for 500-1000 chicks; 200-350 turkey poults depending on housing type and climate. Particularly suited for warm to temperate climate locations. 5,000 to 10,000 BTU. Wt. 4.85 lbs.

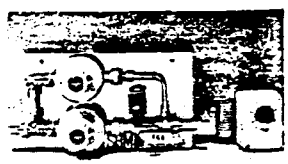


SUNNYBIRD 8

REF. 8DPRFS: Infrared LPG gas brooder, all stainless steel with air filter and flame safety device, complete with gas valve, two suspension chains, brackets and support plates.

Suitable for 500-1250 chicks; 350-500 turkey poults depending on housing type and climate. Particularly suited for temperate to cold climate locations. 7,000 to 14,000 BTU. Wt. 5.5 lbs.

Natural gas model aveilable.
Automatic model with auto-start available.



SEMI-AUTOMATIC
GROUP CONTROL

REF. RG6 + ST 1: Semi-automatic control panel with thermostat for regulating output (220V AC 60 Hz) single phase. Includes gas filter. For 1-18 8DPRFS or 1-24 6DPRFS.

Input pressure to RG6 15-20 psi; RG6 supplies operating pressure to brooder variable between 20"-60" W.C. (0.7-2.2 psi). Maximum flow rate 3.1 gal/hr. Wt. 6.85 lbs.

ACCESSORIES

GAS VALVE

REF. V 11: Individual gas valve inlet ¼" NPT male threaded pipe, outlet: 3/8" nipple, attached by compression joint.

3/8" ID LPG gas hose is available.

3)

Source: SBM Infrared Heating, Inc.
P.O. Box 3437 College Station
225 Industrial Drive,
Fredericksburg, Virginia 22401

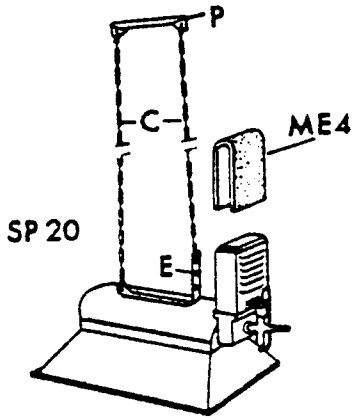
DESCRIPTION OF EQUIPMENT

Brooder support is comprised of a mounting plate P for attaching to the ceiling, two lengths of chains C and a support plate E. REF. SP 20.

Air filter media for placing in filter box. REF. ME 4.

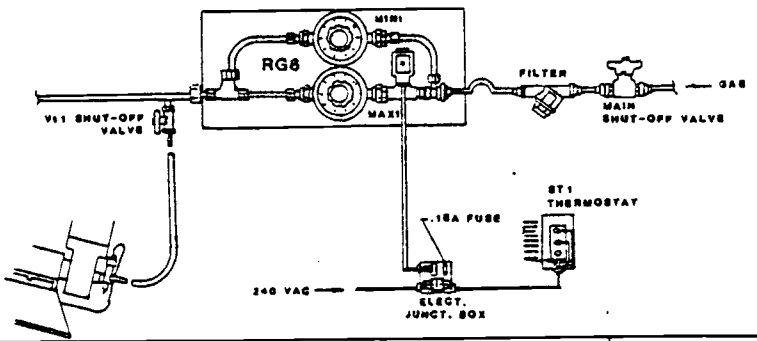
Security flame failure device is fitted as standard.

Gas supply from rigid pipe circuit to brooder by flexible hose, nipple connection 3/8" to injector block is standard. Note: hose ferrule or recognized equipment attachment of rubber hose to nipple is essential.



	6DPRFS	8DPRFS
GAS CONSUMPTION MAXIMUM (60" WG)	0.125 GAL/H	0.182 GAL/H
GAS CONSUMPTION MINIMUM (20" WG)	0.063 GAL/H	0.09 GAL/H
DIMENSIONS	1'4" x 9" x 11"	1'11" x 9" x 11"
UNPACKED WEIGHT	3.75 LB.	4.2 LB.

SCHEMATIC DIAGRAM OF RG6 CONTROL PANEL, THERMOSTAT AND BROODER CONNECTION



EQUIPMENT NECESSARY FOR AN INSTALLATION	QUANTITY TOTALS
1 Sunnybird 8 ref. 8DPRFS Kit for 500 to 1250 chicks depending on housing type and climate for 350 to 500 turkey poults depending on housing type and climate. 1 Sunnybird 6 ref. 6DPRFS Kit for 500 to 100 chicks: CHECK YOUR REQUIREMENTS. for 200 to 350 turkey poults: CHECK YOUR REQUIREMENTS. 1 gas valve per brooder (included in all kits) 1 control panel RG6 with thermostat ST1 for 1-18 8DPRFS. 1-24 6DPRFS	

Attention: Minimum 1 control panel per brooding chamber.

DO NOT FORGET TO INCLUDE:
- **in the gas pipe line a general gas valve, a gas filter**
- **flexible hose for each brooder**
- **for the electric circuit, a differential switch and fuse 0.1 A for each RG 6**

THE SUN'S HEAT COMES DOWN AND SBM'S TOO

4)

Source: SBM Infrared Heating, Inc.
P.O. Box 3437 College Station
225 Industrial Drive,
Fredericksburg, Virginia 22401

GUIDELINES FOR INSTALLATION

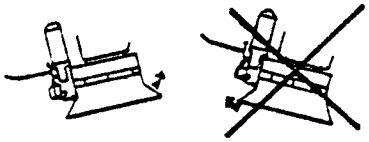
THIS IS YOUR CHECKLIST

NO. ✓

1. ☐ **GAS AND PRESSURE**

SBM brooders for poultry are designed for using LPG — Propane gas. They operate at a pressure variable between 20" and 60" W.G. (0.7-2.2 psi) which is obtained using an SBM control panel. NEVER drill out a brooder orifice.

2. ☐ **INCLINATION AND ATTACHMENT HEIGHT**



Brooder 6DPRFS and 8DPRFS require a hanging angle of approximately 20° to the horizontal (as shown) for efficient operation and should be suspended such that the brooder

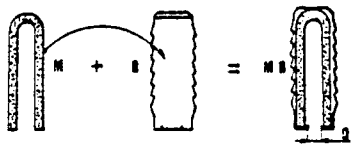
2.1 ☐ nipple fitting is 5' above the litter or floor level. Height can be altered for fine adjustment of temperature and heating area required.

3. ☐ **CEILING**

Minimum distance to be maintained between a radiant heater and the ceiling:
6DPRFS: 2 Ft. 8DPRFS: 2 ft. 10 in.

In case of polystyrene or straw insulation material, these distances must be increased by 1' or more according to the inflammability of the material or place an asbestos protection sheet between the brooder and the ceiling. Brooders should be installed at a minimum of 3 ft. from side walls or other panelling which represents a fire hazard.

4. ☐ **MOUNTING FILTER M**



Fit filter M into the tip of filter holder B taking care to leave space D open.

Then, put the filter holder into the recess provided on the brooder. See diag. page 4 if necessary.

GAS PIPING

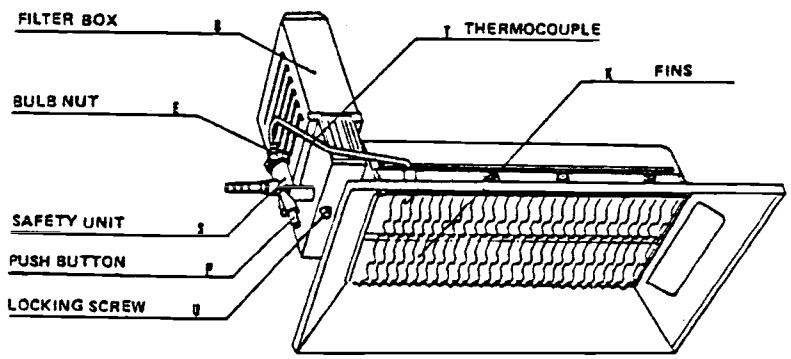
5. ☐ **Diameter:** Designed to keep pressure drops below 5%.

5.1 ☐ **RG6 attachment:** All the connections should be installed by a professional gas serviceman.

5.2 ☐ **Blow off:** All the conduits should be carefully cleaned ensuring there are no dirt particles in the circuit before making the connection to the different control panels and brooders.

5.3 ☐ **Leaks:** Each connection must be checked with leak-detector products before starting up the unit.

continued on page 4



CAUTION — FOLLOW INSTALLATION INSTRUCTIONS CAREFULLY. DO NOT TAKE SHORT-CUTS.

5)

Source: SBM Infrared Heating, Inc.
P.O. Box 3437 College Station
225 Industrial Drive,
Fredericksburg, Virginia 22401

CAUTION: AS WITH ALL GAS APPLIANCES, ADEQUATE VENTILATION SHOULD BE ASSURED.

HOW TO START UP SBM BROODERS

LIGHTING BROODERS

6. — Open main valve for building and put maximum regulator to position 7. Turn up thermostat to open electrovalve, making maximum regulator operational.

6.1 — Turn on current to installation if a control panel RG6 is being used.

6.2 — Open individual brooder valve, press safety push button P while holding flame close to fins K. Hold pressure on button for 30 to 40 seconds. Repeat for next brooder.

6.3 — Set thermostat to desired temperature. Reset mini and maxi control knobs to required levels.

REGULATION OF HEATING POWER

7. **MANUAL:** According to the required temperature under the brooders, regulate by turning the dial.
SEMI-AUTOMATIC: After regulation of your control panel you will obtain the temperature desired automatically, without any further manual operation. Regulate the controls according to climate conditions and time of year.

SHUT-OFF BROODERS

— Close individual valve of each brooder.
— Close main valve for building, turn off current to installation if control panel RG6 is being used.

MAINTENANCE GUIDELINES FOR SBM BROODERS

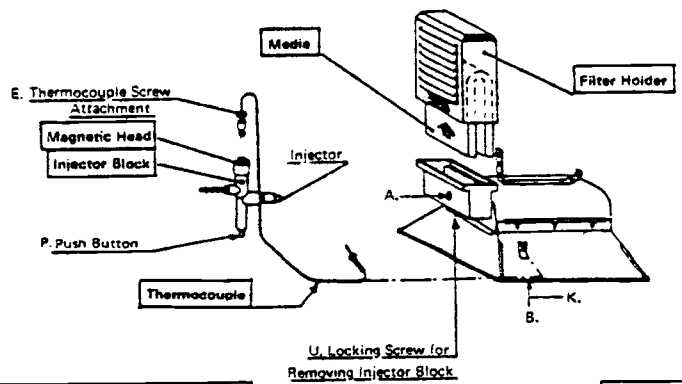
Never aim a high pressure jet of steam, water or chemical at the brooders.

EACH WEEK

— **Replace the filter with a clean one.** CARE: Filters can be washed in warm water (140°). DO NOT START USING THEM AGAIN UNTIL THEY ARE ABSOLUTELY DRY.

BETWEEN EACH FLOCK

1. Remove the filter holder with filter media.
2. Unscrew nut E holding thermocouple to injector block.
3. Unscrew U to release the injecting unit: remove the injecting unit.
4. Ensuring brooders are COLD, aim a stream of compressed air 40-80 psi.
   A. inside the injector block entry location blowing into the entire brooder.
   B. on the grating and fins of the brooder heating surface.
5. Re-assemble injector block and thermocouple, hand tighten plus ¼ turn with small wrench.
6. Check if the flexible hose is in good condition. Replace at least every 2 years.



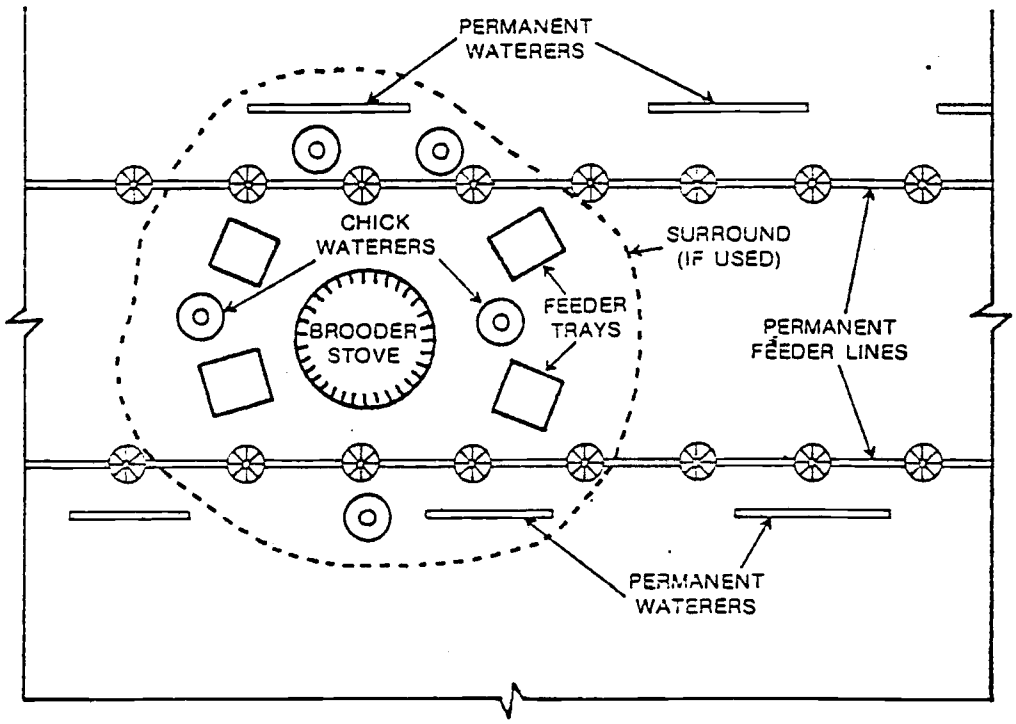
GENERAL RECOMMENDATIONS FOR GAS USAGE
Never test for gas leaks with a lighted match. Only when all connections have been tested and there are no leaks proceed with the start up of a unit.

REPLACEMENT PARTS
All boxed-in parts are available

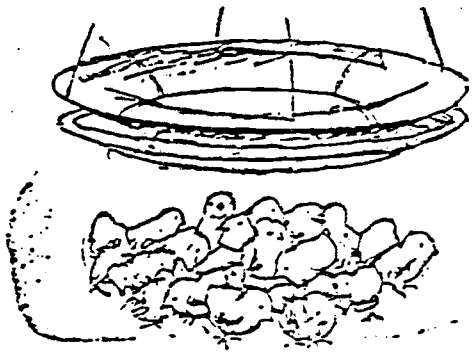
REGULAR MAINTENANCE — MAXIMUM EFFICIENCY

6)

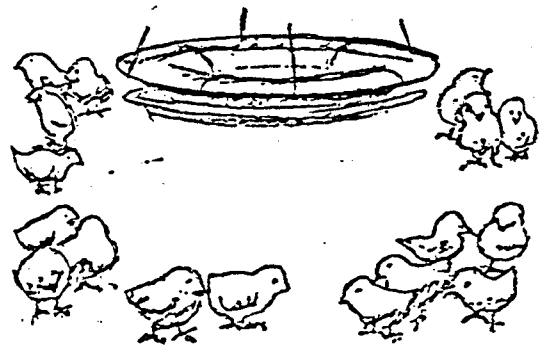
Source: SBM Infrared Heating, Inc.
P.O. Box 3437 College Station
225 Industrial Drive,
Fredericksburg, Virginia 22401



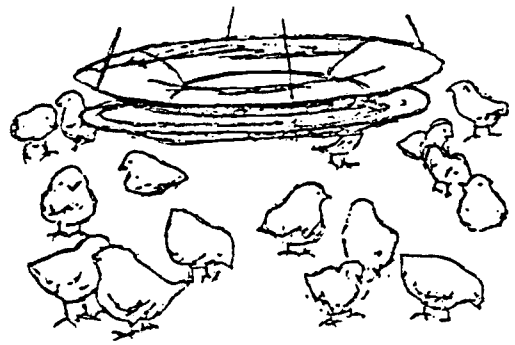
7) Suggested Layout for Brooding Period.
Source: Shaver Starbro Parent Management Guide. 1981.
Shaver Breeding Farms Limited.
P.O. Box 400 Cambridge, Ontario
Canada N1R 5V9



Crowding means they're cold.



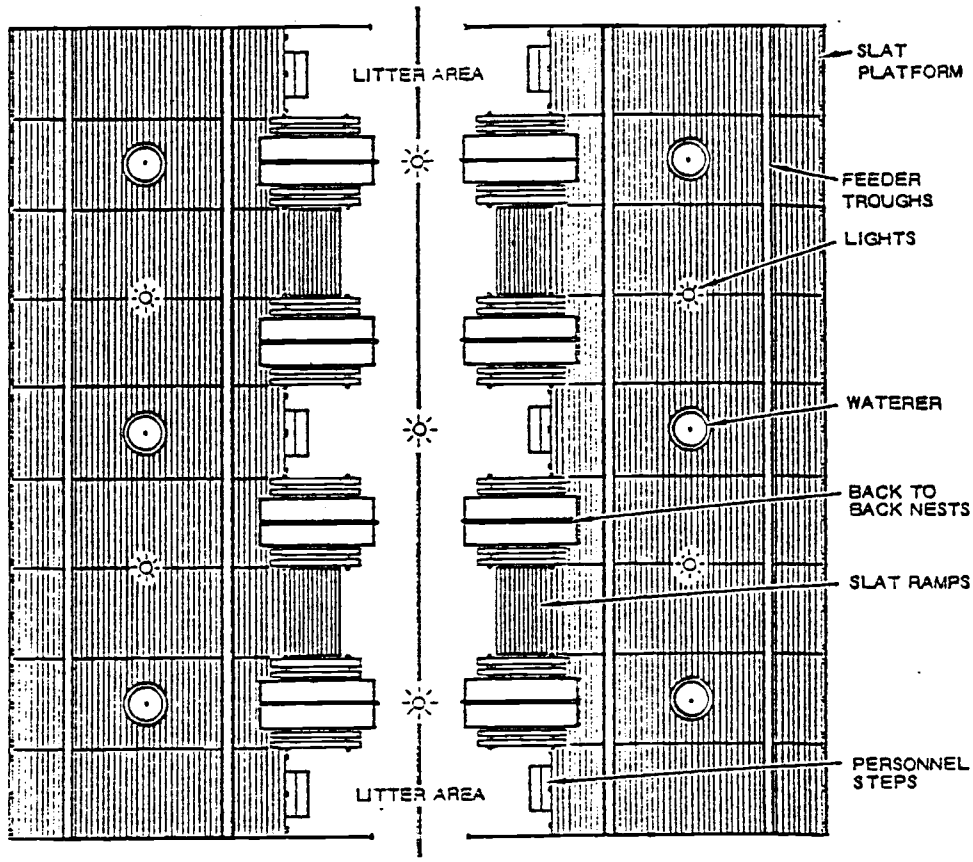
Chickens outside the hover.
Temperature too high.



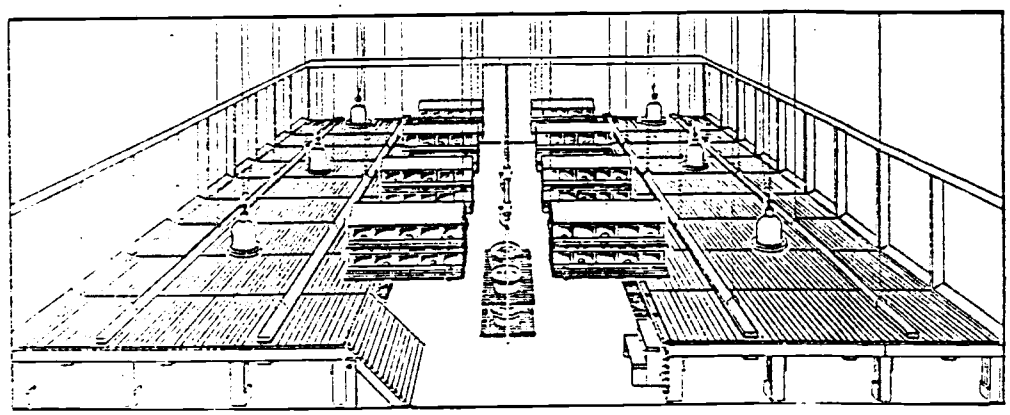
Proper temperature.
Chicks well distributed.

8) Chick Behavior Regarding Brooding Temperature.
Source: Pfizer H & N
"Meat Nick" Breeder Management Program, 1981.
H & N, Inc.
15305 N.E. 40th St., Redmond, WA 98052

9) Precision Debeaking (It holds through laying period)
Source: Broiler Breeder Female. Feeding and Management. 1981.
Arbor Acres Farm, Inc.
Technical Service Department
Glastonbury, Connecticut USA



10) Basic Litter/Slat House Equipment Arrangement.
Source: Arbor Acres.
Slat Plans and Management for Poultry Houses, 1981.
Arbor Acres Farm, Inc.
Glastonbury, Connecticut USA



11) Basic Litter/Slat House View.
Source: Arbor Acres.
Slat Plans and Management for Poultry Houses.
1981.
Arbor Acres Farm, INc.
Glastonbury, Connecticut USA

APPENDIX 5

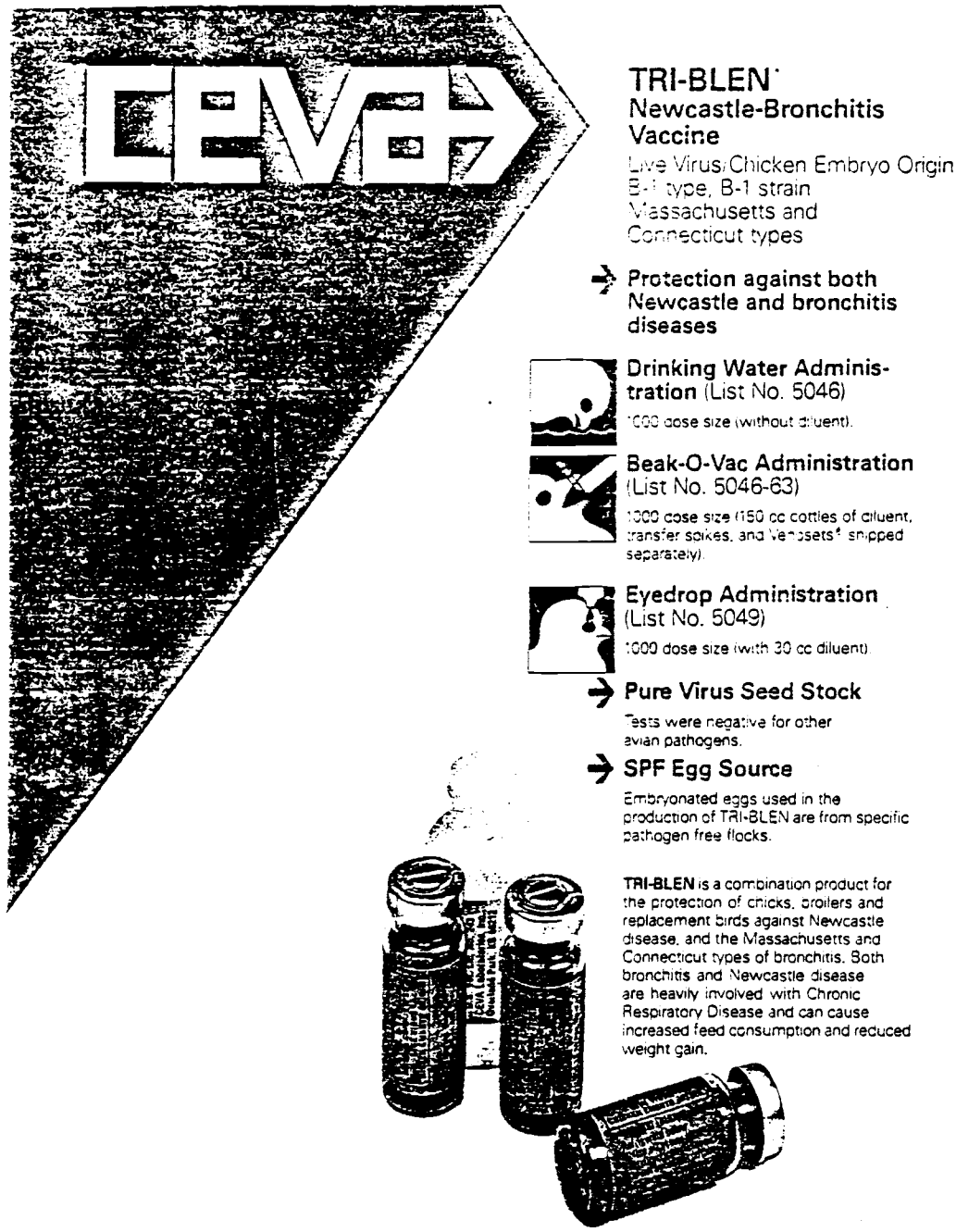
VACCINATION PROGRAMS

AGE	TYPE	PRODUCT	LIST NO.	APPLICATION
1 DAY	MAREK'S			INJECTED
10-14 DAYS	NEWCASTLE/BRONCHITIS	TRI-BLEN	5046	DRINKING WATER
6 WEEKS	NEWCASTLE/BRONCHITIS	NB-BLEN	5741	DRINKING WATER
		OR		
		NB-BLEN-PLUS	5299	DRINKING WATER
8 WEEKS	FOWL POX	FP-BLEN	5179	WING STAB
	AND			
	FOWL CHOLERA	C.U. STRAIN		INJECTED
12 WEEKS	A.E.	TREMOR-BLEN-D	5210	DRINKING WATER
	OR			
	A.E./FOWL POX			WING STAB
11-12 WEEKS	I.B.D. (LIVE)			DRINKING WATER
13-14 WEEKS	FOWL POX	FP-BLEN	5179	WING STAB
	AND			
	CHOLERA	C.U. STRAIN		INJECTED
16 WEEKS	NEWCASTLE/BRONCHITIS	BRON-BLEN-L	5265	DRINKING WATER
19 WEEKS	NEWCASTLE (KILLED)			INJECTED

1) General Broiler Breeder Vaccination Program.
Source: CEVA Laboratories, Inc.
10560 Barkley. Overland Park, KS 66212

AGE	TYPE	PRODUCT	LIST NO.	APPLICATION
1 Day	Mareks	HVT-BLEN	5323	Sub-Cu
1 Day	Fowl Pox	TCP-BLEN	5778	Sub-Cu
8 Days	Infectious Bursal Dis.	IBD-BLEN	5321	Drinking Water
14 Days	Newcastle-Bronchitis	TRI-BLEN	5046	Drinking Water
4 Weeks	Viral Arthritis	VA-BLEN	5315	Sub-Cu
6 Weeks	Newcastle-Bronchitis	NB-BLEN-PLUS	5299	Drinking Water
10 Weeks	AE-Fowl Pox	PT-BLEN	8344	Wing Web
10 Weeks	Viral Arthritis	VA-BLEN	5315	Sub-Cu
16 Weeks	Newcastle-Bronchitis	BI-BLEN-H	3728	Drinking Water
		OR		
		NB-BLEN-PLUS	5299	Drinking Water
18 Weeks	Newcastle (Killed)			Sub-Cu
18 Weeks	Fowl Cholera			Sub-Cu
Every 90 days	Bronchitis	BRON-BLEN	5566	Drinking Water

2) Broiler Breeder Vaccination Program for the State of Georgia.
Source: CEVA Laboratories, Inc.
10560 Barkley. Oveland Park, KS 66212



3) Description of Selected Vaccines.
Source: CEVA Laboratories, Inc.
10560 Barkley
Overland Park, KS 66212

TRI-BLEN®

Newcastle-Bronchitis Vaccine

List No. 5046 (Drinking Water)
List No. 5046-63 (Beak-O-Vac)
List No. 5049 (Eyedrop)

DESCRIPTION

TRI-BLEN is a live virus, chicken embryo origin vaccine for the prevention of Newcastle and bronchitis diseases in chickens. It contains B-1 type, B-1 strain Newcastle, and Massachusetts and Connecticut types of bronchitis virus.

ADMINISTRATION

Initial Vaccination, Drinking Water Method. The drinking water method of administration (List No. 5046) may be used for initial vaccination of chickens 21 days of age or older.

Initial Vaccination, Beak-O-Vac Method. The beak-o-vac method of administration (List No. 5046-63) may be used for chickens at one day of age.

Initial Vaccination, Eyedrop Method. The eyedrop method of administration (List No. 5049) may be used for initial vaccination of chickens 4 days of age or older.

REVACCINATION

Revaccinate approximately 4 weeks after initial vaccination by eyedrop or drinking water methods. Birds held over as replacement stock should be revaccinated against Newcastle disease and infectious bronchitis at 16 to 18 weeks of age.

PRECAUTIONS

1. Birds should be vaccinated before they reach maturity since bronchitis virus may cause permanent damage to the reproductive tract of mature birds, resulting in eggs with poor interior quality and shell texture.
2. Infectious bronchitis is highly contagious when non-vaccinated birds are kept in close contact with vaccinated birds during the period of respiratory signs. The vaccine should be used with caution around non-vaccinated laying birds.
3. Newcastle virus may cause a mild inflammation of the eye in humans which last for two or three days. Care should be taken in handling the vaccine to avoid contact with eyes.
4. Mix only the amount of vaccine to be used immediately and use promptly. Use all at one time and do not stretch dosage.
5. Burn all vaccine containers, applicators and unused vaccine when vaccination is complete.
6. Do not vaccinate within 21 days of slaughter.
7. This vaccine is prepared for vaccination of healthy birds. Improper handling or administration may result in variable responses.
8. Consult package circular for full product information and directions for use.

STORAGE

Refrigerate under 40°F (4.4°C) until ready for use.

MANUFACTURER'S QUALITY ASSURANCE

Virus Seed Stock. The virus seed stock used in the manufacture of TRI-BLEN was negative when tested for lymphoma-sarcoma group of avian viruses associated with the avian leukosis complex (COFAL test).

Egg Source. The embryonated chicken eggs used in production of TRI-BLEN were obtained from specific pathogen free flocks (SPF).

PACKAGING

List No.	Administration	Case Size	Diluent
5046-01	Drinking Water	10x1000 dose	none
5046-63	Beak-O-Vac	10x1000 dose	2x150 cc
5049-03	Eyedrop	10x1000 dose	10x30 cc

For beak-o-vac administration, 150 cc bottles of diluent, transfer spikes, and Venosets are shipped separately from the vaccine as components for the BLEN system. Two 150 cc bottles of diluent will rehydrate 10x1000 doses of List No. 5046-63.

CEVA Laboratories, Inc.
10560 Barkley
Overland Park, KS 66212

C-25-Id

NB-BLEN® PLUS
Newcastle-Bronchitis Vaccine

Live Virus/Chicken Embryo Origin
B-1 type, LaSota strain
Massachusetts and
Connecticut types

→ **Protection against both Newcastle and bronchitis diseases**

Eyedrop Administration (List No. 5289)

Initial or revaccination 1000 dose size (with 30 cc diluent).

Drinking-Water Administration (List No. 5299)

Initial or revaccination 1000 dose size (without diluent).

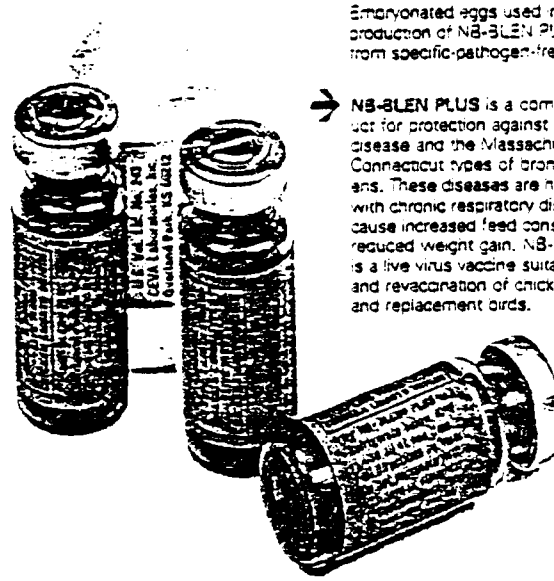
→ **Pure Virus Seed Stock**

Tests were negative for other avian pathogens.

→ **SPF Egg Source**

Embryonated eggs used in the production of NB-BLEN PLUS are from specific-pathogen-free flocks.

→ **NB-BLEN PLUS** is a combination product for protection against Newcastle disease and the Massachusetts and Connecticut types of bronchitis in chickens. These diseases are heavily involved with chronic respiratory disease and cause increased feed consumption and reduced weight gain. NB-BLEN PLUS is a live virus vaccine suitable for initial and revaccination of chicks, broilers, and replacement birds.



NB-BLEN® PLUS
Newcastle-Bronchitis Vaccine

List No. 5289 (Eyedrop)
List No. 5299 (Drinking-Water)

DESCRIPTION

NB-BLEN PLUS is a live virus vaccine of chicken embryo origin for the prevention of Newcastle and bronchitis diseases in chickens. It contains B-1 type, LaSota strain Newcastle and the Massachusetts and Connecticut types of bronchitis virus.

ADMINISTRATION

Initial Vaccination, Eyedrop Method. The eyedrop method of administration (List No. 5289) may be used for the initial vaccination of chickens 4 days of age or older.

Initial Vaccination, Drinking-Water Method. The drinking-water method of administration (List No. 5299) may be used for the initial vaccination of chickens 21 days of age or older.

REVACCINATION

Revaccinate approximately 4 weeks after initial vaccination by the eyedrop or drinking-water method of administration. If birds are held over as replacement stock, they should be revaccinated against Newcastle disease and infectious bronchitis at 16 to 18 weeks of age.

PRECAUTIONS

1. Birds should be vaccinated before they reach maturity since bronchitis virus may cause permanent damage to the reproductive tract of mature birds, resulting in eggs with poor interior quality and shell texture.
2. Infectious bronchitis is highly contagious when non-vaccinated birds are kept in close contact with vaccinated birds during the period of respiratory signs. The vaccine should be used with caution around non-vaccinated laying birds.
3. Newcastle virus may cause a mild inflammation of the eye in humans which lasts for two or three days. Care should be taken in handling the vaccine to avoid contact with eyes.
4. Mix only the amount of vaccine to be used immediately and use promptly. Use all at one time and do not stretch dosage.
5. Burn all vaccine containers, applicators and unused vaccine when vaccination is complete.
6. Do not vaccinate within 21 days of slaughter.
7. This vaccine is prepared for vaccination of healthy birds. Improper handling or administration may result in variable responses.
8. Consult package circular for full product information and directions for use.

STORAGE

Refrigerate under 40°F (4.4°C) until ready for use.

MANUFACTURER'S QUALITY ASSURANCE

Virus Seed Stock. The virus seed stock used in the manufacture of NB-BLEN PLUS vaccine was negative when tested for the lymphoma-sarcoma group of avian viruses associated with the avian leukosis complex (COFAL test).

Egg Source. The embryonated chicken eggs used in the production of NB-BLEN PLUS were obtained from specific-pathogen-free (SPF) flocks.

PACKAGING

List No.	Administration	Case Size	Diluent
5289-03	Eyedrop	10x1000 dose	10x30 cc
5299-01	Drinking-Water	10x1000 dose	none

CEVA Laboratories, Inc.
10560 Barkley
Overland Park, KS 66212

C-PB-19

TREMOR-BLEN-D®

Avian Encephalomyelitis Vaccine

Live Virus/Chicken Embryo Origin

→ **Effective protection against epidemic tremor**

Wing-Web Administration (List No. 5205)

500 dose size (with 5 cc diluent).

Drinking-Water Administration (List No. 5210)

1000 dose size (without diluent).

→ **Pure Virus Seed Stock**

Tests were negative for other avian pathogens.

→ **SPF Egg Source**

Embryonated eggs used in the production of TREMOR-BLEN-D are from specific-pathogen-free flocks.

TREMOR-BLEN D is an effective, desiccated vaccine for the immunization of commercial layer or breeder replacement pullets against avian encephalomyelitis (epidemic tremor in chicks). TREMOR-BLEN-D is a live virus vaccine suitable for wing-web or drinking-water administration.

TREMOR-BLEN-D*
Avian Encephalomyelitis Vaccine

List No. 5205 (Wing-Web)
List No. 5210 (Drinking-Water)

DESCRIPTION

TREMOR-BLEN-D is a live virus vaccine of chicken embryo origin for immunization of commercial layer or breeder replacement pullets against avian encephalomyelitis.

ADMINISTRATION

Initial Vaccination, Wing-Web Method. The wing-web method of administration (List No. 5205) may be used for initial vaccination of chickens between 10 weeks of age and 4 weeks before birds go into production.

Initial Vaccination, Drinking-Water Method. The drinking-water method of administration (List No. 5210) may be used for initial vaccination of chickens between 10 weeks of age and 4 weeks before birds go into production.

REVACCINATION

Revaccination is not required following proper initial vaccination.

PRECAUTIONS

1. Mix only the amount of vaccine to be used immediately and use promptly. Use all at one time and do not stretch dosage.
2. Burn all vaccine containers, applicators and unused vaccine when vaccination is complete.
3. Do not vaccinate within 21 days of slaughter.
4. This vaccine is prepared for vaccination of healthy birds. Improper handling or administration may result in variable responses.
5. Consult package circular for full product information and directions for use.

STORAGE

Refrigerate under 40°F (4.4°C) until ready for use.

MANUFACTURER'S QUALITY ASSURANCE

Virus Seed Stock. The virus seed stock used in the manufacture of TREMOR-BLEN-D vaccine was negative when tested for the lymphoma-sarcoma group avian viruses associated with the avian leukosis complex (COFAL test).

Egg Source. The embryonated chicken eggs used in the production of TREMOR-BLEN-D were obtained from specific-pathogen-free (SPF) flocks.

PACKAGING

List No.	Administration	Case Size	Diluent
5205-04	Wing-Web	10x500 dose	10x5 cc
5210-02	Drinking-Water	10x1000 dose	None

For wing-web administration, a 5 cc bottle of diluent and a two-pronged applicator are provided with each bottle of vaccine.

CEVA Laboratories, Inc.
10560 Barkley
Overland Park, KS 66212

C-PS-23

TCP-BLEN®
Fowl Pox Vaccine
Live Virus, Chicken Tissue Culture Origin

→ Mild, Effective Fowl Pox Protection

Vaccinate as early as one day of age.

→ Chicken Tissue Culture Origin

For more consistent antigenicity and improved immune response.

Wing-Web Administration (List No. 6778)

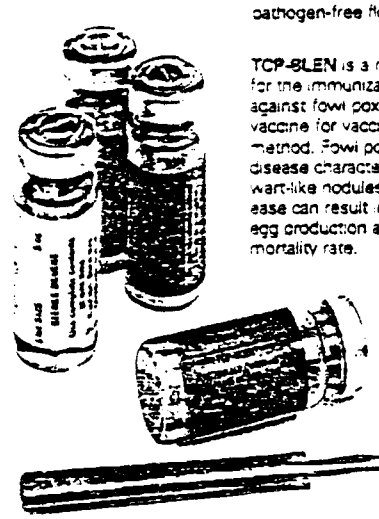
Initial or revaccination 500 dose size (with 5 cc diluent).

→ Pure Virus Seed Stock

Tests were negative for other avian pathogens.

→ SPF Egg Source

Embryonated eggs used in the production of TCP-BLEN are from specific-pathogen-free flocks.



TCP-BLEN is a highly effective product for the immunization of healthy chickens against fowl pox. It is a mild live virus vaccine for vaccination by the wing-web method. Fowl pox is a contagious disease characterized by eruptions of wart-like nodules on the skin. The disease can result in a temporary drop in egg production and can produce a high mortality rate.

TCP-BLEN®
Fowl Pox Vaccine
Live Virus/Chicken Tissue Culture Origin

List No. 5778 (Wing-Web)

DESCRIPTION

TCP-BLEN is a live virus vaccine of chicken tissue culture origin for the prevention of fowl pox in chickens 1 day of age or older.

ADMINISTRATION

Initial Vaccination, Wing-Web Method. The wing-web method of administration (List No. 5778) may be used for initial vaccination of chickens 1 day of age or older. Birds should be vaccinated no later than 4 weeks before they come into egg production. Fowl pox vaccine will cause a drop in egg production if birds are vaccinated while they are in production. Check for takes 4 to 7 days after vaccination.

REVACCINATION

Revaccination with FP-BLEN® (List No. 5179) is recommended at 4 to 16 weeks of age if birds were vaccinated at less than 4 weeks of age with TCP-BLEN.

PRECAUTIONS

1. Mix only the amount of vaccine to be used immediately and use promptly. Use all at one time and do not stretch dosage.
2. Burn all vaccine containers, applicators and unused vaccine when vaccination is complete.
3. Do not vaccinate within 21 days of slaughter.
4. This vaccine is prepared for vaccination of healthy birds. Improper handling or administration may result in variable responses.
5. Consult package circular for full product information and directions for use.

STORAGE

Refrigerate under 40°F (4.4°C) until ready for use.

MANUFACTURER'S QUALITY ASSURANCE

Virus Seed Stock. The virus seed stock used in the manufacture of TCP-BLEN vaccine was negative when tested for the lymphoma-sarcoma group of avian viruses associated with the avian leukosis complex (COFAL test).

Egg Source. The embryonated chicken eggs used in the production of TCP-BLEN were obtained from specific-pathogen-free (SPF) flocks.

PACKAGING

List No.	Administration	Case Size	Diluent
5778-01	Wing-Web	10x500 dose	10x5 cc

For wing-web administration, a 5 cc bottle of diluent and a two pronged wing-stick applicator are provided with each bottle of vaccine.

CEVA Laboratories, Inc.
10560 Barkley
Overland Park, KS 66212

CPB-27

BRON-BLEN®
Bronchitis Disease Vaccine

Live Virus/Chicken Embryo Origin
Massachusetts and
Connecticut types

→ **Protection against both Massachusetts and Connecticut types of bronchitis disease**

Eyedrop Administration (List No. 5066)

For revaccination following N8-BLEN or TRI-BLEN 1000 dose size (with 30 cc diluent.

Drinking Water Administration (List No. 5566)

For revaccination following N8-BLEN or TRI-BLEN 1000 dose size.

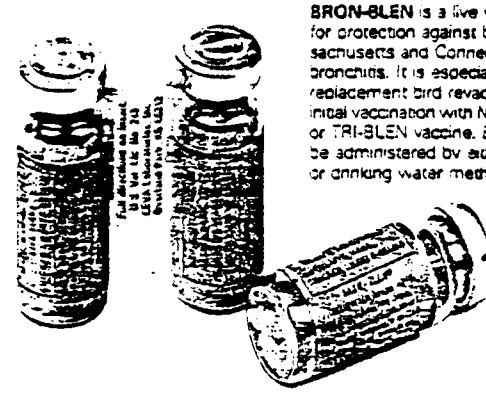
→ **Pure Virus Seed Stock**

Tests were negative for other avian pathogens.

→ **SPF Egg Source**

Embryonated eggs used in the production of BRON-BLEN are from specific pathogen free flocks.

BRON-BLEN is a live virus vaccine for protection against both the Massachusetts and Connecticut types of bronchitis. It is especially suitable for replacement bird revaccination following initial vaccination with N8-BLEN vaccine or TRI-BLEN vaccine. BRON-BLEN may be administered by either the eyedrop or drinking water methods.



BRON-BLEN®
Bronchitis Disease Vaccine

List No. 5066 (Eyedrop)
List No. 5566 (Drinking Water)

DESCRIPTION

BRON-BLEN is a live virus, chicken embryo origin vaccine for the prevention of bronchitis disease in chickens. It contains Massachusetts (Cannaught strain) and Connecticut types of bronchitis virus.

ADMINISTRATION

Initial Vaccination, Eyedrop Method. For revaccination only. See revaccination below.

Initial Vaccination, Drinking Water Method. For revaccination only. See revaccination below.

REVACCINATION

BRON-BLEN may be used by the eyedrop (List No. 5066) or drinking water (List No. 5566) methods for the revaccination of chickens at least 12 weeks after an initial bronchitis vaccination and before the chickens come into egg production. BRON-BLEN is specifically recommended for revaccination following NB-BLEN or TRI-BLEN.

PRECAUTIONS

1. Birds should be vaccinated before they reach maturity since bronchitis virus may cause permanent damage to the reproductive tract of mature birds, resulting in eggs with poor interior quality and shell texture.
2. Infectious bronchitis is highly contagious when non-vaccinated birds are kept in close contact with vaccinated birds during the period of respiratory signs. The vaccine should be used with caution around non-vaccinated laying birds.
3. Mix only the amount of vaccine to be used immediately and use promptly. Use all at one time and do not stretch dosage.
4. Burn all vaccine containers, applicators and unused vaccine when vaccination is complete.
5. Do not vaccinate within 21 days of slaughter.
6. This vaccine is prepared for vaccination of healthy birds. Improper handling or administration may result in variable responses.
7. Consult package circular for full product information and directions for use.

STORAGE

Refrigerate under 40°F (4.4°C) until ready for use.

MANUFACTURER'S QUALITY ASSURANCE

Virus Seed Stock. The virus seed stock used in the manufacture of BRON-BLEN vaccine was negative when tested for the lymphoma-sarcoma group of avian viruses associated with the avian leukosis complex (COFAL test).

Egg Source. The embryonated chicken eggs used in the production of BRON-BLEN were obtained from specific pathogen free flocks. (SPF).

PACKAGING

List No.	Administration	Case Size	Diluent
5066-03	Eyedrop	10x1000 dose	10x30 cc
5566-03	Drinking Water	10x1000 dose	none

CEVA Laboratories, Inc.
10560 Barkley
Overland Park, KS 66212

Printed U.S.A. C-PB-13

BI-BLEN®-H

Newcastle-Bronchitis Vaccine

Live Virus/Chicken Embryo Origin
B-1 type, B-1 strain
Massachusetts type
(Netherlands strain)

Protection against both Newcastle and bronchitis diseases

Eyedrop Administration (List No. 5733)

Initial or revaccination 1000 dose size (with 30 cc diluent).

Drinking-Water Administration (List No. 5734)

Initial or revaccination 1000 dose size (without diluent).

Beak-O-Vac Administration (List No. 5734-63)

1000 dose size (150 cc bottles of diluent, transfer spikes, and administration sets shipped separately).

Pure Virus Seed Stock

Tests were negative for other avian pathogens.

SPF Egg Source

Embryonated egg used in the production of BI-BLEN-H are from specific-pathogen-free flocks.

BI-BLEN-H provides effective immunity against both Newcastle disease and the Massachusetts type (Netherlands strain) of bronchitis in chickens. BI-BLEN-H is a live virus vaccine suitable for initial and revaccination of chicks, broilers and replacement pullets. These highly contagious diseases are heavily involved with chronic respiratory disease and can cause poor feed conversion.

BI-BLEN'-H
Newcastle-Bronchitis Vaccine

List No. 5733 (Eyedrop)
List No. 5734 (Drinking-Water)
List No. 5734-63 (Beak-O-Vac)

DESCRIPTION

BI-BLEN-H is a live virus vaccine of chicken embryo origin for the prevention of Newcastle and bronchitis diseases in chickens. It contains B-1 type, B-1 strain Newcastle and Massachusetts type (Netherlands strain) bronchitis virus.

ADMINISTRATION

Initial Vaccination, Eyedrop Method. The eyedrop method of administration (List No. 5733) may be used for initial vaccination of chickens 4 days of age or older.

Initial Vaccination, Drinking-Water Method. The drinking-water method of administration (List No. 5734) may be used for initial vaccination of chickens 21 days of age or older.

Initial Vaccination, Beak-O-Vac Method. The beak-o-vac method of administration (List No. 5734-63) may be used for chickens at 1 day of age.

REVACCINATION

Revaccinate approximately 4 weeks after initial vaccination by eyedrop or drinking-water method of administration. If birds are held over as replacement stock, they should be revaccinated against Newcastle disease and infectious bronchitis at 16 to 18 weeks of age.

PRECAUTIONS

1. Birds should be vaccinated before they reach maturity since bronchitis virus may cause permanent damage to the reproductive tract of mature birds, resulting in eggs with poor interior quality and shell texture.
2. Infectious bronchitis is highly contagious when non-vaccinated birds are kept in close contact with vaccinated birds during the period of respiratory signs. The vaccine should be used with caution around non-vaccinated laying birds.
3. Newcastle virus may cause a mild inflammation of the eye in humans which lasts for two or three days. Care should be taken in handling the vaccine to avoid contact with eyes.
4. Mix only the amount of vaccine to be used immediately and use promptly. Use all at one time and do not stretch dosage.
5. Burn all vaccine containers, applicators and unused vaccine when vaccination is complete.
6. Do not vaccinate within 21 days of slaughter.
7. This vaccine is prepared for the vaccination of healthy birds. Improper handling or administration may result in variable responses.
8. Consult package circular for full product information and directions for use.

STORAGE

Refrigerate under 40°F (4.4°C) until ready for use.

MANUFACTURER'S QUALITY ASSURANCE

Virus Seed Stock. The virus seed stock used in the manufacture of BI-BLEN-H vaccine was negative when tested for the lymphoma-sarcoma group of avian viruses associated with the avian leukosis complex (COFAL test).

Egg Source. The embryonated chicken eggs used in the production of BI-BLEN-H were obtained from specific-pathogen-free (SPF) flocks.

PACKAGING

List No.	Administration	Case Size	Diluent
5733-03	Eyedrop	10x1000 dose	10x30 cc
5734-03	Drinking-Water	10x1000 dose	None
5734-63	Beak-O-Vac	10x1000 dose	2x150 cc

For beak-o-vac administration, 150 cc bottles of diluent, transfer spikes, and administration sets are shipped separately from the vaccine as components for the BLEN systems. Two 150 cc bottles of diluent will rehydrate 10x1000 doses of List No. 5734-63.

CEVA Laboratories, Inc.
10560 Barkley
Overland Park, KS 66212

C-PB-20

PT-BLEN™
Avian Encephalomyelitis-Fowl Pox Vaccine
Live Virus/
Chicken Embryo Origin

Protection against both Avian Encephalomyelitis and Fowl Pox

Wing-Web Administration
(List 8344)

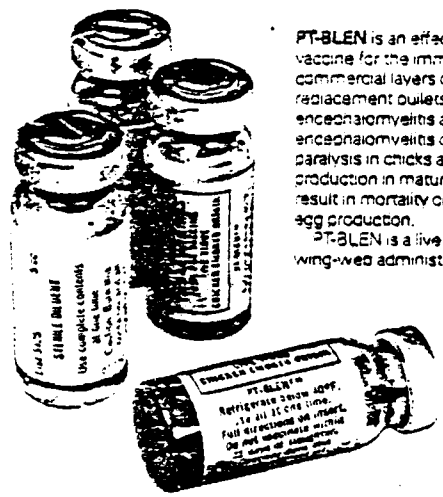
Initial vaccination 500 dose size (with 5 ml diluent).

Pure Virus Seed Stock

Tests were negative for other avian pathogens.

SPF Egg Source

Embryonated eggs used in the production of PT-BLEN are from specific pathogen free flocks.



PT-BLEN is an effective, desiccated vaccine for the immunization of commercial layers or breeder replacement pullets against avian encephalomyelitis and fowl pox. Avian encephalomyelitis can cause death or paralysis in chicks and a drop in egg production in mature birds. Fowl pox can result in mortality or a temporary drop in egg production.

PT-BLEN is a live virus vaccine for wing-web administration.

PT-BLEN™
Avian Encephalomyelitis-Fowl Pox Vaccine

DESCRIPTION

PT-BLEN is a live virus, chicken embryo origin vaccine for the prevention of avian encephalomyelitis and fowl pox in commercial layer or breeder replacement pullets.

ADMINISTRATION

Initial Vaccination, Wing-Web Method. The wing-web method of administration (List No. 8344) is used for initial vaccination of chickens between 10 weeks of age and 4 weeks before birds go into egg production. At about 7-10 days after vaccination, the birds should be checked for fowl pox takes.

REVACCINATION

Revaccination is not required for avian encephalomyelitis following proper initial vaccination. Revaccination for fowl pox may be required following initial vaccination depending on geographic area and management practices.

PRECAUTIONS

1. Mix only the amount of vaccine to be used immediately and use promptly. Use all at one time and do not stretch dosage.
2. Burn all vaccine containers, applicators and unused vaccine when vaccination is complete.
3. Do not vaccinate within 21 days of slaughter.
4. This vaccine is prepared for vaccination of healthy birds. Improper handling or administration may result in variable responses.
5. Consult package circular for full product information and directions for use.

STORAGE

Refrigerate under 40°F (4.4°C) until ready for use.

MANUFACTURER'S QUALITY ASSURANCE

Virus Seed Stock. The virus seed stock used in manufacture of PT-BLEN vaccine was negative when tested for the lymphoma-sarcoma group of avian viruses associated with the avian leukosis complex (COFAL test).

Egg Source. The embryonated chicken eggs used in production of PT-BLEN were obtained from specific pathogen free flocks (SPF).

PACKAGING

List No.	Administration	Case Size	Diluent
8344-04-01	Wing-Web	10x500 dose	5 ml/500 doses

A 5 ml bottle of diluent and a two pronged wing-stick applicator are provided with each bottle of vaccine for wing-web administration.

CEVA
Laboratories, Inc.
10560 Barkley
Overland Park, KS 66212

C PB-24

BRON BLEN®-L
Newcastle-Bronchitis Vaccine

Live Virus/Chicken Embryo Origin
B-1 type, LaSota strain
Massachusetts and
Connecticut types

Protection against both Newcastle and Bronchitis Disease

Drinking Water Administration (List 5265)

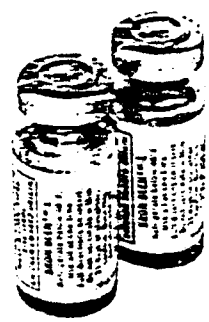
Revaccination 1000 dose size.

Pure Virus Seed Stock

Tests were negative for other avian pathogens.

SPF Egg Source

Embryonated eggs used in the production of BRON BLEN-L are from specific pathogen free flocks.



BRON BLEN-L provides effective immunity against both Newcastle disease and Massachusetts and Connecticut types of bronchitis in chickens. Both diseases are heavily involved with Chronic Respiratory Disease and cause increased feed consumption and reduced weight gain. BRON BLEN-L is a live virus vaccine suitable for revaccination of replacement birds.

BRON BLEN®-L
Newcastle-Bronchitis Vaccine

DESCRIPTION

BRON BLEN-L is a live virus, chicken embryo origin vaccine for the prevention of Newcastle and bronchitis disease in chickens. It contains B-1 type, LaSota strain Newcastle and Massachusetts and Connecticut types of bronchitis virus.

ADMINISTRATION

Initial Vaccination, Drinking Water Method. For revaccination only, see revaccination below.

REVACCINATION

BRON BLEN-L may be used by the drinking water (List No. 5285) method of administration for the revaccination of chickens at least 12 weeks after an initial bronchitis vaccination and before the chickens come into egg production. BRON BLEN-L is specifically recommended for revaccination following NB-BLEN® or TRI-BLEN.®

PRECAUTIONS

1. Newcastle virus may cause a mild inflammation of the eye in humans which lasts for two or three days. Care should be taken in handling the virus to avoid contact with eyes.
2. Mix only the amount of vaccine to be used immediately and use promptly. Use all at one time and do not stretch dosage.
3. Burn all vaccine containers, applicators and unused vaccine when vaccination is complete.
4. Do not vaccinate within 21 days of slaughter.
5. This vaccine is prepared for the vaccination of healthy birds. Improper handling or administration may result in variable responses.
6. Consult package circular for full product information and directions for use.

STORAGE

Refrigerate under 40°F (4.4°C) until ready for use.

MANUFACTURER'S QUALITY ASSURANCE

Virus Seed Stock. The virus seed stock used in manufacture of BRON BLEN-L vaccine was negative when tested for the lymphoma-sarcoma group of avian viruses associated with the avian leukosis complex (COFAL test).

Egg Source. The embryonated chicken eggs used in production of BRON BLEN-L were obtained from specific pathogen free flocks (SPF).

PACKAGING

List No.	Administration	Case Size	Diluent
5285-04-01	Drinking Water	10x1000 dose	none

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10560 Barkley
Overland Park, KS 66212

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STERWIN LABORATORIES INC.
Subsidiary of Sterling Drug Inc.

BROILER BREEDER VACCINATION PROGRAM #1

AGE	VACCINE	METHOD OF ADMINISTRATION	STERWIN CODE NO.
1 DAY	STERWIN'S HVT (Frozen) Marek's Vaccine (In the Hatchery)	SUBCUTANEOUS	S-605
	(Start Birds on Feed Containing a Total of 12-18 Million Units of Vitamin A, and 4-8 Grams of Vitamin K Per Ton of Feed. No Coccidiostat.)		
7 DAYS	BURSA VAC (OPTIONAL)	WATER	G-603
12-14 DAYS	COCCIVAC - TYPE D	WATER	ATD-3
	N79 BROILERBRON-H (Clone Selected Lasota Strain Newcastle with Modified Mass-Holland Bronchitis)	WATER	HC-405
5 WKS.	N63 POLYBRON (B1 Type - Lasota Strain) Newcastle/ Bronchitis (Mass + Conn)	WATER	C-403
8 WKS.	BROILERTRAKE (Laryngotracheitis)	EYEDROP	D-807
10 WKS.	TENO-VAXIN (Tenosynovitis)	WATER	T-1133
* 12 WKS.	BURSA-VAC (3 X Dose)	WATER	G-603
14-15 WKS.	BROILERTRAKE (Laryngotracheitis)	EYEDROP	D-807
	A.E. (Ava-Trem) *	WATER (or) WINGWEB	K-903 K-907
	FOWL POX *	WINGWEB	E-102
	FOWL CHOLERA BACTERIN	SUBCUTANEOUS	FCB-200
	* (A.E. & POX MAY BE MIXED IN ONE DILUENT FOR WINGWEB INJECTION)		
18 WKS.	N63 POLYBRON (B1 Type - Lasota Strain) Newcastle/ Bronchitis (Mass + Conn)	WATER	C-403
18-20 WKS.	FOWL CHOLERA BACTERIN	SUBCUTANEOUS	FCB-200
26 WKS.	N63 NEWCASTLE (B1 Type Lasota Strain)	WATER	A-43

BOOST EVERY 70 DAYS THEREAFTER WITH A-43 IN THE DRINKING WATER.

* THE 12 WEEK G-603 SHOULD BE GIVEN FOR SURE IF BIRDS DO NOT TEST POSITIVE ON AGP FOR INFECTIOUS BURSAL DISEASE.

012381

Broiler Breeder Vaccination Program.

STERWIN LABORATORIES INC.
Subsidiary of Sterling Drug Inc.

BROILER BREEDER VACCINATION PROGRAM #2

AGE	VACCINE	METHOD OF ADMINISTRATION	STERWIN CODE NO.
1 DAY	STERWIN'S HVT (Frozen) Marek's Vaccine	SUBCUTANEOUS	S-605
	(Start Birds on Feed Containing a Total of 12-18 Million Units of Vitamin A, and 4-8 Grams of Vitamin K Per Ton of Feed - No Coccidiostat.)		
6 DAYS	BURSA VAC (OPTIONAL)	WATER	G-603
10 DAYS	N79 BROILERBRON-H (Clone Selected Lasota Strain Newcastle with Modified Mass-Holland Bronchitis)	WATER	HC-405
	COCCIVAC - TYPE D	WATER	ATD-3
5 WKS.	BROILERTRAKE (Laryngotracheitis) *	EYEDROP	D-807
	N63 AVA-BRON-H (Holland Strain Bronchitis with Lasota Newcastle) *	EYEDROP	H-407
	FOWL POX	WINGWEB	E-102
	* (H-407 & D-807 MIXED IN ONE DILUENT AND EYE DROPPED.)		
10 WKS.	N63 AVA-BRON-H (Holland Strain Bronchitis with Lasota Newcastle)	WATER	H-407
12 WKS.	BURSA-VAC (IF INDICATED)	WATER	G-603
14 WKS.	TENO-VAXIN (Tenosynovitis)	WATER	T-1133
15-16 WKS.	BROILERTRAKE (Laryngotracheitis)	EYEDROP	D-807
	A.E. (Ava-Trem)	WATER	K-903
	FOWL CHOLERA BACTERIN	SUBCUTANEOUS	FCB-200
18 WKS.	N63 AVA-BRON-H (Holland Strain Bronchitis with Lasota Newcastle) **	WATER	H-407
	** (SOME COMPANIES SPRAY THIS VACCINATION TO ACHIEVE HIGHER TITER.)		
20 WKS.	FOWL CHOLERA BACTERIN	SUBCUTANEOUS	FCB-200
	MOVE TO LAY HOUSE AND SECOND INJECTION OF FCB-200		

012881

STERWIN LABORATORIES INC.
Subsidiary of Sterling Drug Inc.

BROILER BREEDER VACCINATION
PROGRAM #3

AGE	VACCINE	METHOD OF ADMINISTRATION	STERWIN CODE NO.
1 DAY	STERWIN'S HVT (Frozen) Marek's Vaccine (In The Hatchery)	SUBCUTANEOUS	S-605
	(Start Birds on Feed Containing a Total of 12-18 Million Units of Vitamin A, and 4-8 Grams of Vitamin X Per Ton of Feed. No Coccidiostat.)		
7 DAYS	BURSA-VAC	WATER	G-603
12-14 DAYS	COCCIVAC - TYPE D	WATER	ATD-3
	N79 BROILERBRON-H (Clone Selected Lasota Strain Newcastle with Modified Mass-Holland Bronchitis)	WATER	HC-405
5 WEEKS	N63 POLYBRON (B1 Type - Lasota Strain) Newcastle/ Bronchitis (Mass + Conn)	WATER	C-403
8 WEEKS	BROILERTRAKE (Laryngotracheitis)	EYEDROP	D-807
10 WEEKS	TENO-VAXIN (Tenosynovitis)	WATER	T-1133
12 WEEKS	BURSA-VAC (1 X DOSE)	WATER	G-603
14-15 WEEKS	BROILERTRAKE (Laryngotracheitis)	EYEDROP	D-807
	AE-POX COMBINATION *	WINGWEB	EP-912
	FOWL CHOLERA BACTERIN	SUBCUTANEOUS	FCB-200
	* This is a new combined product.		
17-18 WEEKS	FOWL CHOLERA BACTERIN	SUBCUTANEOUS	FCB-200
	Killed Infectious Bursal Disease (Gumboro Vaccine) *		
	* Not Presently Available from Sterwin		
18 WEEKS	N63 POLYBRON (B1 - Type - Lasota Strain) Newcastle/ Bronchitis (Mass + Conn)	WATER	C-403
26 WEEKS	N63 NEWCASTLE (B1 Type Lasota Strain)	WATER	A-43

BOOST EVERY 70 DAYS THEREAFTER WITH A-43 IN THE DRINKING WATER.

STERWIN LABORATORIES INC.
Reference Sheet for Ordering Sterwin Vaccines

Code No.	Trade Name	Use Method	Contains Newcastle	Contains Bronchitis
A-13	B.	Eye, Water or Spray	B.	None
A-23	N-63	Eye or Water	LaSota	None
A-33	B.	Water	B.	None
A-43	N-63	Water	LaSota	None
* A-62	N-63	Intramuscular	LaSota	None
A-79	N-79	Eye or Water	LaSota	None
A-99	N-79	Water	LaSota	None
C-103	Poivbron B.	Eye or Water	B.	Regular Mass. + Conn.
C-203	Poivbron N-63	Eye or Water	LaSota	Regular Mass. + Conn.
C-303	Poivbron B.	Water	B.	Regular Mass. + Conn.
C-403	Poivbron N-63	Water	LaSota	Regular Mass. + Conn.
C-107	Avabron B.	Eye or Water	B.	Regular Mass.
C-307	Avabron B.	Water	B.	Regular Mass.
C-503	Delbron B.	Eye or Water	B.	Regular Mass. + JMK
C-703	Delbron B.	Water	B.	Regular Mass. + JMK
D-807	Broilertrake	Eye	None	None
* E-102	Ava-Pox-CE	Wing-Web	None	None
* F-102	Pigeon Pox Vaccine	Wing-Web	None	None
G-603	Bursa-Vac	Water	None	None
G-607	Bursa-Vac-M	Subcutaneous	None	None
GM-605	Bursa-Vac-M-HVT	Subcutaneous	None	None
GML-605	Bursa-Vac-M-HVT Lyophilized	Subcutaneous	None	None
H-93	Ava-Bron-H	Eye or Water	None	Mass. Holland
H-107	Ava-Bron-H B.	Eye or Water	B.	Mass. Holland
H-207	Ava-Bron-H N-63	Eye or Water	LaSota	Mass. Holland
H-307	Ava-Bron-H B.	Water	B.	Mass. Holland
H-407	Ava-Bron-H N-63	Water	LaSota	Mass. Holland
H-105	Broilerbron-H B.	Eye or Water	B.	Mild Mass. Holland
H-305	Broilerbron-H B.	Water	B.	Mild Mass. Holland
H-110	Broilerbron-H	Eye or Water	None	Mild Mass. Holland
HC-205	Broilerbron-H N-79	Eye or Water	LaSota	Mild Mass. Holland
HC-405	Broilerbron-H N-79	Water	LaSota	Mild Mass. Holland
H-503	Delbron-H B.	Eye or Water	B.	Mild Mass. Holland + JMK
H-703	Delbron-H B.	Water	B.	Mild Mass. Holland + JMK
K-903	Ava-Trem-DW	Water	None	None
* K-907	Ava-Trem-WW	Wing-Web	None	None
S-605	Sterwin HVT Frozen	Subcutaneous	None	None
L-605	Sterwin HVT Lyophilized	Subcutaneous	None	None
ATD-3	CocciVac Type D	Water	None	None
FCB-200	F. C. Bacterin Water-Oil	Subcutaneous	None	None

*Indicates 500 dose size

SALES OFFICES AND WAREHOUSES

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- ☐ Menlo Park, California 94025 PHONE: 415-324-4721
- ☐ Gainesville, Georgia 30501 PHONE: 404-534-7356
- ☐ (Home Office) Millsboro, Delaware 19966 PHONE: 302-934-9274 ☐

DL-4882

Appendix 6. Male and Female Mortality

The mortality rate among the flock is one of the most serious problems confronting poultrymen in Venezuela. There have been almost no studies done in this area in order to find a way to predict the mortality rate among the flock, even though the farmers are really concerned aobut the general condition of the flock. The purpose of the researcher in this Appendix is to find such a way.

The researcher collected some data of male and female mortality in one of the largest Broiler breeder Farms in Valencia, Venezuela. The data comes from four different flocks, all of them were Arbor Acres Broiler Breeders. The mortality rates are expressed in percentage during the life of the flock (67 weeks). The collected data is shown in Tables 10 and 11.

In order to analyze the data an average for week was found based on the four collected values of mortality rates. These averages are plotted against time in Figure 5 for the male population and in Figure 6 for the female one.

From Figures 5 and 6 it can be seen that the mortality rates for both populations are considerably higher during the first two weeks. Such values of mortality are undoubtedly due to the adjustment of the flock to a new environment. Since there is such abrupt change in the flock mortality, two different treatments were applied in the study of it.

There are only two values of average mortality rate for the first two weeks of the flock's life. Therefore, a complete analysis seems very difficult to carry on. For that reason the average values

obtained from the collected data are used as an approximation of the existing male and female mortality during the first two weeks in the simulation.

For the rest of the flock's life (65 weeks) statistical analysis was done in order to find the relationship between male and female mortality and time. For that purpose linear regression methods were used and the results provided by this application are explained below.

Male Mortality

The first step in the analysis of the male mortality was the examination of the plot shown in Figure 5 which presents how the male mortality changes during the flock's life. The researcher found evidences of curvature in that plot and she proceeded to fit the quadratic model:

$$Y = \beta_0 + \beta_1 X + \beta_{11} X^2 + \varepsilon$$

where:

Y is the percentage of male mortality (APMMOR)

β_0, β_1 and β_{11} are parameters

X is the age in weeks of the male population (AGE)

ε is a random error assumed as having an expected value equal to zero and a constant variance

The equation which best fitted the data was the following paralola:

$$\text{APMMOR (AGE)} = .2851 + .0887 * \text{AGE} - .0011 * (\text{AGE})^2$$

The fitted regression equation is plotted in Figure 5, together with the original data. The Analysis of Variance is shown in Table 8.

To test for the existence of a regression relation, we have the hypothesis:

C_1: $\beta_1 = 0$ and $\beta_{11} = 0$

C_2: not both β_1 and β_{11} equal 0.

The test statistic for the hypothesis is:

$$F^* = \frac{MSR}{MSE} = \frac{8.9333}{.2181} = 40.9597$$

Controlling the level of significance at .05, it is required that $F(.95; 2,62) = 3.15$ (the degrees of freedom for error were assumed to be 60 because the actual value does not appear in the F tables available). Since F^* far exceeds the action limit (3.15), it can be concluded that C_2 is true. That is, there is a regression relation between APMMOR and AGE and AGE^2.

For a descriptive measure of the degree of relation between male mortality and the age of the male population, the researcher calculated the coefficient of multiple determination using the data in Table 1:

$$R^2 = \frac{SSR}{SSTO} = \frac{17.8666}{31.3879} = .5692$$

This measure shows that the variation in the average percentage of male mortality is reduced by 56.92% when the quadratic relation to the age of the male population is utilized. It should be pointed out that in order to examine the aptness of the equation for the data part of the residual analysis was made concluding that the error terms present in the calculations of the male mortality using the fitted equation have a constant variance, an expected

value equal to zero; they are independent and they do not show any major departure from normality.

Female Mortality

A similar procedure was followed and the researcher proceeded to fit the following model:

$$Y = \beta_0 * e^{\frac{\beta_1}{X}} + \varepsilon$$

where:

Y is the percentage of female mortality (APFMOR)

β_0 and β_1 are parameters

X is the age in weeks of the female population (AGE)

ε is a random error.

A reciprocal transformation was used to make the model linear

$$Y' = \ell n\ Y$$

$$X' = 1/x$$

Then the linear model is:

$$Y' = \beta_0' + \beta_1 + X' + \varepsilon'$$

The equation which best fitted the data was

$$APFMOR\ (AGE) = .6007 * e^{-\frac{4.4998}{AGE}}$$

The fitted regression equation is plotted in Figure 6, together with the original data. The Analysis of Variance is shown in Table 9.

To test for the existence of a regression relation, we have the hypothesis:

$$C_1: \beta_1 = 0$$

$$C_2: \beta_1 \neq 0$$

The test statistic for the hypothesis is:

$$F^* = \frac{MSR}{MSE} = \frac{4.3262}{.0683} = 63.34$$

Assuming the significance level is to be held at .05, it is required that $F(.95; 1,63) = 4$ (the degrees of freedom for error were assumed to be 60 because the actual value does not appear in the F tables available).

Since F^* exceeds the action limit (4), it can be concluded that C_1 is true. That is, there is a regression relation between APFMOR and the exponential value $e^{\frac{-\beta_1}{AGE}}$.

For a descriptive measure of the degree of relation between female mortality and the age of the female population, the researcher calculated the coefficient of determination using the data in Table 9.

$$R^2 = \frac{SSR}{SSTO} = \frac{4.3262}{8.6298} = .5013$$

This value shows that the variation in the average percentage of female mortality is reduced by 50.13% where the age is taken into account.

A residual analysis was made in order to examine the aptness of the equation for the data. The results were similar to those obtained with the male population. The error terms used in the residual analysis were those of the linear model (ε').

The equations found are the best approximation of the existing relationship between male and female mortality and age of the population taking into account the existence of error in the measurements of the mortality rates. The two equations were incorporated

to the simulation as the following functions: APMMOR (average percentage of male mortality) and APFMOR (average percentage of female mortality). The values of mortality for the first two weeks were the averages calculated from the collected data during those weeks. The equations found are applicable to Arbor Acres Broiler Breeders because all the data utilized for their calculations comes from flocks of such breed.

TABLE 8

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS
Regression	17.8666	2	8.9333
Error	13.5213	62	.2181
TOTAL	31.3879	64	

TABLE 9

ANALYSIS OF VARIANCE

Source of Variation	SS	df	MS
Regression	4.3262	1	4.3262
Error	4.3036	63	.0683
TOTAL	8.6298	64	

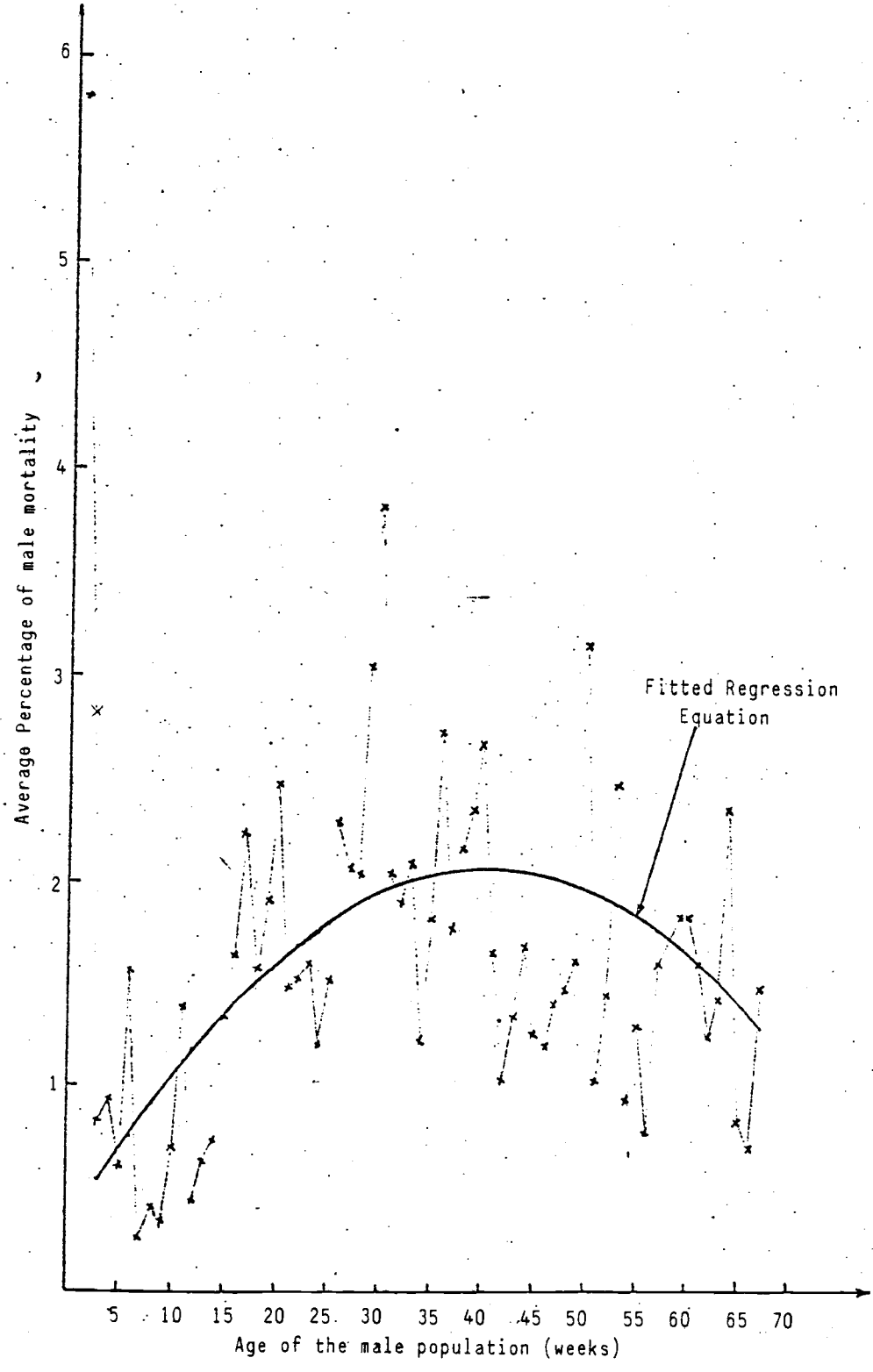
Average Percentage of male mortality
6
5
4
3
2
1
Fitted Regression Equation
5
10
15
20
25
30
35
40
45
50
55
60
65
70
Age of the male population (weeks)

Figure 5

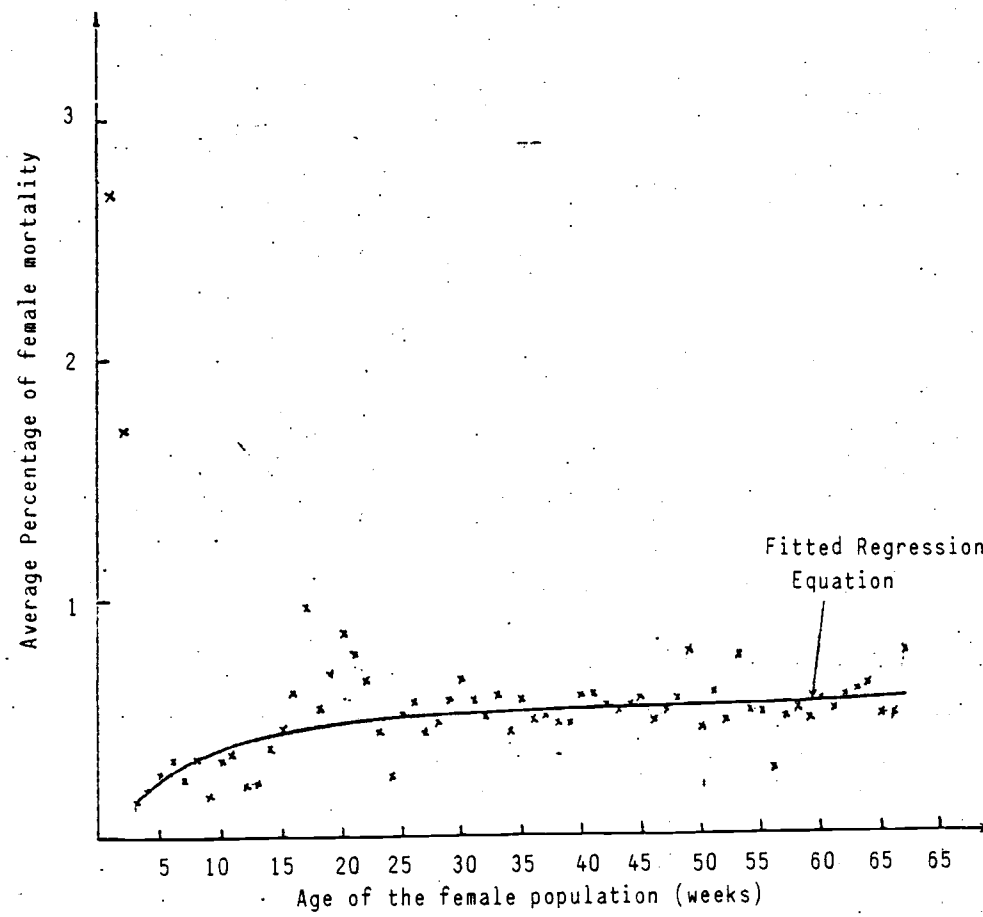
Average Percentage of female mortality
3
2
1
Fitted Regression
Equation
5 10 15 20 25 30 35 40 45 50 55 60 65 65
Age of the female population (weeks)

Figure 6

TABLE 10

COLLECTED DATA OF MALE MORTALITY

Flock / Age	Mortality Rate (%) 1	2	3	4
1	11.43	10.49	.70	.58
2	5.45	5.27	2.24	.23
3	1.54	.83	.84	.11
4	2.43	.84	.24	.23
5	.43	.28	1.22	.47
6	1.32	2.12	2.23	.59
7	.14	.72	.12	.00
8	.44	.29	.50	.00
9	.60	.29	.25	.23
10	1.51	1.02	.25	.00
11	2.76	2.07	.25	.47
12	.15	.30	1.28	.00
13	.15	.30	1.82	.24
14	.47	.15	1.72	.60
15	.39	.45	1.61	2.91
16	.15	.46	2.88	3.12
17	.79	1.07	4.37	2.71
18	.48	.15	3.84	1.85
19	.16	.15	3.53	3.78
20	.81	1.09	3.34	4.64
21	.00	1.26	2.47	2.21
22	.65	.48	4.22	.75
23	.32	1.68	2.82	1.61
24	1.32	1.92	.36	1.20
25	1.81	1.51	.79	1.92
26	2.33	2.17	.80	3.92
27	2.60	2.22	1.01	2.44
28	2.00	2.22	1.22	2.71
29	4.10	3.04	2.06	3.01
30	3.33	7.48	3.82	.66
31	3.19	3.13	.74	1.11
32	3.30	1.34	2.07	.90
33	2.88	1.36	2.31	1.82
34	2.43	1.38	.59	.46
35	2.49	1.96	.79	2.09
36	1.70	3.15	2.73	3.33
37	2.60	.59	1.37	2.46
38	2.67	2.08	1.86	2.02
39	2.35	2.35	2.13	2.57
40	2.59	4.12	2.68	1.32
41	1.66	1.66	1.45	1.87
42	1.24	1.08	.98	.81
43	1.72	.73	.99	1.92
44	1.44	1.28	1.50	2.52

TABLE 10 (Continued)

Flock Age	Mortality Rate (%) 1	2	3	4
45	1.62	1.30	1.26	.86
46	.98	.56	1.53	1.74
47	1.16	1.14	1.55	1.77
48	1.00	2.11	1.57	1.20
49	.84	2.16	1.33	2.13
50	4.10	5.42	1.89	1.24
51	1.24	1.48	.82	.63
52	1.26	.64	1.67	2.22
53	1.27	5.64	1.98	.99
54	.37	1.83	.86	.65
55	.74	1.40	1.74	1.28
56	1.13	1.66	2.96	1.35
57	1.51	1.44	2.75	.68
58	1.73	1.47	2.20	1.37
59	.97	1.99	1.60	2.78
60	.59	.50	1.63	4.65
61	.99	1.53	1.99	1.87
62	.80	2.07	1.01	1.14
63	1.41	1.05	1.71	1.55
64	2.25	1.33	3.48	2.36
65	.84	.81	.83	.83
66	.84	.54	.69	.69
67	1.49	1.49	1.50	1.49

TABLE 11

COLLECTED DATA OF FEMALE MORTALITY

Flock Age	Mortality Rate (%) 1	2	3	4
1	3.42	4.16	2.28	.88
2	1.93	2.79	1.29	.82
3	.22	.24	.10	.09
4	.31	.24	.14	.09
5	.35	.26	.31	.20
6	.13	.80	3.8	.05
7	.43	.40	.09	.07
8	.16	.64	.49	.05
9	.20	.25	.14	.09
10	.63	.56	.05	.09
11	.56	.51	.25	.07
12	.22	.17	.40	.09
13	.11	.21	.50	.09
14	.03	.03	.80	.65
15	.11	.29	.45	.99
16	.07	.09	.51	1.78
17	.78	.45	1.06	1.62
18	.25	.18	.77	1.04
19	.11	.12	.83	1.68
20	.21	.34	.92	1.95
21	.42	.38	1.40	.88
22	.50	.32	1.52	.33
23	.33	.17	.87	.46
24	.15	.40	.22	.26
25	.52	.52	.38	.66
26	.28	.60	.66	.76
27	.38	.29	.62	.48
28	.32	.34	.45	.75
29	.32	.63	.78	.53
30	.83	.66	.52	.68
31	.53	.39	.79	.61
32	.41	.39	.53	.67
33	.59	.44	.56	.77
34	.35	.39	.42	.60
35	.56	.53	.33	.88
36	.60	.47	.49	.40
37	.37	.33	.51	.82
38	.48	.28	.42	.69
39	.42	.40	.73	.31
40	.55	.31	.88	.62
41	.53	.50	.53	.79
42	.77	.31	.58	.55
43	.69	.45	.60	.37
44	.26	.46	.93	.50

TABLE 11 (Continued)

Flock Age	Mortality Rate (%) 1	2	3	4
45	.41	.43	.69	.78
46	.57	.39	.29	.67
47	.37	.61	.77	.38
48	.44	.66	.68	.52
49	.58	.77	.76	.96
50	.44	.44	.46	.41
51	.41	.46	.69	.67
52	.30	.55	.41	.64
53	.44	1.39	.70	.42
54	.44	.48	.49	.71
55	.47	.34	.52	.74
56	.40	.29	.68	.28
57	.47	.24	.63	.60
58	.35	.86	.52	.34
59	.43	.54	.54	.38
60	.38	.49	.76	.61
61	.45	.35	.52	.76
62	.31	.49	.80	.77
63	.41	.68	.75	.51
64	.31	.47	.98	.72
65	.44	.53	.49	.49
66	.54	.44	.49	.49
67	.76	.78	.74	.76

Appendix 7. Listing of the Simulation Program

Listing of the Simulation Program

for example 1: Main Program

Subroutines and

Functions

```
      PROGRAM S80F(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
C SIMULATION OF A BROILER BREEDER FARM
C
C COMPUTE GROWTH AND PRODUCTION OF A CHICKEN FARM
C
C VARIABLES
      REAL AMBW (2,2,24), AFBW (2,2,24), AFAM (2,2,24), AFAF (2,2,2,24
     Z), TAFAM (24), TAFAF (24), CFEAMM (24), APFMOR, APMMOR
     Z, ANDL, AFBWP (2,2,25167), AFAFP (2,2,25167), AREPR (25167), APM
     ZEG (25167), CFEAMP (24167), TAFAFP (25167), FEPDEG (25167), CFEA
     ZMF (24)
      INTEGER AGE, FBREED, MBREED, LOCFA, MOFLHA, FEEPRF, FEEPRM, FARR
     Z, MARR, ANMAL (67), ANFEM (67), MAMOR (67), FEMOR (67), NDL (67),
     Z THRLO (67), FPF, MM, ANFLC (24167), AMEGGD (24167), AMHAEG (251
     Z67), CHATE6 (24167), LATFA
      INTEGER A, B, BORMA (67), DAGE, ADAGE
      DATA IBORMA(AGE), AGE = 1,67) / 67*0 /
C INPUT
      READ*, FBREED, MBREED, LOCFA, MOFLHA, LATFA, FEEPRF, FEEPRM, FAR
     ZR, MARR
      READ*, DAGE
C COMPUTE THE LIGHTING PROGRAM
      CALL LIGHT (MOFLHA, LOCFA, LATFA, THRLO, NDL, ANDL)
      ADAGE = DAGE
      IF (DAGE.LE.24)THEN
C OBTAIN FOLLOWING DATA - AVERAGES OF FEMALE AND MALE BODY WEIGHT
C                       - AVERAGES OF FEED AMOUNT PER 100 MALES PER DAY
C                       - AVERAGES OF FEED AMOUNT PER 100 FEMALES PER DAY
      CALL GROWTH (MOFLHA, LOCFA, FEEPRF, AFBW, AFAF, AMBW, AFAM, FPF,
     ZMM)
C
C
C ** F E M A L E S **
C
C
C TITLES
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT 5, DAGE
    5 FORMAT (' DESIRED AGE FOR THE SIMULATION =',I2,' WEEK')
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, '                          ** F E M A L E S **'
      PRINT*, ' '
      PRINT 10, FBREED, LOCFA, FARR, LATFA, MOFLHA, FEEPRF, ANDL
   10 FORMAT (' FEMALE BREED = ',I1,39X,'LOCATION OF FARM =',I1,//,' NUM
     ZBER OF FEMALES ARRIVING TO FARM = ',I7,11X,'LATITUD WHERE FARM IS
     Z =',I2,7X,'MONTH WHEN FLOCK WAS HATCHED =',I2,22X,'FEEDING PRO
     ZGRAM =',I1,//,' AVERAGE HOURS OF DAYLIGHT =',F5.2)
      PRINT*, ' '
      PRINT*, ' AGE  AMOUNT BIRDS MORTALITY AVERAGE BODY   FEED        CUM
     ZULATIVE      REQUIRED '
      PRINT*, '  (WK)   END OF WK    (AMOUNT)   WEIGHT (KG) AMOUNT(KG) FEED
     ZAMOUNT(KG) LIGHT(HR)'
C
C COMPUTE TOTAL AVERAGE FEED AMOUNT PER DAY, CUMULATIVE FEED AMOUNT,
C NUMBER OF FEMALES IN FARM DURING THE FIRST 24 WEEKS
C
      IF (DAGE.EQ.1)THEN
      FEMOR (1)= MINT (APFMOR (1) * REAL(FARR) * .01)
      ANFEM (1)= FARR - FEMOR(1)
      TAFIF (1)= AFAF (LOCFA, MM,FPF,1) * (REAL(FARR)/100.)
      CFEAMF (1)= TAFAF (1)
      PRINT 20, ANFEM (1), FEMOR (1)
   20 FORMAT (/,3X,'1',4X,I7,6X,I4,7X,' MIN.',6X,'FULL FD',5X,'FULL FEED
     Z',2X,'NDL')
      DAGE = 2
      ELSE
      ENDIF
      DO 30 AGE = DAGE,24
      FEMOR (AGE)= MINT (APFMOR(AGE) * REAL(ANFEM(AGE-1)) * .01)
      ANFEM (AGE)= ANFEM (AGE-1) - FEMOR (AGE)
      IF (AGE.EQ.2)THEN
```

```
                  IF ((LOCFA.EQ.1.AND.MM.EQ.1).OR.(LOCFA.EQ.2.AND.MM.EQ.2))THEN
                    CFEAMF (2)= 25.6 * (REAL(ANFEM(1))/100.)
                    PRINT 40, AGE, ANFEM (2), FEMOR (2), CFEAMF (2)
               40   FORMAT (/,2X,I2,4X,I7,6X,I4,7X,' MIN.',2X,'FULL FO',5X,F10.2
              Z     ,7X,'NOL')
                  ELSE
                    CFEAMF (2)= 25.3 * (REAL (ANFEM(1))/100.)
                    PRINT 40, AGE, ANFEM (2), FEMOR (2), CFEAMF (2)
                  ENDIF
                ELSE
                  IF (AGE.GE.3.AND.AGE.LE.5)THEN
                    TAFAF (AGE)= AFAF (LOCFA,MM,FPF,AGE) * (REAL (ANFEM (AGE-1))
              Z     /100.)
                    CFEAMF (AGE)= CFEAMF (AGE-1) + (TAFAF (AGE) * 7.)
                  ELSE
                    IF (FEEPRF.EQ.1)THEN
                      TAFAF (AGE)= AFAF (LOCFA,MM,FPF,AGE) * (REAL (ANFEM(AGE
              Z       -1))/100.)
                      CFEAMF (AGE)= CFEAMF (AGE-1) +(TAFAF (AGE) * 7.)
                    ELSE IF (FEEPRF.EQ.2)THEN
                      TAFAF (AGE)= AFAF (LOCFA,MM,FFF,AGE) * (REAL (ANFEM(AGE
              Z       -1))/100.) * 2.
                      CFEAMF (AGE)= CFEAMF (AGE-1) + (TAFAF (AGE) * 3.5)
                    ELSE
                      TAFAF (AGE)= AFAF (LOCFA,MM,FPF,AGE) * (REAL (ANFEM(AGE
              Z       -1))/100.)
                      CFEAMF (AGE)= CFEAMF (AGE-1) + (TAFAF (AGE) * 5.)
                    ENDIF
                  ENDIF
                  IF (NOL (AGE).EQ.1)THEN
                    PRINT 50, AGE, ANFEM (AGE), FEMOR (AGE), AFBM (LOCFA,MM,AGE)
              Z, TAFAF (AGE), CFEAMF (AGE)
              50    FORMAT (/,2X,I2,4X,I7,6X,I4,7X,F5.3,6X,F7.2,5X,F10.2,7X,'NOL
              Z     ')
                  ELSE
                    PRINT 60, AGE, ANFEM (AGE), FEMOR (AGE), AFBM (LOCFA,MM,AGE)
              Z, TAFAF (AGE), CFEAMF (AGE), IWOLD (AGE)
              60    FORMAT (/,2X,I2,4X,I7,6X,I4,7X,F5.3,6X,F7.2,5X,F10.2,7X,I2)
                  ENDIF
                ENDIF
              30 CONTINUE
                OAGE = AGAGE
                IF (FEEPRF.GE.2)THEN
                PRINT*,' '
                PRINT*,'***THE FEEDING PROGRAM *LIMITED EVERY DAY * SHOULD BE USE
               ZD DURING THE FIRST 6 WEEKS*
                ENDIF
            C
            C
            C ** M A L E S **
            C
            C
            C TITLES
                PRINT*,' '
                PRINT*,' '
                PRINT*,' '
                PRINT*,' '
                PRINT*,'                                        ** M A L E S ***'
                PRINT*,' '
                PRINT 70, NHREED, NARK, FEEPRM
              70 FORMAT (' MALE BREED = ',I1,//,' NUMBER OF MALES ARRIVING TO FARM
              Z= ',I5,//,' FEEDING PROGRAM = ',I1)
                PRINT*,' '
                PRINT*,' AGE  AMOUNT BIRDS MORTALITY AVERAGE BODY   FEED       CUM
               ZULATIVE     REQUIRED'
                PRINT*,' (WK)  END OF WK     (AMOUNT)  WEIGHT (KG) AMOUNT(KG) FEED
               ZAMOUNT(KG) LIGHT(HF)'
            C
            C COMPUTE TOTAL AVERAGE FEED AMOUNT PER DAY, CUMULATIVE FEED AMOUNT,
            C NUMBER OF MALES IN FARM DURING THE FIRST 24 WEEKS
            C
                IF (OAGE.EQ.1)THEN
                MAMOR (1)= NINT (APMMOR (1) * REAL (MARR) * .01)
                ANMAL (1)= MARR - MAMOR (1)
                TAFAM (1)= AFAP (LOCFA,MM,AGE) * (REAL (MARR)/100.)
                CFEAMM (1)= TAFAM (1) * 7.
                PRINT 20, ANMAL (1), MAMOR (1)
```

```
155                   DAGE = 2
156                   ELSE
157                   ENDIF
158                   DO 88 AGE = DAGE,24
159                   MAMOR (AGE)= NINT (APMMOR (AGE) * REAL (ANMAL(AGE-1)) * .81)
160                   ANMAL (AGE)= ANMAL (AGE-1) - MAMOR (AGE)
161                   A = NINT(0.1*REAL(ANFEM(AGE)))
162                   IF (ANMAL(AGE).LT.A)THEN
163                     ANMAL (AGE) = A
164                     RORMA (AGE) = 1
165                   ELSE
166                   ENDIF
167                   IF (AGE.EQ.2)THEN
168                     IF ((LOCFA.EQ.1.AND.MM.EQ.1).OR.(LOCFA.EQ.2.AND.MM.EQ.2))THEN
169                       CFEAMM (2)= 28.68 * (REAL (ANMAL (1))/100.)
170                       PRINT 48, AGE, ANMAL (2), MAMOR (2), CFEAMM (2)
171                     ELSE
172                       CFEAMM (2)= 28.65 * (REAL (ANMAL(1))/100.)
173                       PRINT 48, AGE, ANMAL (2), MAMOR (2), CFEAMM (2)
174                     ENDIF
175                   ELSE
176                     IF (AGE.GE.3.AND.AGE.LE.5)THEN
177                       TAFAM (AGE)= AFAM (LOCFA,MM,AGE) * REAL (ANMAL (AGE-1))/100.
178                     CFEAMM (AGE)= CFEAMM (AGE-1) + (TAFAM(AGE)*7.)
179                       PRINT 98, AGE, ANMAL (AGE), MAMOR (AGE), TAFAM (AGE), CFEAMM
180                   Z     (AGE)
181                98   FORMAT (/,2X,I2,4X,I7,6X,I4,7X,' MM,',6X,F7.2,5X,F10.2,7X,'MO
182                   ZL')
183                     ELSE
184                       IF (FEEPRM.EQ.1)THEN
185                         TAFAM (AGE)= AFAM (LOCFA,MM,AGE) * (REAL (ANMAL(AGE-1))
186                   Z     /100.)
187                         CFEAMM (AGE)= CFEAMM (AGE-1) + TAFAM (AGE) * 7.
188                       ELSE
189                         TAFAM (AGE)= AFAM (LOCFA,MM,AGE) * (REAL (ANMAL(AGE-1))
190                   Z     /100.) * 2.
191                         CFEAMM (AGE)= CFEAMM (AGE-1) + TAFAM (AGE) * 3.5
192                       ENDIF
193                       IF (MOL(AGE).EQ.1)THEN
194                         IF (RORMA(AGE).EQ.0)THEN
195                           PRINT 50,-AGE,-ANMAL (AGE), MAMOR (AGE), AMBW (LOCFA,
196                   Z       MM,AGE), TAFAM (AGE), CFEAMM (AGE)
197                         ELSE
198                           PRINT 55, AGE, ANMAL (AGE), MAMOR (AGE), AMBW (LOCFA,
199                   Z       MM,AGE), TAFAM (AGE), CFEAMM (AGE)
200                55     FORMAT (/,'*',1X,I2,4X,I7,6X,I4,7X,F5.3,6X,F7.2,5X,
201                   Z       F10.2,7X,'MOL')
202                         ENDIF
203                       ELSE
204                         IF (RORMA(AGE).EQ.0)THEN
205                           PRINT 60, AGE, ANMAL (AGE), MAMOR (AGE), AMBW (LOCFA,
206                   Z       MM,AGE), TAFAM (AGE), CFEAMM (AGE) , THELD (AGE)
207                         ELSE
208                           PRINT 65, AGE, ANMAL (AGE), MAMOR (AGE), AMBW (LOCFA,
209                   Z       MM,AGE), TAFAM (AGE), CFEAMM (AGE) , THELD (AGE)
210                65     FORMAT(/,'*',1X,I2,4X,I7,6X,I4,7X,F5.3,6X,F7.2,5X,
211                   Z       F10.2,7X,I2)
212                         ENDIF
213                       ENDIF
214                     ENDIF
215                   ENDIF
216                88 CONTINUE
217                   ELSE
218                   ENDIF
219                   PRINT*,' '
220                   PRINT*,' '  THE TOTAL NUMBER OF MALES IS LESS THAN TEN PERCENT OF
221                  ZTHE TOTAL NUMBER OF FEMALES, THEN CERTAIN NUMBER OF MALES HAS TO B
222                  ZE ORDERED.
223                   IF (FEEPRM.EQ.2)THEN
224                   PRINT*,' '
225                   PRINT*,' THE FEEDING PROGRAM 'LIMITED EVERY DAY' SHOULD ALWAYS BE U
226                  ZSED DURING THE FIRST 5 WEEKS AND THE 'SKIP A DAY' PROGRAM SHOULD B
227                  ZEGIN AT THE 6TH WEEK'
228                   ELSE
229                   ENDIF
230                C
231             C
```

```
      C ** F L O C K ** M A L E S AND F E M A L E S
      C
      C
      C OBTAIN FOLLOWING DATA - AVERAGE BODY WEIGHT
      C                       - AVERAGE FEED AMOUNT PER 100 BIRDS PER DAY
      C                       - AVERAGE RATE OF EGG PRODUCTION PER DAY
      C                       - AVERAGE RATE OF HATCHING EGG PER DAY
            CALL PRODUC (MM, LOCFA, AFBWP, AFAFP, AREPN, AFHEG)
      C TITLES
            PRINT*,' '
            PRINT*,' '
            PRINT*,' '
            PRINT*,' '
            PRINT*,'                                   ** F L O C K **'
            PRINT*,' '
            PRINT*,'FEEDING PROGRAM = 1'
            PRINT*,' '
            PRINT*,' AGE   AMOUNT  AMOUNT  MORTALITY  AVERAGE BODY   FEED PER
     Z CUMULATIVE     PRODUCTION   HATCHING  CUMULATIVE  LIGHT/ CUMULATI
     ZVE'
            PRINT*,' (WK) FEMALE    MALE    FEM    MAL    WEIGHT (KG)  DAY (KG)
     Z FEED (KG)      EGGS/DAY     EGGS/DAY HATCHING EGG DAY(HR)  FEED/D
     ZOZ-EGG'
      C SIZE OF FLOCK WEEK 24
            ANFLO (24)= ANFEM (24) + ANMAL (24)
      C INITIAL VALUE
            CFEAMP (24)= 0.0
            AHEGGD (24)= 0
            CHATEG (24)= 0
            IF (DAGE.LE.24)THEN
            DAGE = 25
            ELSE
            ENDIF
      C
      C COMPUTE TOTAL AVERAGE FEED AMOUNT PER DAY, CUMULATIVE FEED AMOUNT,
      C NUMBER OF FEMALES AND MALES, EGG PRODUCTION , CUMULATIVE HATCHING
      C EGGS FROM WEEK 25 TO 67
      C
            DO 100 AGE = DAGE,67
            FEMOR (AGE)= MINT (APFMOR (AGE) * REAL (ANFEM (AGE-1)) *.01)
            MAMOR (AGE)= MINT (APMMOR (AGE) * REAL (ANMAL (AGE-1)) *.01)
            ANFEM (AGE)= ANFEM (AGE-1) - FEMOR (AGE)
            ANMAL (AGE)= ANMAL (AGE-1) - MAMOR (AGE)
            B = MINTTB.I*REACTANFEM(AGE))
            IF (ANMAL(AGE).LT.B)THEN
               ANMAL (AGE) = B
               RORMA (AGE) = 1
            ELSE
            ENDIF
            ANFLO (AGE)= ANFEM (AGE) + ANMAL (AGE)
            TAFAFP (AGE)= AFAFP (LOCFA,MM,AGE) * (REAL (ANFLO (AGE-1))/100.)
            CFEAMP (AGE)= CFEAMP (AGE-1) + (TAFAFP (AGE) * 7.)
            AHEGGD (AGE)= MINT (AREPN (AGE) * REAL(ANFEM(AGE)) *.01)
            ANHAEG (AGE)= MINT (AFHEG (AGE) * REAL(AHEGGD(AGE)) *.01)
            CHATEG (AGE)= CHATEG (AGE -1) + ANHAEG (AGE) * 7
            FEPDEG (AGE)= (CFEAMP(AGE) / (REAL( AHEGGD(AGE-1) + AHEGGD(AGE)
           Z) * 7.)) * 12
            IF (NOL(AGE).EQ.1)THEN
            IF (RORMA(AGE).EQ.0)THEN
            PRINT 110, AGE , ANFEM (AGE), ANMAL (AGE), FEMOR (AGE), MAMOR (AG
           ZE), AFBWP (LOCFA,MM,AGE), TAFAFP (AGE), CFEAMP (AGE), AHEGGD (AG
           ZE), ANHAEG (AGE), CHATEG (AGE), FEPDEG (AGE)
        110 FORMAT (2X,I2,2X,I6,2X,I5,2X,I4,3X,I4,4X,F5.3,6X,F7.2,5X,F10.2,4
           ZX,I9,3X,I9,4X,I9,4X,'NOL',3X,F6.2)
            ELSE
            PRINT 115, AGE , ANFEM (AGE), ANMAL (AGE), FEMOR (AGE), MAMOR (AG
           ZE), AFBWP (LOCFA,MM,AGE), TAFAFP (AGE), CFEAMP (AGE), AHEGGD (AG
           ZE), ANHAEG (AGE), CHATEG (AGE), FEPDEG (AGE)
        115 FORMAT(' ',I2,2X,I6,2X,I5,2X,I4,3X,I4,4X,F5.3,6X,F7.2,5X,F10.2,4
           ZX,I9,3X,I9,4X,I9,4X,'NOL',3X,F6.2)
            ENDIF
            ELSE
            IF (RORMA(AGE).EQ.0)THEN
            PRINT 120, AGE , ANFEM (AGE), ANMAL (AGE), FEMOR (AGE), MAMOR (AG
           ZE), AFBWP (LOCFA,MM,AGE), TAFAFP (AGE), CFEAMP (AGE), AHEGGD (AG
           ZE), ANHAEG (AGE), CHATEG (AGE), THREO (AGE), FEPDEG (AGE)
        120 FORMAT (2X,I2,2X,I6,2X,I5,2X,I4,3X,I4,4X,F5.3,6X,F7.2,5X,F10.2,4
```

```
309                 2X,I9,3X,I9,4X,I9,4X,I2,3X,F6.2)
310                  ELSE
311                  PRINT 125, AGE, ANFEM (AGE), ANMAL (AGE), FEMOR (AGE), MAMOR (AG
312                 2E), AFBRP (LOCFA,MA,AGE), TAFAPP (AGE), CFEAPP (AGE), AHEGGD (AG
313                 2E), AMHAEG (AGE), CHATEG (AGE), THRLD (AGE), FEPDEG (AGE)
314              125 FORMAT(' ',I2,2X,I6,2X,I5,2X,I4,3X,I4,4X,F5.3,6X,F7.2,5X,F10.2,4
315                 2X,I9,3X,I9,4X,I9,4X,I2,3X,F6.2)
316                  ENDIF
317                  ENDIF
318              100 CONTINUE
319                  PRINT*,' '
320                  PRINT*,' **  THE TOTAL NUMBER OF MALES IS LESS THAN TEN PERCENT OF
321                 2THE TOTAL NUMBER OF FEMALES, THEN CERTAIN NUMBER OF MALES HAS TO B
322                 2E ORDERED.'
323                  PRINT*,' '
324                  PRINT*,'   ALL THE VALUES SHOWN ON TABLES ARE GIVEN PER WEEK WITH
325                 2THE FOLLOWING EXCEPTIONS = FEED AMOUNT PER DAY, EGG PRODUCTION PER
326                 2 DAY, AMOUNT OF HATCHING EGG PER DAY, LIGHT PER DAY'
327                  STOP
328                  END
```

```
      1                 SUBROUTINE GROWTH (MOFLHA, LOCFA, FEEPRF, AFBW, AFAF, AMBW, AFAM
      2                1, FPF, MH)
      3                C DETERMINATION OF MALE AND FEMALE GROWTH FROM WEEK 1 TO WEEK 24
      4                C ARGUMENT DEFINITONS
      5                C    INPUT ARGUMENTS
      6                C       MOFLHA -MONTH WHEN FLOCK WAS MATCHED
      7                C       LOCFA - LOCATION OF THE FARM - NORTH OR SOUTH OF EQUATOR -
      8                C       FEEPRF - FEEDING PROGRAM USED BY THE FARM FOR FEMALES
      9                C    OUTPUT ARGUMENTS -
     10                C       AFBW - AVERAGE FEMALE BODY WEIGHT -KG-
     11                C       AFAF - AVERAGE FEED AMOUNT PER 100 FEMALES PER DAY  -KG-
     12                C       AMBW - AVERAGE MALE BODY WEIGHT -KG-
     13                C       AFAM - AVERAGE FEED AMOUNT PER 100 MALES PER DAY  -KG-
     14                C       FPF - INDICATOR OF FEEDING PROGRAM FOR FEMALES /1 IF FEEPR = 1 O
     15                C       R 2 / 2 OTHERWISE
     16                C       MH - INDICATOR OF THE SEASON WHEN FLOCK WAS HATCHED / 1 IF MOFLH
     17                C       BETWEEN OCTOBER AND MARCH / 2 OTHERWISE
     18                        INTEGER AGE, FEEPRF, LOCFA, MOFLHA, FPF, MH
     19                        REAL AFBW(2,2,24), AFAF(2,2,2,24), AMBW(2,2,24), AFAM(2,2,24
     20                       Z)
     21                        REAL AFBWS(2,2,24), AFAFS(2,2,2,24), AMBWS(2,2,24), AFAMS(2,2,24
     22                       Z)
     23                C
     24                C AVERAGE FEMALE BODY WEIGHT -KG-   AFBWS
     25                C
     26                      DATA (AFBWS(1,1,AGE), AGE = 1,24) /0.0, 0.0, 0.465, 0.650, 0.681
     27                     Z, 0.744, 0.817, 0.930, 1.024, 1.115, 1.214, 1.308, 1.392, 1.442,
     28                     Z1.580, 1.670, 1.765, 1.860, 1.955, 2.050, 2.140, 2.230, 2.325,
     29                     Z 2.420 /
     30                      DATA (AFBWS(2,1,AGE), AGE = 1,24) /0.0, 0.0, 0.512, 0.619, 0.725
     31                     Z, 0.832, 0.934, 1.045, 1.150, 1.260, 1.365, 1.475, 1.580, 1.650,
     32                     Z1.795, 1.905, 2.010, 2.115, 2.225, 2.330, 2.435, 2.540, 2.650,
     33                     Z2.760 /
     34                C
     35                C AVERAGE FEED AMOUNT PER 100 FEMALES PER DAY -KG-  AFAFS
     36                C
     37                      DATA (AFAFS(1,1,1,AGE), AGE = 1,24) /0.0, 0.0, 3.6, 4.0,5.4,5.5,5.
     38                     Z 6.1, 6.4, 6.4, 6.8, 7.0, 7.3, 7.5, 7.7, 7.9, 8.2, 8.4,8.6,8.6
     39                     Z 9.1, 9.1, 9.5, 9.5, 10.0 /
     40                      DATA (AFAFS(2,1,1,AGE), AGE = 1,24) /0.0, 0.0, 4.1, 5.0, 5.7,6.1
     41                     Z, 6.4, 6.8, 7.0, 7.3, 7.5, 7.9, 8.2, 8.4, 8.6, 9.1, 9.3,9.5,9.8
     42                     Z, 10.2, 10.7, 10.7, 10.9, 11.4 /
     43                      DATA (AFAFS(1,2,1,AGE), AGE = 1,24) /0.0, 0.0, 3.6, 4.2,5.4,5.65
     44                     Z, 4.57, 8.84, 9.28, 9.52, 9.84, 10.16, 10.47, 11.13, 11.11,11.43
     45                     Z, 11.75, 12.06, 12.38, 12.70, 13.02, 13.34, 13.66, 13.97 /
     46                      DATA (AFAFS(2,2,1,AGE), AGE = 1,24) /0.0, 0.0, 4.1, 5.0,5.7,6.57
     47                     Z, 8.83, 9.52, 9.84, 10.16, 10.47, 11.11, 11.43, 11.75, 12.06,
     48                     Z12.70, 13.02, 13.34, 13.66, 14.28, 14.60, 14.92, 15.24, 15.87 /
     49                C
     50                C AVERAGE MALE BODY WEIGHT -KG-  AMBWS
     51                C
     52                      DATA (AMBWS(1,1,AGE), AGE = 1,24) /0.0, 0.0, 0.0, 0.0, 0.0, .929
     53                     Z, 1.045, 1.161, 1.277, 1.375, 1.533, 1.650, 1.767, 1.867, 2.066,
     54                     Z2.122, 2.240, 2.359, 2.477, 2.594, 2.712, 2.873, 2.993, 3.113 /
     55                      DATA (AMBWS(2,1,AGE), AGE = 1,24) /0.0, 0.0, 0.0, 0.0, 0.0, 0.0,1.680
     56                     Z, 1.798, 1.918, 2.038, 2.158, 2.278, 2.398, 2.518, 2.638, 2.758,
     57                     Z, 2.878, 2.998, 3.118, 3.238, 3.358, 3.478, 3.598, 3.718, 3.838/
     58                C
     59                C AVERAGE FEED AMOUNT PER 100 MALES PER DAY -KG-  AFAMS
     60                C
     61                      DATA (AFAMS(1,1,AGE), AGE = 1,24) /0.0, 0.0, 3.65,5.00,5.65,6.25
     62                     Z, 6.45, 6.70, 6.95, 7.25, 7.45, 7.75, 7.95, 8.15, 8.50, 8.75,
     63                     Z1.95, 9.30, 9.50, 9.75, 10.00, 10.20, 10.45, 10.70 /
     64                      DATA (AFAMS(2,1,AGE), AGE = 1,24) /0.0, 0.0, 4.3, 5.26,5.90,6.45,
     65                     Z, 6.70, 7.15, 7.35, 7.75, 7.95, 8.35, 8.65, 8.95, 9.15, 9.65,
     66                     Z9.45, 10.20, 10.45, 10.90, 11.10, 11.35, 11.55, 12.00 /
     67                C
     68                      IF (MOFLHA.GE.4.AND.MOFLHA.LE.9)THEN
     69                        MH = 2
     70                      ELSE
     71                        MH = 1
     72                      ENDIF
     73                      IF (FEEPRF.EQ.3)THEN
     74                        FPF = 2
     75                      ELSE
     76                        FPF = 1
     77                      ENDIF
```

```
      C
      C DETERMINATION OF THE AVERAGE BODY WEIGHT AND FEED AMOUNT ACCORDING TO
      C THE LOCATION OF THE FARM , SEASON WHEN FLOCK WAS HATCHED AND FEEDING
      C PROGRAM
      C
            IF ((LOCFA.EQ.2.AND.MH.EQ.2).OR.(LOCFA.EQ.1.AND.MH.EQ.1))THEN
                DO 10 AGE = 1,24
                AFAW (LOCFA,MH,AGE)= AFBWS(1,1,AGE)
                AFAM (LOCFA,MH,AGE)= AFAMS(1,1,AGE)
                AMBW (LOCFA,MH,AGE)= AMBWS(1,1,AGE)
           10   CONTINUE
            ELSE IF ((LOCFA.EQ.1.AND.MH.EQ.2).OR.(LOCFA.EQ.2.AND.MH.EQ.1))TH
              ZEN
                DO 20 AGE = 1,24
                AFAW (LOCFA,MH,AGE)= AFBWS(2,1,AGE)
                AFAM (LOCFA,MH,AGE)= AFAMS(2,1,AGE)
                AMBW (LOCFA,MH,AGE)= AMBWS(2,1,AGE)
           20   CONTINUE
            ENDIF
            IF ((LOCFA.EQ.2.AND.MH.EQ.2).AND.(FPF.EQ.1))THEN
                DO 30 AGE = 1,24
                AFAF (LOCFA,MH,FPF,AGE)= AFAFS(1,1,1,AGE)
           30   CONTINUE
            ELSE IF ((LOCFA.EQ.1.AND.MH.EQ.1).AND.(FPF.EQ.1))THEN
                DO 35 AGE = 1,24
                AFAF (LOCFA,MH,FPF,AGE)= AFAFS(1,1,1,AGE)
           35   CONTINUE
            ELSE IF ((LOCFA.EQ.1.AND.MH.EQ.2).AND.(FPF.EQ.1))THEN
                DO 40 AGE = 1,24
                AFAF (LOCFA,MH,FPF,AGE)= AFAFS( 2,1,1,AGE)
           40   CONTINUE
            ELSE IF ((LOCFA.EQ.2.AND.MH.EQ.1).AND.(FPF.EQ.1))THEN
                DO 45 AGE = 1,24
                AFAF (LOCFA,MH,FPF,AGE)= AFAFS(2,1,1,AGE)
           45   CONTINUE
            ENDIF
            IF ((LOCFA.EQ.2.AND.MH.EQ.2).AND.(FPF.EQ.2))THEN
                DO 50 AGE = 1,24
                AFAF (LOCFA,MH,FPF,AGE)= AFAFS(1,1,2,AGE)
           50   CONTINUE
            ELSE IF ((LOCFA.EQ.1.AND.MH.EQ.1).AND.(FPF.EQ.2))THEN
                DO 55 AGE = 1,24
                AFAF (LOCFA,MH,FPF,AGE)= AFAFS(1,1,2,AGE)
           55   CONTINUE
            ELSE IF ((LOCFA.EQ.1.AND.MH.EQ.2).AND.(FPF.EQ.2))THEN
                DO 60 AGE = 1,24
                AFAF (LOCFA,MH,FPF,AGE)= AFAFS(2,1,2,AGE)
           60   CONTINUE
            ELSE IF ((LOCFA.EQ.2.AND.MH.EQ.1).AND.(FPF.EQ.2))THEN
                DO 65 AGE = 1,24
                AFAF (LOCFA,MH,FPF,AGE)= AFAFS(2,1,2,AGE)
           65   CONTINUE
            ENDIF
            RETURN
            END
```

```
      SUBROUTINE PRODUC ( MH, LOCFA, AFBWP, AFAFP, AREPR, ARHEG)
C DETERMINATION OF FLOCK PRODUCTION, BODY WEIGHT AND FEED AMOUNT FROM
C WEEK 25 TO WEEK 67
C ARGUMENT DEFINITIONS
C   INPUT ARGUMENTS
C     MH - INDICATOR OF THE SEASON WHEN FLOCK WAS HATCHED /1 IF PERIOD
C     BETWEEN OCTOBER AND MARCH /2 OTHERWISE
C     LOCFA - LOCATION OF THE FARM -NORTH OR SOUTH OF EQUATOR-
C   OUTPUT ARGUMENTS
C     AFBWP - AVERAGE FLOCK BODY WEIGHT -KG-
C     AFAFP - AVERAGE FEED AMOUNT PER 100 BIRDS PER DAY -KG-
C     AREPR - AVERAGE RATE OF EGG PRODUCTION PER DAY -PERCENTAGE-
C     ARHEG - AVERAGE RATE OF HATCHING EGGS PER DAY -PERCENTAGE-
      INTEGER LOCFA, AGE, MH
      REAL AFBWP (2,2,25:67), AFAFP (2,2,25:67), ARHEG (25:67), AREPR
     Z(25:67)
      REAL AFBWPS(2,2,25:67), AFAFPS(2,2,25:67), ARHEGS(25:67), AREPRS
     Z(25:67)
C
C AVERAGE FEED AMOUNT PER 100 BIRDS PER DAY -KG-  AFAFPS
C
      DATA (AFAFPS(1,1,AGE), AGE= 25,67) /14.05, 14.55, 15.85,
     Z7*16.75, 7*15.85, 8*15.40, 8*14.50, 10*14.05 /
C
C AVERAGE FLOCK BODY WEIGHT -KG-  AFBWPS
C
      DATA (AFBWPS(1,1,AGE), AGE = 25,67) /2.52, 2.62, 2.73, 2.79,2.86
     Z, 2.92, 2.95, 8*3.03, 12*3.12, 16*3.27 /
      DATA (AFBWPS(2,1,AGE), AGE= 25,67) /2.86, 2.97, 3.06, 3.14, 3.20
     Z, 3.26, 3.33, 8*3.37, 12*3.47, 16*3.53 /
C
C AVERAGE RATE OF EGG PRODUCTION PER DAY -PERCENTAGE-  AREPRS
C
      DATA (AREPPS(AGE), AGE = 25,67) /5.0, 20.0, 38.0, 55.0,72.0,80.0
     Z, 2*83.0, 82.0, 2*81.0, 80.0, 2*79.0, 78.0,77.0,76.0,75.0,74.0,
     Z  73.0, 72.0, 71.0, 2*70.0, 69.0, 68.0, 67.0, 66.0, 65.0,64.0
     Z, 63.0, 62.0, 2*61.0, 60.0, 59.0, 58.0, 57.0, 56.0, 55.0, 54.0,
     Z53.0, 52.0 /
C
C AVERAGE RATE OF HATCHING EGGS PER DAY -PERCENTAGE-  ARHEGS
C
      DATA (ARHEGS(AGE), AGE = 25,67) /0.0, 75.0, 78.0, 82.0,85.0,86.0
     Z, 87.0, 2*88.0, 5*90.0, 2*89.0, 4*88.0, 4*87.0, 2*86.0, 2*85.0
     Z, 2*84.0, 83.0, 82.0, 2*81.0, 2*80.0, 2*79.0, 2*78.0, 2*77.0,
     Z75.0 /
C
C DETERMINATION OF THE AVERAGE BODY WEIGHT AND FEED AMOUNT ACCORDING TO
C THE LOCATION OF THE FARM AND SEASON WHEN FLOCK WAS HATCHED
C
      IF ((LOCFA.EQ.1.AND.MH.EQ.1).OR.(LOCFA.EQ.2.AND.MH.EQ.2))THEN
         DO 10 AGE = 25,67
         AFAFP (LOCFA,MH,AGE)= AFAFPS (1,1,AGE)
         AFBWP (LOCFA,MH,AGE)= AFBWPS(1,1,AGE)
   10    CONTINUE
      ELSE IF ((LOCFA.EQ.2.AND.MH.EQ.1).OR.(LOCFA.EQ.1.AND.MH.EQ.2))TH
     ZEN
         DO 20 AGE = 25,67
         AFAFP (LOCFA,MH,AGE)= AFAFPS (1,1,AGE)
         AFBWP (LOCFA,MH,AGE)= AFBWPS(2,1,AGE)
   20    CONTINUE
      ENDIF
      DO 30 AGE = 25,67
      AREPR (AGE)= AREPRS (AGE)
      ARHEG (AGE)= ARHEGS (AGE)
   30 CONTINUE
      RETURN
      END
```

```
FUNCTION APFMOR    73/172  OPT=0                    FTN 5.1+552    82/04/26. 20.43.04    PAGE    1

      1                 REAL FUNCTION APFMOR (AGE)
      2           C COMPUTE AVERAGE PERCENTAGE OF FEMALE MORTALITY
      3                 INTEGER AGE
      4                 REAL A,B
      5                 PARAMETER (A = 0.6007, B = -4.4998)
      6                 IF (AGE.EQ.1)THEN
      7                    APFMOR = 2.69
      8                 ELSE IF (AGE.EQ.2)THEN
      9                    APFMOR = 1.71
     10                 ELSE
     11                    APFMOR = A*EXP (B/REAL(AGE))
     12                 ENDIF
     13                 RETURN
     14                 END
```

```
FUNCTION APMMOR    73/172  OPT=0                    FTN 5.1+552    82/04/26. 20.43.04

      1                 REAL FUNCTION APMMOR (AGE)
      2           C COMPUTE AVERAGE PERCENTAGE OF MALE MORTALITY
      3                 INTEGER AGE
      4                 REAL B0,B1,B2
      5                 PARAMETER (B0 = 0.2851, B1 = 0.0887, B2 = -.0011)
      6                 IF (AGE.EQ.1)THEN
      7                    APMMOR = 5.80
      8                 ELSE IF (AGE.EQ.2)THEN
      9                    APMMOR = 3.30
     10                 ELSE
     11                    APMMOR = B0 + B1*REAL(AGE) + B2*REAL(AGE)*REAL(AGE)
     12                 ENDIF
     13                 RETURN
     14                 END
```

```
      SUBROUTINE LIGHT (MOFLHA, LOCFA, LATFA, THRLD, NDL, AHDL)
C DETERMINATION OF THE LIGHTING PROGRAM
C
C ARGUMENT DEFINITIONS
C   INPUT ARGUMENTS
C     MOFLHA - MONTH WHEN FLOCK WAS HATCHED
C     LOCFA - LOCATION OF THE FARM - NORTH OR SOUTH OF EQUATOR -
C     LATFA - LATITUDE WHERE THE FARM IS
C   OUTPUT ARGUMENTS
C     THRLD - TOTAL HOURS OF REQUIRED LIGHT PER DAY ,NATURAL AND ARTIF
C     ICTAL
C     NDL - INDICATOR OF THE USE OF NATURAL DAYLIGHT WHEN ITS VALUE IS
C     1
C     AHDL - AVERAGE HOURS OF DAYLIGHT
      INTEGER AGE, LOCFA, LATFA, THRLD(67), NDL(67)
      REAL AHDL
      DO 5 AGE= 1,67
      NDL(AGE)= 0
    5 CONTINUE
      AHDL= 0.0
      DO 3 AGE = 1,67
      THRLD(AGE) = 0
    3 CONTINUE
C
C LATITUD BETWEEN 0 AND 29 DEGREES
C
      IF (LATFA.GE.0.AND.LATFA.LE.29)THEN
        IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.2).OR.((LOCFA.EQ.2.AND.MOFLHA.EQ
     Z      .7)))THEN
          AHDL = 11.40
          DO 10 AGE = 1,21
          NDL(AGE) = 1
   10     CONTINUE
          DO 15 AGE = 22,67
          THRLD(AGE) = 14
   15     CONTINUE
        ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.2).OR.((LOCFA.EQ.2.AND.MOFL
     Z        HA.EQ.8)))THEN
          AHDL = 12.0
          DO 20 AGE = 1,17
          NDL(AGE) = 1
   20     CONTINUE
          DO 25 AGE = 18,67
          THRLD(AGE) = 14
   25     CONTINUE
        ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.3).OR.((LOCFA.EQ.2.AND.MOFL
     Z        HA.EQ.9)))THEN
          AHDL = 12.4
          DO 30 AGE = 1,17
          NDL(AGE) = 1
   30     CONTINUE
          DO 35 AGE = 18,21
          THRLD(AGE) = 13
   35     CONTINUE
          DO 40 AGE = 22,67
          THRLD(AGE) = 14
   40     CONTINUE
        ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.4).OR.((LOCFA.EQ.2.AND.MOFL
     Z        HA.EQ.10)))THEN
          AHDL = 12.50
          DO 45 AGE = 1,13
          NDL(AGE) = 1
   45     CONTINUE
          DO 50 AGE = 14,17
          THRLD(AGE) = 12
   50     CONTINUE
          DO 55 AGE = 18,21
          THRLD(AGE) = 13
   55     CONTINUE
          DO 60 AGE = 22,67
          THRLD(AGE) = 14
   60     CONTINUE
        ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.5).OR.((LOCFA.EQ.2.AND.MOFL
     Z        HA.EQ.11)))THEN
          AHDL = 13.10
          DO 65 AGE = 1,13
          NDL(AGE) = 1
```

```
      65    CONTINUE
            DO 70 AGE = 14,17
           THRLO(AGE) = 12
      70    CONTINUE
            DO 75 AGE = 18,21
            THRLO(AGE) = 13
      75    CONTINUE
            DO 80 AGE = 22,67
            THRLO(AGE) = 14
      80    CONTINUE
           ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.6).OR.(LOCFA.EQ.2.AND.MOFL
     2          HA.EQ.12))THEN
            AHOL = 13.3
            DO 85 AGE = 1,13
            NOL(AGE) = 1
      85    CONTINUE
            DO 90 AGE = 14,17
            THRLO(AGE) = 12
      90    CONTINUE
            DO 100 AGE = 18,21
            THRLO(AGE) = 13
     100    CONTINUE
            DO 105 AGE = 22,67
            THRLO(AGE) = 14
     105    CONTINUE
           ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.7).OR.(LOCFA.EQ.2.AND.MOFL
     2          HA.EQ.1))THEN
            AHOL = 13.29
            DO 110 AGE = 1,13
            NOL(AGE) = 1
     110    CONTINUE
            DO 115 AGE = 14,17
            THRLO(AGE) = 12
     115    CONTINUE
            DO 120 AGE = 18,21
            THRLO(AGE) = 13
     120    CONTINUE
            DO 125 AGE = 22,67
            THRLO(AGE) = 14
     125    CONTINUE
           ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.8).OR.(LOCFA.EQ.2.AND.MOFL
     2          HA.EQ.2))THEN
            AHOL = 13.1
            DO 130 AGE = 1,13
            NOL(AGE) = 1
     130    CONTINUE
            DO 135 AGE = 14,17
            THRLO(AGE) = 12
     135    CONTINUE
            DO 140 AGE = 18,21
            THRLO(AGE) = 13
     140    CONTINUE
            DO 145 AGE = 22,67
            THRLO(AGE) = 14
     145    CONTINUE
           ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.9).OR.(LOCFA.EQ.2.AND.MOFL
     2          HA.EQ.3))THEN
            AHOL = 12.6
            DO 150 AGE = 1,13
            NOL(AGE) = 1
     150    CONTINUE
            DO 155 AGE = 14,17
            THRLO(AGE) = 12
     155    CONTINUE
            DO 160 AGE = 18,21
            THRLO(AGE) = 13
     160    CONTINUE
            DO 165 AGE = 22,67
            THRLO(AGE) = 14
     165    CONTINUE
           ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.10).OR.(LOCFA.EQ.2.AND.MOF
     2          LHA.EQ.4))THEN
            AHOL = 12.1
            DO 170 AGE = 1,21
            NOL(AGE) = 1
     170    CONTINUE
            DO 175 AGE = 22,29
```

```
155                     THRLO(AGE) = 13
156               175   CONTINUE
157                     DO 180 AGE = 30,67
158                     THRLO(AGE) = 14
159               180   CONTINUE
160                   ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.11).OR.(LOCFA.EQ.2.AND.MOF
161                  Z        LHA.EQ.5))THEN
162                     AMDL = 11.5
163                     DO 185 AGE = 1,27
164                     MDL(AGE) = 1
165               185   CONTINUE
166                     DO 190 AGE = 28,67
167                     THRLO(AGE) = 14
168               190   CONTINUE
169                   ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.12).OR.(LOCFA.EQ.2.AND.MOF
170                  Z        LHA.EQ.6))THEN
171                     AMDL = 11.3
172                     DO 195 AGE = 1,25
173                     MDL(AGE) = 1
174               195   CONTINUE
175                     DO 200 AGE = 26,67
176                     THRLO(AGE) = 14
177               200   CONTINUE
178                     ELSE
179                     PRINT*, 'ERROR NO. 1'
180                     ENDIF
181                 ELSE
182               C
183               C LATITUD BETWEEN 30 AND 33 DEGREES
184               C
185                   IF ((LATFA.GE.30.AND.LATFA.LE.39)THEN
186                   IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.1).OR.(LOCFA.EQ.2.AND.MOFLHA.EQ
187                  Z        .7))THEN
188                     AMDL = 10.03
189                     DO 205 AGE = 1,21
190                     MDL(AGE) = 1
191               205   CONTINUE
192                     DO 210 AGE = 22,67
193                     THRLO(AGE) = 15
194               210   CONTINUE
195                   ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.2).OR.(LOCFA.EQ.2.AND.MOFL
196                  Z        HA.EQ.8))THEN
197                     AMDL = 10.56
198                     DO 215 AGE = 1,19
199                     MDL(AGE) = 1
200               215   CONTINUE
201                     DO 220 AGE = 20,67
202                     THRLO(AGE) = 15
203               220   CONTINUE
204                   ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.3).OR.(LOCFA.EQ.2.AND.MOFL
205                  Z        HA.EQ.9))THEN
206                     AMDL = 11.56
207                     DO 225 AGE = 1,13
208                     MDL(AGE) = 1
209               225   CONTINUE
210                     DO 230 AGE = 14,21
211                     THRLO(AGE) = 14
212               230   CONTINUE
213                     DO 235 AGE = 22,67
214                     THRLO(AGE) = 15
215               235   CONTINUE
216                   ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.4).OR.(LOCFA.EQ.2.AND.MOFL
217                  Z        HA.EQ.10))THEN
218                     AMDL = 13.04
219                     DO 240 AGE = 1,13
220                     MDL(AGE) = 1
221               240   CONTINUE
222                     DO 245 AGE = 14,21
223                     THRLO(AGE) = 14
224               245   CONTINUE
225                     DO 250 AGE = 22,67
226                     THRLO(AGE) = 15
227               250   CONTINUE
228                   ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.5).OR.(LOCFA.EQ.2.AND.MOFL
229                  Z        HA.EQ.11))THEN
230                     AMDL = 16.01
231                     DO 255 AGE = 1,13
```

```
      NDL(AGE) = 1
255   CONTINUE
      DO 260 AGE = 14,17
      THRLD(AGE) = 13
260   CONTINUE
      DO 265 AGE = 18,25
      THRLD(AGE) = 14
265   CONTINUE
      DO 270 AGE = 26,67
      THRLD(AGE) = 15
270   CONTINUE
      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.6).OR.((LOCFA.EQ.2.AND.MOFL
     Z          HA.EQ.12))THEN
      AHDL = 14.31
      DO 275 AGE = 1,13
      NDL(AGE) = 1
275   CONTINUE
      DO 280 AGE = 14,17
      THRLD(AGE) = 12
280   CONTINUE
      THRLD(18) = 13
      THRLD(19) = 13
      DO 285 AGE = 20,25
      THRLD(AGE) = 14
285   CONTINUE
      DO 290 AGE = 26,67
      THRLD(AGE) = 15
290   CONTINUE
      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.7).OR.(LOCFA.EQ.2.AND.POFL
     Z          HA.EQ.11))THEN
      AHDL = 14.19
      DO 295 AGE = 1,13
      NDL(AGE) = 1
295   CONTINUE
      DO 300 AGE = 14,17
      THRLD(AGE) = 12
300   CONTINUE
      THRLD(18) = 13
      THRLD(19) = 13
      DO 305 AGE = 20,25
      THRLD(AGE) = 14
305   CONTINUE
      DO 310 AGE = 26,67
      THRLD(AGE) = 15
310   CONTINUE
      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.8).OR.(LOCFA.EQ.2.AND.POFL
     Z          HA.EQ.21))THEN
      AHDL = 13.38
      DO 315 AGE = 1,13
      NDL(AGE) = 1
315   CONTINUE
      DO 320 AGE = 14,17
      THRLD(AGE) = 12
320   CONTINUE
      THRLD(18) = 13
      THRLD(19) =13
      DO 325 AGE = 20,25
      THRLD(AGE) = 14
325   CONTINUE
      DO 330 AGE = 26,67
      THRLD(AGE) = 15
330   CONTINUE
      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.9).OR.(LOCFA.EQ.2.AND.POFL
     Z          HA.EQ.31))THEN
      AHDL = 12.25
      DO 335 AGE = 1,13
      NDL(AGE) = 1
335   CONTINUE
      DO 340 AGE = 14,17
      THRLD(AGE) = 12
340   CONTINUE
      THRLD(18) = 13
      THRLD(19) = 13
      DO 345 AGE = 20,25
      THRLD(AGE) = 14
345   CONTINUE
      DO 350 AGE = 26,67
```

```
                  THRLO(AGE) = 15
            350   CONTINUE
                 ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.10).OR.(LOCFA.EQ.2.AND.MOF
           Z          LHA.EQ.4))THEN
                  AHOL = 11.19
                  DO 355 AGE = 1,21
                  NOL(AGE) = 1
            355   CONTINUE
                  DO 360 AGE = 22,25
                  THRLO(AGE) = 14
            360   CONTINUE
                  DO 365 AGE = 26,67
                  THRLO(AGE) = 15
            365   CONTINUE
                 ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.11).OR.(LOCFA.EQ.2.AND.MOF
           Z          LHA.EQ.5))THEN
                  AHOL = 10.2
                  DO 370 AGE = 1,27
                  NOL(AGE) = 1
            370   CONTINUE
                  DO 375 AGE = 28,67
                  THRLO(AGE) = 15
            375   CONTINUE
                 ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.12).OR.(LOCFA.EQ.2.AND.MOF
           Z          LHA.EQ.6))THEN
                  AHOL = 9.49
                  DO 380 AGE = 1,27
                  NOL(AGE) = 1
            380   CONTINUE
                  DO 385 AGE = 28,67
                  THRLO(AGE) = 15
            385   CONTINUE
                  ELSE
                  PRINT*,'ERROR NO. 2'
                  ENDIF
                ELSE
C
C LATITUD BETWEEN 40 AND 45 DEGREES
C
                  IF (LATFA.GE.40.AND.LATFA.LE.45)THEN
                   IF ((LOCFA.EQ.1.AND.MOLFHA.EQ.1).OR.(LOCFA.EQ.2.AND.MOF
           Z          LHA.EQ.7))THEN
                    AHOL = 9.89
                    DO 390 AGE = 1,21
                    NOL(AGE) = 1
            390     CONTINUE
                    DO 395 AGE = 22,67
                    THRLO(AGE) = 16
            395     CONTINUE
                    ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.2).OR.(LOCFA.EQ.2.AN
           Z          D.MOFLHA.EQ.8))THEN
                    AHOL = 10.26
                    DO 400 AGE = 1,19
                    NOL(AGE) = 1
            400     CONTINUE
                    DO 405 AGE = 20,67
                    THRLO(AGE) = 16
            405     CONTINUE
                    ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.3).OR.(LOCFA.EQ.2.AN
           Z          D.MOFLHA.EQ.9))THEN
                    AHOL = 11.52
                    DO 410 AGE = 1,13
                    NOL(AGE) = 1
            410     CONTINUE
                    DO 415 AGE = 14,21
                    THRLO(AGE) = 15
            415     CONTINUE
                    DO 420 AGE = 22,67
                    THRLO(AGE) = 16
            420     CONTINUE
                    ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.4).OR.(LOCFA.EQ.2.AN
           Z          D.MOFLHA.EQ.10))THEN
                    AHOL = 13.29
                    DO 425 AGE = 1,13
                    NOL(AGE) = 1
            425     CONTINUE
                    DO 430 AGE = 14,21
```

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386                     THRLD(AGE) = 15
387             430     CONTINUE
388                     DO 435 AGE = 22,67
389                     THRLD(AGE) = 16
390             435     CONTINUE
391                     ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.5).OR.(LOCFA.EQ.2.AN
392           2               D.MOFLHA.EQ.1))THEN
393                     ANDL = 14.58
394                     DO 440 AGE = 1,13
395                     NDL(AGE) = 1
396             440     CONTINUE
397                     DO 445 AGE = 14,17
398                     THRLD(AGE) = 14
399             445     CONTINUE
400                     DO 450 AGE = 18,25
401                     THRLD(AGE) = 15
402             450     CONTINUE
403                     DO 455 AGE = 26,67
404                     THRLD(AGE) = 16
405             455     CONTINUE
406                     ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.6).OR.(LOCFA.EQ.2.AN
407           2               D.MOFLHA.EQ.12))THEN
408                     ANDL = 15.36
409                     DO 460 AGE = 1,13
410                     NDL(AGE) = 1
411             460     CONTINUE
412                     DO 465 AGE = 14,17
413                     THRLD(AGE) = 13
414             465     CONTINUE
415                     THRLD(18) = 14
416                     THRLD(19) = 14
417                     DO 470 AGE = 20,25
418                     THRLD(AGE) = 15
419             470     CONTINUE
420                     DO 475 AGE = 26,67
421                     THRLD(AGE) = 16
422             475     CONTINUE
423                     ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.7).OR.(LOCFA.EQ.2.AN
424           2               D.MOFLHA.EQ.11))THEN
425                     ANDL = 15.17
426                     DO 480 AGE = 1,13
427                     NDL(AGE) = 1
428             480     CONTINUE
429                     DO 485 AGE = 14,17
430                     THRLD(AGE) = 12
431             485     CONTINUE
432                     THRLD(18) = 13
433                     THRLD(19) = 13
434                     THRLD(20) = 14
435                     THRLD(21) = 14
436                     DO 490 AGE = 22,25
437                     THRLD(AGE) = 15
438             490     CONTINUE
439                     DO 495 AGE = 26,67
440                     THRLD(AGE) = 16
441             495     CONTINUE
442                     ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.8).OR.(LOCFA.EQ.2.AN
443           2               D.MOFLHA.EQ.2))THEN
444                     ANDL = 14.06
445                     DO 500 AGE = 1,13
446                     NDL(AGE) = 1
447             500     CONTINUE
448                     DO 505 AGE = 14,17
449                     THRLD(AGE) = 12
450             505     CONTINUE
451                     THRLD(18) = 13
452                     THRLD(19) = 13
453                     THRLD(20) = 14
454                     THRLD(21) = 14
455                     DO 510 AGE = 22,25
456                     THRLD(AGE) = 15
457             510     CONTINUE
458                     DO 515 AGE = 26,67
459                     THRLD(AGE) = 16
460             515     CONTINUE
461                     ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.9).OR.(LOCFA.EQ.2.AN
462           2               D.MOFLHA.EQ.3))THEN
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463                     AHOL = 12.33
464                     DO 520 AGE = 1,13
465                     NOL(AGE) = 1
466           520       CONTINUE
467                     DO 525 AGE = 14,17
468                     THRLD(AGE) = 12
469           525       CONTINUE
470                     THRLD(18) = 13
471                     THRLD(19) = 13
472                     THRLD(20) = 14
473                     THRLD(21) = 14
474                     DO 530 AGE = 22,25
475                     THRLD(AGE) = 15
476           530       CONTINUE
477                     DO 535 AGE = 26,67
478                     THRLD(AGE) = 16
479           535       CONTINUE
480                     ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.10).OR.(LOCFA.EQ.2.A
481                    Z          ND.MOFLHA.EQ.4))THEN
482                     AHOL = 11.01
483                     DO 540 AGE = 1,21
484                     NOL(AGE) = 1
485           540       CONTINUE
486                     THRLD(22) = 14
487                     THRLD(23) = 14
488                     THRLD(24) = 15
489                     THRLD(25) = 15
490                     DO 545 AGE = 26,67
491                     THRLD(AGE) = 16
492           545       CONTINUE
493                     ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.11).OR.(LOCFA.EQ.2.A
494                    Z          ND.MOFLHA.EQ.5))THEN
495                     AHOL = 9.34
496                     DO 550 AGE = 1,27
497                     NOL(AGE) = 1
498           550       CONTINUE
499                     DO 555 AGE = 28,67
500                     THRLD (AGE)= 16
501           555       CONTINUE
502                     ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.11).OR.(LOCFA.EQ.2.A
503                    Z          ND.MOFLHA.EQ.5))THEN
504                     AHOL = 9.34
505                     DO 556 AGE = 1,27
506                     NOL(AGE) = 1
507           556       CONTINUE
508                     DO 557 AGE = 28,67
509                     THRLD(AGE) = 16
510           557       CONTINUE
511                     ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.12).OR.(LOCFA.EQ.2.A
512                    Z          ND.MOFLHA.EQ.6))THEN
513                     AHOL = 8.48
514                     DO 561 AGE = 1,27
515                     NOL(AGE) = 1
516           560       CONTINUE
517                     DO 565 AGE = 28,67
518                     THRLD(AGE) = 16
519           565       CONTINUE
520                     ELSE
521                     PRINT*,'ERROR NO. 3'
522                     ENDIF
523                   ELSE
524                     IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.11.OR.(LOCFA.EQ.2.AND.MOF
525                    Z       LHA.EQ.7))THEN
526                     AHOL = 9.20
527                     DO 570 AGE = 1,21
528                     NOL(AGE) = 1
529           570       CONTINUE
530                     DO 580 AGE = 22,67
531                     THRLD(AGE) = 17
532           580       CONTINUE
533                     ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.21).OR.(LOCFA.EQ.2.AN
534                    Z          D.MOFLHA.EQ.8))THEN
535                     AHOL = 10.0
536                     DO 585 AGE = 1,19
537                     NOL(AGE) = 1
538           585       CONTINUE
539                     DO 590 AGE = 20,67
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                      THRLO(AGE) = 17
                  590 CONTINUE
                      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.3).OR.(LOCFA.EQ.2.AN
                     Z      D.MOFLHA.EQ.9))THEN
                      AHOL = 12.8
                      DO 595 AGE = 1,13
                      NOL(AGE) = 1
                  595 CONTINUE
                      DO 600 AGE = 14,67
                      THRLO(AGE) = 17
                  600 CONTINUE
                      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.4).OR.(LOCFA.EQ.2.AN
                     Z      D.MOFLHA.EQ.10))THEN
                      AHOL = 14.0
                      DO 605 AGE = 1,13
                      NOL(AGE) = 1
                  605 CONTINUE
                      DO 610 AGE = 14,21
                      THRLO(AGE) = 16
                  610 CONTINUE
                      DO 615 AGE = 22,67
                      THRLO(AGE) = 17
                  615 CONTINUE
                      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.5).OR.(LOCFA.EQ.2.AN
                     Z      D.MOFLHA.EQ.11))THEN
                      AHOL = 15.45
                      DO 620 AGE = 1,13
                      NOL(AGE) = 1
                  620 CONTINUE
                      DO 625 AGE = 14,19
                      THRLO(AGE) = 15
                  625 CONTINUE
                      THRLO(20) = 16
                      THRLO(21) = 16
                      DO 630 AGE = 22,67
                      THRLO(AGE) = 17
                  630 CONTINUE
                      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.6).OR.(LOCFA.EQ.2.AN
                     Z      D.MOFLHA.EQ.12))THEN
                      AHOL = 16.55
                      DO 635 AGE = 1,13
                      NOL(AGE) = 1
                  635 CONTINUE
                      THRLO(14) = 12
                      THRLO(15) = 12
                      THRLO(16) = 13
                      THRLO(17) = 13
                      THRLO(18) = 14
                      THRLO(19) = 14
                      THRLO(20) = 15
                      THRLO(21) = 15
                      THRLO(22) = 16
                      THRLO(23) = 16
                      DO 640 AGE = 24,67
                      THRLO(AGE) = 17
                  640 CONTINUE
                      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.7).OR.(LOCFA.EQ.2.AN
                     Z      D.MOFLHA.EQ.1))THEN
                      AHOL = 16.25
                      DO 645 AGE = 1,13
                      NOL(AGE) = 1
                  645 CONTINUE
                      THRLO(14) = 12
                      THRLO(15) = 12
                      THRLO(16) = 13
                      THRLO(17) = 13
                      THRLO(18) = 14
                      THRLO(19) = 14
                      THRLO(20) = 15
                      THRLO( 21) = 15
                      THRLO(22) = 16
                      THRLO(23) = 16
                      DO 650 AGE = 24,67
                      THRLO(AGE) = 17
                  650 CONTINUE
                      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.8).OR.(LOCFA.EQ.2.AN
                     Z      D.MOFLHA.EQ.2))THEN
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                      AHOL = 14.40
                      DO 655 AGE = 1,13
                      NOL(AGE) = 1
                655   CONTINUE
                      THRLD(14) = 10
                      THRLD(15) = 10
                      THRLD(16) = 11
                      THRLD(17) = 11
                      THRLD(18) = 12
                      THRLD(19) = 12
                      THRLD(20) = 13
                      THRLD(21) = 13
                      THRLD(22) = 14
                      THRLD(23) = 14
                      THRLD(24) = 15
                      THRLD(25) = 15
                      THRLD(26) = 16
                      THRLD(27) = 16
                      DO 660 AGE = 28,67
                      THRLD(AGE) = 17
                660   CONTINUE
                      ELSE IF ((LOCFA.EQ.1.AND.(MOFLHA.EQ.9).OR.(LOCFA.EQ.2.AN
                     Z                 D.MOFLHA.EQ.3))THEN
                      AHOL = 12.4
                      DO 665 AGE = 1,13
                      NOL(AGE) = 1
                665   CONTINUE
                      THRLD(14) = 10
                      THRLD(15) = 10
                      THRLD(16) = 11
                      THRLD(17) = 11
                      THRLD(18) = 12
                      THRLD(19) = 12
                      THRLD(20) = 13
                      THRLD(21) = 13
                      THRLD(22) = 14
                      THRLD(23) = 14
                      THRLD(24) = 15
                      THRLD(25) = 15
                      THRLD(26) = 16
                      THRLD(27) = 16
                      DO 670 AGE = 28,67
                      THRLD(AGE) = 17
                670   CONTINUE
                      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.10).OR.(LOCFA.EQ.2.A
                     Z                 ND.MOFLHA.EQ.4))THEN
                      AHOL = 10.4
                      DO 675 AGE = 1,29
                      NOL(AGE) = 1
                675   CONTINUE
                      DO 680 AGE = 38,67
                      THRLD(AGE) = 17
                680   CONTINUE
                      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.11).OR.(LOCFA.EQ.2.A
                     Z                 ND.MOFLHA.EQ.5))THEN
                      AHOL = 8.45
                      DO 685 AGE = 1,29
                      NOL(AGE) = 1
                685   CONTINUE
                      DO 690 AGE = 38,67
                      THRLD(AGE) = 17
                690   CONTINUE
                      ELSE IF ((LOCFA.EQ.1.AND.MOFLHA.EQ.12).OR.(LOCFA.EQ.2.A
                     Z                 ND.MOFLHA.EQ.6))THEN
                      AHOL = 7.4
                      DO 695 AGE = 1,25
                      NOL(AGE) = 1
                695   CONTINUE
                      DO 700 AGE = 26,67
                      THRLD(AGE) = 17
                700   CONTINUE
                      ELSE
                      PRINT*, 'ERROR NO. 4'
                      ENDIF
                    ENDIF
                  ENDIF
                  ENDIF
```

Listing of the Simulation Main Program

for examples 2 and 3

```
      PROGRAM S8BF(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
C SIMULATION OF A BROILER BREEDER FARM
C
C COMPUTE GROWTH AND PRODUCTION OF A CHICKEN FARM
C
C VARIABLES
      REAL AMBW (2,2,24), AFBW (2,2,24), AFAM (2,2,24), AFAF (2,2,2,24
     Z), TAFAM (24), TAFAF (24), CFEAMM (24), APFMOR,    APMMOR
     Z, AMDL, AFBMP (2,2,25167), AFAPP (2,2,25167), AREPR (25167), ARM
     ZEG (25167), CFEAMP (24167), TAFAFP (25167), FEPDEG (25167), CFEA
     ZMF (24)
      INTEGER AGE, FBREED, MBREED, LOCFA, MOFLMA, FEEPRF, FEEPRM, FARM
     Z,MARR, ANMAL (67), ANFEM (67), MAMOR (67), FEMOR (67), NDL (67),
     Z THRLD (67), FPF, MM, ANFLG (24167), AMEGGD (24167), AMMAEG (251
     Z67), CHATEG (24167), LATFA
      INTEGER A, B, RORMA (67), DAGE, ADAGE
      DATA (RORMA(AGE), AGE = 1,67) / 67*0 /
C INPUT
      READ*, FBREED, MBREED, LOCFA, MOFLMA, LATFA, FEEPRF, FEEPRM, FAR
     ZR, MARR
      READ*, DAGE
      READ*, ANFEM (DAGE-1), ANMAL (DAGE-1), CFEAMP (DAGE-1),
     ZCHATEG (DAGE-1), ANFLG (DAGE-1), AMEGGD (DAGE-1)
C COMPUTE THE LIGHTING PROGRAM
      CALL LIGHT (MOFLMA, LOCFA, LATFA, THRLD, NDL, AMDL)
      ADAGE = DAGE
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT 14, DAGE, ANFEM (DAGE-1), ANMAL (DAGE-1), CFEAMP (DAGE-1),
     ZCHATEG (DAGE-1), ANFLG (DAGE-1), AMEGGD (DAGE-1)
   14 FORMAT (' INITIAL CONDITIONS FOR THE SIMULATION ',//,' AGE = ',I2,
     Z//,' NUMBER OF FEMALES = ',I7,//,' NUMBER OF MALES = ',I7,//,
     Z' CUMULATIVE FEED AMOUNT IN PRODUCTION = ',F10.2,//,' CUMULATIVE H
     ZATCHING EGGS = ',I9,//,' AVERAGE NUMBER OF BIRDS IN FLOCK = ',I7,
     Z//,' AVERAGE AMOUNT OF EGGS PRODUCED PER DAY = ',I7,//)
C OBTAIN FOLLOWING DATA - AVERAGES OF FEMALE AND MALE BODY WEIGHT
C                       - AVERAGES OF FEED AMOUNT PER 100 MALES PER DAY
C                       - AVERAGES OF FEED AMOUNT PER 100 FEMALES /DAY
      CALL GROWTH (MOFLMA, LOCFA, FEEPRF, AFBW, AFAF, AMBW, AFAM, FPF,
     ZMM)
      IF (DAGE.LE.24)THEN
C
C
C ** F E M A L E S **
C
C
C TITLES
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '
      PRINT*, ' '                    ** F E M A L E S **
      PRINT*, ' '
      PRINT 10, FBREED, LOCFA, FARM, LATFA, MOFLMA, FEEPRF, AMDL
   10 FORMAT (' FEMALE BREED = ',I1,19X,' LOCATION OF FARM = ',I1,//,' NUM
     ZBER OF FEMALES ARRIVING TO FARM = ',I7,11X,' LATITUD WHERE FARM IS
     Z E ',I2,//,' MONTH WHEN FLOCK WAS HATCHED = ',I2,22X,' FEEDING PRO
     ZGRAM = ',I1,//,' AVERAGE HOURS OF DAYLIGHT = ',F5.2)
      PRINT*, ' '
      PRINT*, ' AGE  AMOUNT BIRDS MORTALITY AVERAGE BODY   FEED      CUM
     ZULATIVE      REQUIRED '
      PRINT*, ' (WK)  END OF WK    (AMOUNT)  WEIGHT (KG) AMOUNT(KG) FEED
     ZAMOUNT(KG) LIGHT(HR)'
C
C COMPUTE TOTAL AVERAGE FEED AMOUNT PER DAY, CUMULATIVE FEED AMOUNT,
C NUMBER OF FEMALES IN FARM DURING THE FIRST 24 WEEKS
C
      IF (DAGE.EQ.1)THEN
      FEMOR (1)= NINT (APFMOR (1) * REAL(FARM) * .01)
      ANFEM (1)= FARM - FEMOR(1)
      TAFAF (1)= AFAF (LOCFA,MM,FPF,1) * (REAL(FARM)/100.)
      CFEAMF (1)= TAFAF (1) * 7.
```

```
      PRINT 20, ANFEM (1), FEMOR (1)
   20 FORMAT (/,3X,'1',4X,I7,6X,I4,7X,' MIN.',6X,'FULL FD',5X,'FULL FEED
     Z',7X,'NDL')
      DAGE = 2
      ELSE
      ENDIF
      DO 30 AGE = DAGE,24
      FEMOR (AGE)= NINT (AMFMOR(AGE) * REAL(ANFEM(AGE-1)) * .01)
      ANFEM (AGE)= ANFEM (AGE-1) - FEMOR (AGE)
      IF (AGE .EQ.2)THEN
        IF ((LOCFA.EQ.1.AND.MH.EQ.1).OR.(LOCFA.EQ.2.AND.MH.EQ.2))THEN
         CFEAMF (2)= 25.6 * (REAL(ANFEM(1))/100.)
         PRINT 40, AGE, ANFEM (2), FEMOR (2), CFEAMF (2)
   40    FORMAT (/,2X,I2.4X,I7,6X,I4,7X,' MIN.',6X,'FULL FD',5X,F10.2
     Z    ,7X,'NDL')
        ELSE
         CFEAMF (2)= 25.3 * (REAL (ANFEM(1))/100.)
         PRINT 40, AGE, ANFEM (2), FEMOR (2), CFEAMF (2)
        ENDIF
      ELSE
        IF (AGE.GE.3.AND.AGE.LE.5)THEN
         TAFAF (AGE)= AFAF (LOCFA,MH,FPF,AGE) * (REAL (ANFEM (AGE-1))
     Z    /100.)
         CFEAMF (AGE)= CFEAMF (AGE-1) + (TAFAF (AGE) * 7.)
        ELSE
          IF (FEEPRF.EQ.1)THEN
           TAFAF (AGE)= AFAF (LOCFA,MH,FPF,AGE) * (REAL (ANFEM(AGE
     Z      -1))/100.)
           CFEAMF (AGE)= CFEAMF (AGE-1) +(TAFAF (AGE) * 7.)
          ELSE IF (FEEPRF.EQ.2)THEN
           TAFAF (AGE)= AFAF (LOCFA,MH,FPF,AGE) * (REAL (ANFEM(AGE
     Z      -1))/100.) * 2.
           CFEAMF (AGE)= CFEAMF (AGE-1) + (TAFAF (AGE) * 3.5)
          ELSE
           TAFAF (AGE)= AFAF (LOCFA,MH,FPF,AGE) * (REAL (ANFEM(AGE
     Z      -1))/100.)
           CFEAMF (AGE)= CFEAMF (AGE-1) + (TAFAF (AGE) * 5.)
          ENDIF
        ENDIF
        IF ( NDL (AGE).EQ.1)THEN
         PRINT 50, AGE, ANFEM (AGE), FEMOR (AGE), AFBM (LOCFA,MH,AGE)
     Z, TAFAF (AGE), CFEAMF (AGE)
   50    FORMAT (/,2X,I2,4X,I7,6X,I4,7X,F5.3,6X,F7.2,5X,F10.2,7X,'NDL
     Z    ')
        ELSE
         PRINT 60, AGE, ANFEM (AGE), FEMOR (AGE), AFBM (LOCFA,MH,AGE)
     Z, TAFAF (AGE), CFEAMF (AGE), THALD (AGE)
   60    FORMAT (/,2X,I2,4X,I7,6X,I4,7X,F5.3,6X,F7.2,5X,F10.2,7X,I2)
        ENDIF
      ENDIF
   30 CONTINUE
      DAGE = LDAGE
      IF (FEEPRF.GE.2)THEN
      PRINT*,' '
      PRINT*,'***THE FEEDING PROGRAM *LIMITED EVERY DAY * SHOULD BE USE
     ZD DURING THE FIRST 5 WEEKS'
      ENDIF
C
C
C** M A L E S **
C
C
C TITLES
      PRINT*,' '
      PRINT*,' '
      PRINT*,' '
      PRINT*,' '
      PRINT*,'                                   ** M A L E S **'
      PRINT*,' '
      PRINT 70, MBREED, MARR, FEEPRM
   70 FORMAT (' MALE BREED = ',I1,//,' NUMBER OF MALES ARRIVING TO FARM
     Z= ',I6,//,' FEEDING PROGRAM = ',I1)
      PRINT*,' '
      PRINT*,' AGE  AMOUNT BIRDS MORTALITY AVERAGE BODY   FEED       CUM
     ULATIVE  REQUIRED'
      PRINT*,'  (WK)  END OF WK    (AMOUNT)  WEIGHT (KG) AMOUNT(KG) FEED
     ZAMOUNT(KG) LIGHT(HR)'
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155            C
156            C COMPUTE TOTAL AVERAGE FEED AMOUNT PER DAY, CUMULATIVE FEED AMOUNT,
157            C NUMBER OF MALES IN FARM DURING THE FIRST 24 WEEKS
158            C
159                  IF (DAGE.EQ.1)THEN
160                  MAMOR (1)= NINT (APMMOR (1) * REAL (MARR) * .01)
161                  ANMAL (1)= MARR - MAMOR (1)
162                  TAFAM (1)= AFAM (LOCFA,MH,AGE) * (REAL (MARR)/100.)
163                  CFEAMM (1)= TAFAM (1) * 7.
164                  PRINT 20, ANMAL (1), MAMOR (1)
165                  DAGE = 2
166                  ELSE
167                  ENDIF
168                  DO 80 AGE = DAGE,24
169                  MAMOR (AGE)= NINT (APMMOR (AGE) * REAL (ANMAL(AGE-1)) * .01)
170                  ANMAL (AGE)= ANMAL (AGE-1) - MAMOR (AGE)
171                  A = NINT(0.1*REAL(ANFEM(AGE)))
172                  IF (ANMAL(AGE).LT.A)THEN
173                     ANMAL (AGE) = A
174                     NORMA (AGE) = 1
175                  ELSE
176                  ENDIF
177                  IF (AGE.EQ.2)THEN
178                     IF ((LOCFA.EQ.1.AND.MH.EQ.1).OR.(LOCFA.EQ.2.AND.MH.EQ.2))THEN
179                     CFEAMM (2)= 20.68 * (REAL (ANMAL (1))/100.)
180                     PRINT 43, AGE, ANMAL (2), MAMOR (2), CFEAMM (2)
181                     ELSE
182                     CFEAMM (2)= 28.65 * (REAL (ANMAL(1))/100.)
183                     PRINT 40, AGE, ANMAL (2), MAMOR (2), CFEAMM (2)
184                     ENDIF
185                  ELSE
186                     IF (AGE.GE.3.AND.AGE.LE.5)THEN
187                     TAFAM (AGE)= AFAM (LOCFA,MH,AGE) * REAL (ANMAL (AGE-1))/100.
188                  CFEAMM (AGE)= CFEAMM (AGE-1) + (TAFAM(AGE)*7.)
189                     PRINT 90, AGE, ANMAL (AGE), MAMOR (AGE), TAFAM (AGE), CFEAMM
190                 Z    (AGE)
191               90    FORMAT (/,2X,I2,4X,I7,6X,I4,7X,' MH.',6X,F7.2,5X,F10.2,7X,'NO
192                 ZL')
193                     ELSE
194                        IF (FEEPRM.EQ.1)THEN
195                        TAFAM (AGE)= AFAM (LOCFA,MH,AGE) * (REAL (ANMAL(AGE-1))
196                 Z       /100.)
197                        CFEAMM (AGE)= CFEAMM (AGE-1) + TAFAM (AGE) * 7.
198                        ELSE
199                        TAFAM (AGE)= AFAM (LOCFA,MH,AGE) * (REAL (ANMAL(AGE-1))
200                 Z       /100.) * 2.
201                        CFEAMM (AGE)= CFEAMM (AGE-1) + TAFAM (AGE) * 3.5
202                        ENDIF
203                        IF (NOL(AGE).EQ.1)THEN
204                           IF (NORMA(AGE).EQ.0)THEN
205                           PRINT 50, AGE, ANMAL (AGE), MAMOR (AGE), AMBW (LOCFA,
206                 Z          MH,AGE), TAFAM (AGE), CFEAMM (AGE)
207                           ELSE
208                           PRINT 55, AGE, ANMAL (AGE), MAMOR (AGE), AMBW (LOCFA,
209                 Z          MH,AGE), TAFAM (AGE), CFEAMM (AGE)
210               55          FORMAT (/,'***',1X,I2,4X,I7,6X,I4,7X,F5.3,6X,F7.2,5X,
211                 Z          F10.2,7X,'NOL')
212                           ENDIF
213                        ELSE
214                           IF (NORMA(AGE).EQ.0)THEN
215                           PRINT 60, AGE, ANMAL (AGE), MAMOR (AGE), AMBW (LOCFA,
216                 Z          MH,AGE), TAFAM (AGE), CFEAMM (AGE) , THRLD (AGE)
217                           ELSE
218                           PRINT 65, AGE, ANMAL (AGE), MAMOR (AGE), AMBW (LOCFA,
219                 Z          MH,AGE), TAFAM (AGE), CFEAMM (AGE) , THRLD (AGE)
220               65          FORMAT (/,'***',1X,I2,4X,I7,6X,I4,7X,F5.3,6X,F7.2,5X,
221                 Z          F10.2,7X,I2)
222                           ENDIF
223                        ENDIF
224                     ENDIF
225                  ENDIF
226               80 CONTINUE
227                  PRINT*,' '
228                  PRINT*,' **  THE TOTAL NUMBER OF MALES IS LESS THAN TEN PERCENT OF
229                 ZTHE TOTAL NUMBER OF FEMALES, THEN CERTAIN NUMBER OF MALES HAS TO B
230                 ZE ORDERED'
231                  IF (FEEPRM.EQ.2)THEN
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                PRINT*,' '
                PRINT*,'THE FEEDING PROGRAM "LIMITED EVERY DAY" SHOULD ALWAYS BE U
               ZSED DURING THE FIRST 5 WEEKS AND THE "SKIP A DAY" PROGRAM SHOULD B
               ZEGIN AT THE 6TH WEEK'
                ELSE
                ENDIF
                ELSE
                ENDIF
C
C
C ** F L O C K ** M A L E S AND F E M A L E S
C
C
C OBTAIN FOLLOWING DATA - AVERAGE BODY WEIGHT
C                       - AVERAGE FEED AMOUNT PER 100 BIRDS PER DAY
C                       - AVERAGE RATE OF EGG PRODUCTION PER DAY
C                       - AVERAGE RATE OF HATCHING EGG PER DAY
      CALL PRODUC (MM, LOCFA, AFEMP, AFAFP, AREPR, AHHEG)
C TITLES
      PRINT*,' '
      PRINT*,' '
      PRINT*,' '
      PRINT*,' '
      PRINT*,'                                        ** F L O C K ***'
      PRINT*,' '
      PRINT*,'FEEDING PROGRAM = 1'
      PRINT*,' '
      PRINT*,' AGE   AMOUNT   AMOUNT   MORTALITY  AVERAGE BODY   FEED PER
     Z CUMULATIVE     PRODUCTION   HATCHING  CUMULATIVE  WEIGHT/ CUMULATI
     ZVE
      PRINT*,' (WK) FEMALE   MALE    FEM   MAL    WEIGHT (KG)   DAY (KG)
     Z FEED (KG)      EGGS/DAY     EGGS/DAY HATCHING EGG DAY(HR)  FEED/D
     ZOZEGG'
      IF (DAGE.LE.24)THEN
      DAGE = 25
      ELSE
      ENDIF
C
C COMPUTE TOTAL AVERAGE FEED AMOUNT PER DAY, CUMULATIVE FEED AMOUNT,
C NUMBER OF FEMALES AND MALES, EGG PRODUCTION , CUMULATIVE HATCHING
C EGGS FROM WEEK 25 TO 67
C
      DO 100 AGE = DAGE,67
      FEMOR (AGE)= NINT (AFEMOR (AGE) * REAL (ANFEM (AGE-1)) * .01)
      MAMOR (AGE)= NINT ( AMMMOR (AGE) * REAL (ANMAL (AGE-1)) * .01)
      ANFEM (AGE)= ANFEM (AGE-1) - FEMOR (AGE)
      ANMAL (AGE)= ANMAL (AGE-1) - MAMOR (AGE)
      B = NINT(0.1*REAL(ANFEM(AGE)))
      IF (ANMAL(AGE).LT.B)THEN
         ANMAL (AGE) = B
         MORMA (AGE) = 1
      ELSE
      ENDIF
      ANFLO (AGE)= ANFEM (AGE) + ANMAL (AGE)
      TAFAFP (AGE)= AFAFP (LOCFA,MM,AGE) * (REAL (ANFLO (AGE-1))/100.)
      CFEAMP (AGE)= CFEAMP (AGE-1) + (TAFAFP (AGE) * 7.)
      AMPGGD (AGE)= NINT (AREPR (AGE)*0.01 * REAL(ANFEM(AGE)) * .01)
      AMHAEG (AGE)= NINT (AHHEG (AGE) * REAL(AMEGGD(AGE)) * .01)
      CHATEG (AGE)= CHATEG (AGE -1) + AMHAEG (AGE) *
     Z) * 7.)) * 12.
      IF (MOL(AGE).EQ.1)THEN
      IF (MORMA(AGE).EQ.0)THEN
      PRINT 110, AGE, ANFEM (AGE), ANMAL (AGE), FEMOR (AGE), MAMOR (AG
     ZE), AFAMP (LOCFA,MM,AGE), TAFAFP (AGE), CFEAMP (AGE), AMEGGD (AG
     ZE), AMHAEG (AGE), CHATEG (AGE), FEPDEG (AGE)
110   FORMAT (2X,I2,2X,I6,2X,I5,2X,I4,3X,I4,4X,F5.3,6X,F7.2,5X,F10.2,4
     ZX,I9,3X,I9,4X,I9,4X,'NOL',3X,F6.2)
      ELSE
      PRINT 115, AGE, ANFEM (AGE), ANMAL (AGE), FEMOR (AGE), MAMOR (AG
     ZE), AFAMP (LOCFA,MM,AGE), TAFAFP (AGE), CFEAMP (AGE), AMEGGD (AG
     ZE), AMHAEG (AGE), CHATEG (AGE), FEPDEG (AGE)
115   FORMAT(' *',I2,2X,I6,2X,I5,2X,I4,3X,I4,4X,F5.3,6X,F7.2,5X,F10.2,4
     ZX,I9,3X,I9,4X,I9,4X,'NOL',3X,F6.2)
      ENDIF
      ELSE
      IF (MORMA(AGE).EQ.0)THEN
```

```
309                PRINT 120, AGE, ANFEM (AGE), ANMAL (AGE), FEMOR (AGE), MAMOR (AG
310               ZE), AFBWP (LOCFA,MH,AGE), TAFAFP (AGE), CFEAMP (AGE), AMEGGD (AG
311               ZE), AMHAEG (AGE), CHATEG (AGE), THRLD (AGE), FEPDEG (AGE)
312            120 FORMAT (2X,I2,2X,I6,2X,I5,2X,I4,3X,I4,4X,F5.3,6X,F7.2,5X,F10.2,4
313               ZX,I9,3X,I9,4X,I9,4X,I2,3X,F6.2)
314                ELSE
315                PRINT 125, AGE, ANFEM (AGE), ANMAL (AGE), FEMOR (AGE), MAMOR (AG
316               ZE), AFBWP (LOCFA,MH,AGE), TAFAFP (AGE), CFEAMP (AGE), AMEGGD (AG
317               ZE), AMHAEG (AGE), CHATEG (AGE), THRLD (AGE), FEPDEG (AGE)
318            125 FORMAT(' *',I2,2X,I6,2X,I5,2X,I4,3X,I4,4X,F5.3,6X,F7.2,5X,F10.2,4
319               ZX,I9,3X,I9,4X,I9,4X,I2,3X,F6.2)
320                ENDIF
321                ENDIF
322            100 CONTINUE
323                PRINT*,' *
324                PRINT*, ' *  THE TOTAL NUMBER OF MALES IS LESS THAN TEN PERCENT OF
325               ZTHE TOTAL NUMBER OF FEMALES, THEN CERTAIN NUMBER OF MALES HAS TO B
326               ZE ORDERED.
327                PRINT*,' *
328                PRINT*,'  ALL THE VALUES SHOWN ON TABLES ARE GIVEN PER WEEK WITH
329               ZTHE FOLLOWING EXCEPTIONS = FEED AMOUNT PER DAY, EGG PRODUCTION PER
330               Z DAY, AMOUNT OF HATCHING EGG PER DAY, LIGHT PER DAY.
331                STOP
332                END
```