BROILER BREEDER PRODUCTION

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WARNING

Throughout this book we have mentioned various feed additives, vaccines, disinfectants and other pharmacological or chemical treatments. Not all of these products are registered in all countries, and so their legal use must be established prior to farm application. While we have mentioned numerous commercial products, we do not endorse or recommend these, and reliase that effective alternatives may be available. With any pharmacological product, vaccine or biological, it is essential to get local recommendations from qualified personnel, and to always administer products strictly according to manufacturers' label recommendations.

Steven Leeson and John Summers

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CHAPTER 1.	INDUSTRY DEVELOPMENT, GENETICS AND BREEDING PROGRAMS

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1.1 INTRODUCTION

Current breeding strategies mean that we no longer have to worry about genetic selection of our commercial broiler breeders. Even at the grandparent level, virtually all selection for heritable traits has been accomplished by the primary breeding company. For grandparents and parent stock, we have only to select birds based on their phenotype for such traits as skeletal integrity, morbidity etc. In large part, such selection is a consequence of birds reacting to adverse environmental factors, where fitness relates to birds performing well under "commercial conditions". The breeding of broiler chickens ultimately comes down to gradual multiplication of the generations necessary to meet the ever increasing demands for broiler meat production. Each generation results in multiplication of bird numbers by factors of about 50 or 100 depending on whether one or both sexes are needed. Within a few generations, pure bred stock measured in just hundreds of birds quickly evolve into commercial broilers measured in hundreds of millions.

Virtually all the genetic selection work is accomplished by the primary breeders working with various pure-line families, and so the job of the commercial grandparent and parent breeders is essentially to expand numbers of offspring from these intensely selected birds. However this multiplication is an important and critical step in the breeding process. The management of broiler grandparent lines is a very specialized industry, and the task is given only to companies that have a history of success in breeder management and that have been carefully screened by the primary breeders. Management problems at the grandparent level have a devastating effect on the ability of a breeding company to maintain its market share of commercial broilers. Inability to meet market demand or production of inferior parent breeding stock or broiler chicks takes considerable

CHAPTER 2. REPRODUCTION

Managing the reproductive processes of the hen and rooster is the basis of broiler breeder production. An understanding of the basic reproductive physiology of both sexes is important in applying management principles involving feeding, lighting and health management. Following is an overview of reproductive processes in both sexes which are to some extent subject to manipulation by the breeder manager.

2.1 STRUCTURE OF THE OVARY AND OVIDUCT

The mature hen has only one ovary and oviduct even though left and right reproductive systems are evident during very early incubation. Unlike the situation with testes in the male, the right ovary and oviduct regress during mid-incubation, and are non-functional in all "normal" hens.

The left ovary is found deep in the body cavity lying in close proximity to the left kidney. During incubation as many as 20,000 eggs develop, of which about 2,000 are visible to the naked eye. There should be minimal development of these oocytes in the growing pullet, and consequently the ovary should be fairly difficult to find during necropsy. During maturation, a hierarchy of ovum will develop so as to supply a sequence of eggs for daily ovulation. In the mature hen the ovary should weigh around 35g, being composed of 3-4 large "maturing" follicles, and a series of 8-12 follicles of ever diminishing size. The follicles consist of concentric layers of "yolk" that are continually being deposited. If fat

CHAPTER 3. LIGHTING

Most birds are seasonal breeders and their reproductive cycle is controlled by changes in day length. Through its effect on the hypothalamus, light is responsible for the control over gonadotrophin releasing hormone production by the pituitary, and this is ultimately responsible for control of ovulation in the hen and spermatogenesis in the rooster. Both hens and roosters can, and do, reproduce in the absence of light or the absence of any meaningful change in the daily light:dark cycle. For example, hens kept in complete darkness will eventually mature and ovulate, and commercial breeders are sometimes kept in equatorial regions on farms without any electricity. Light and lighting programs are therefore not essential for reproduction in broiler breeders. Unfortunately, few farms have the luxury of a constant 12h light:12h dark natural photoperiod, and few houses are completely lightproof. Consequently, for most commercial flocks we must manipulate the lighting program so as to initially dictate age at sexual maturity and subsequently sustain egg production and fertility for a predetermined cycle.

3.1 BASIC PRINCIPLES OF LIGHT STIMULATION

Birds differentiate night from day because of the effect of light stimulating the hypothalamus in the brain. Light energy is converted into neural transmissions which ultimately guide the pituitary in releasing the all important gonadotrophin releasing hormones. However, birds are really not "stimulated" by the entire period of light, but rather by two important parts of this period. Birds are sensitive to the time of initial "lights-on" and subsequently during a period 11-13h later. This latter period is called the photosensitive phase, and essentially dictates whether or not the bird perceives the day as being "long" or "short". A short day is not stimulatory, whereas a long day initiates or maintains the cascade of hormonal releases that control ovulation or spermatogenesis. Therefore if birds perceive light during the photosensitive phase which occurs 11-13h after initiation of natural dawn or "lights on", then the ovary or testes can be functional. This pattern of dawn/dusk or lights-on/lights-off sets the circadian rhythm of the

CHAPTER 4. HEALTH MANAGEMENT

Health management and biosecurity are perhaps the most critical aspect of modern breeder production. Disease outbreaks are especially catastrophic with breeders because of disruption in egg supply to the hatchery. Today it is becoming more difficult to achieve adequate isolation of breeder farms so as to ensure a comfortable degree of protection against flock infection. However even with isolation and optimum biosecurity procedures, it is impossible to ensure absolute protection for a flock of breeders. Health management today revolves around appropriate use of vaccines, biosecurity, and where appropriate, careful use of feed and water additives. We are now acutely aware of the importance of priming and maintaining optimum immune response in the bird, a situation that starts with the day old breeder and continues through to the end of the breeder cycle. Health management involves not only studying the immune function of the breeders themselves, but also the effect that these programs have on the immunity and health status of the embryo and young broiler chick.

Actual disease challenge obviously varies from country to country and even for different geographical locations within a country. Health management programs should obviously be tailored to combat local potential disease challenge. However breeder managers must be continually updated on new potential diseases and be prepared to modify the protective programs for their flocks. In this chapter, we have given only a brief description of potential diseases, because these are more adequately described elsewhere (Calnek *et al.,*1997). Although we have

CHAPTER 5. NUTRITION AND FEEDING

The challenge of feeding broiler breeders relates to tempering their growth potential in order to realize adequate reproductive performance. As discussed in Chapter 1, there is a negative correlation between growth rate and reproduction, and so this means that we cannot allow either the hen or the rooster to exhibit genetic growth potential, because reproduction in these very large birds is uneconomical. Feeding programs therefore involve conscientious formulation of appropriate diets, and perhaps more importantly, a schedule for feed restriction aimed at control over growth rate. With commercial breeders, the weight of the birds at maturity is very similar to that potentially achieved at 5-6 weeks with free choice feeding. At this time,

CHAPTER 6. ENVIRONMENTAL CONTROL

Breeders rarely achieve their genetic potential today if any aspect of the environment is stressful to the bird or is poorly managed. As discussed in Chapter 3, one must have absolute control over the lighting schedule regardless of house design or other environmental factors. There is now a trend towards greater control over the environment, especially in the grow-out period, and so black-out housing is becoming more popular. It is assumed that these more costly building designs are economically advantageous in terms of improved control over sexual development. For breeders, black-out housing is the standard in cooler climates and this technology is now being considered in warmer regions, in order to reduce fluctuations in lighting and environmental temperature. When outside temperature is much above 28°C, then there should be consideration for some form of cooling system, such as foggers or evaporative cool cells.

This chapter centres around control of house temperature and humidity since the critical aspects of light control are covered separately in Chapter 3. However, when designing new facilities or retrofitting established buildings, any attempts at modifying environmental systems must not be at the expense of the lighting program. This latter concern is very important with fan and air inlet design for black-out houses.

6.1 BODY TEMPERATURE CONTROL

After brooding, the bird must maintain a body temperature close to 41°C. Being homeothermic, the bird is continually losing heat to its surroundings although the mechanisms involved change as both temperature and humidity change within the environment. Table 6.1 shows normal heat balance in an adult breeder with the need to remove about 325 kcal heat daily.

CHAPTER 7. BROODING AND MANAGEMENT OF THE GROWING PULLET AND ROOSTER

7.1 INTRODUCTION

The goals of the brooding and grow-out systems are to provide pullets and roosters of ideal weight, condition and stage of sexual maturity as they enter the breeder facilities. Such management requires knowledge and understanding of the growth and development of the birds and how these factors are influenced by husbandry decisions. The major factors influencing development of breeder birds are:

Nutrition and feeding management

Environmental control

Health status

Behavioral and social interactions

Strain specific development

Table 7.1 outlines major production goals for breeders in the growing period as well as the breeder cycle. All too often in integrated companies, the goals of the grow out manager are separated from those of the breeder manager. It must

CHAPTER 8. MANAGEMENT OF ADULT BREEDERS

The major goals in managing the adult breeders are to maintain the health status of the flock, while allowing for continued, but slow increases in body weight. As in the rearing period, some form of controlled feeding is essential in order to maintain ovary function. Under feeding causes failure to attain peak egg numbers, while overfeeding is more commonly associated with very rapid decline in egg numbers following a brief period of peak egg output. Body weight and condition therefore continue to be the major criteria for monitoring the development of the birds. Separate sex feeding of hens and roosters is almost universally accepted, although there has been a trend away from using specialized male diets, with all birds being fed diets formulated to the needs of the breeder hen. This choice of diet for the males is based simply on convenience for the manager. Because the hen diet is of a higher nutrient density than are specialized male diets, lesser quantities are necessarily given, and in part this accounts for the male aggressiveness seen in some flocks. The ultimate profitability of the breeder flock is dictated by the number of eggs produced. However not all eggs are suitable for incubation and measures of hatching success are usually incorporated into egg payments. The main concerns of the breeder manager in this regard are egg size, egg cleanliness, floor egg production, eggshell quality, fertility, hatchability and ultimately, chick quality. In truly integrated operations the growth performance of the broiler offspring becomes the ultimate goal in assessing breeder efficiency.

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