FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
POULTRY DEVELOPMENT REVIEW

Poultry housing and management in developing countries

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POULTRY HOUSING

Improvements to poultry housing systems in developing countries have focused on providing an environment that satisfies the birds' thermal requirements. Newly hatched birds have a poor ability to control body temperature, and require some form of supplementary heating, particularly in the first few days after hatch. Many developing countries are located in tropical areas where minimal heating is required. Indeed, the emphasis in these countries – particularly for meat chickens – is on keeping the birds cool.

Production systems

International poultry breeding and feed companies operate in many developing countries and have established large-scale commercial farms in a significant number of them. The housing and equipment used make it possible to exert considerable control over the climate provided to the birds, but such houses are expensive to build and operate, and require a large turnover of birds to make them viable. Owing to the lower construction and running costs, medium- and small-scale commercial housing is popular in developing countries. By far the most prevalent poultry farming system in many developing countries is the small-scale scavenging system, which usually involves only very basic (if any) shelter for housing birds.

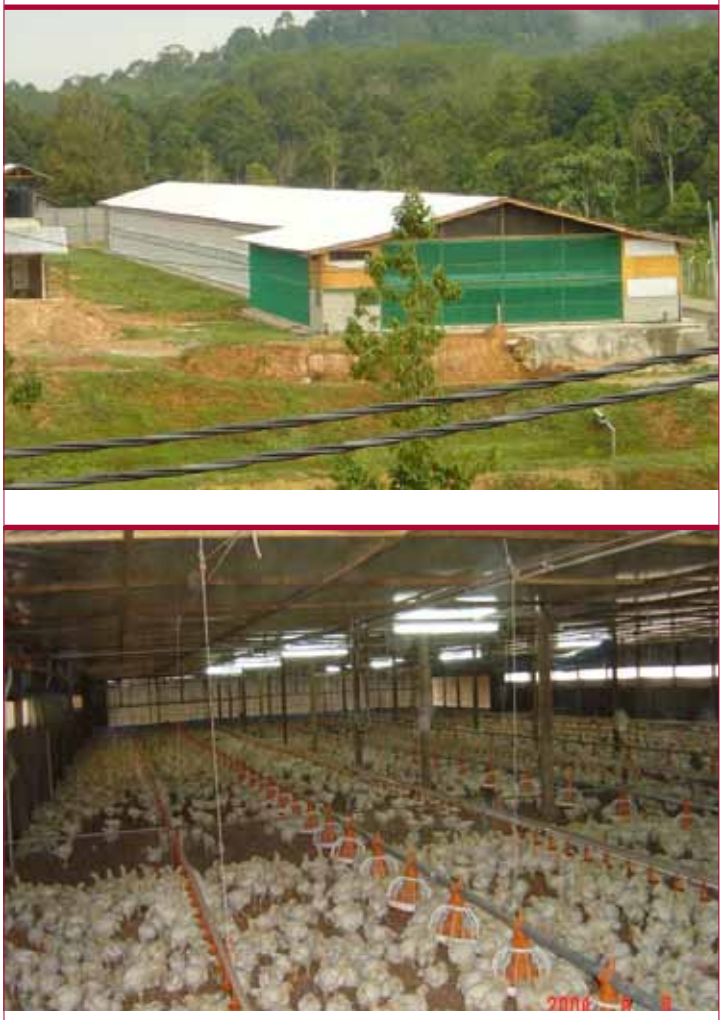
Large-scale commercial farms: Commercial houses in developing countries are clear-span structures with litter on the floor for meat birds or cages for laying hens. The commercial chicken meat industry in some developing countries is vertically integrated, with single companies owning feed mills, breeder farms, hatcheries and processing plants. Arrangements typically involve agreements in which the farmer or landowner provides the housing, equipment and labour, while the company provides the chicks, feed, medication, transport and supervision.

For controlled-environment housing of layers, multi-tier cage systems are common. Most large-scale commercial farms use controlled-environment systems to provide the ideal thermal environment for the birds (Glatz and Bolla, 2004). Birds' performance in controlled-environment sheds is generally superior to that in naturally ventilated houses, as the conditions can be maintained in the birds' thermal comfort zone. Achieving the ideal environment for birds depends on appropriate management of the poultry house.

Modern houses are fully automated, with fans linked to sensors to maintain the required environment. Some commercial operators use computerized systems for the remote checking and changing of settings in houses. Forced-air furnaces and radiant heating are the main methods of providing heat to young chicks.

Medium-scale commercial: In developing countries, most medium-scale commercial layer and chicken meat houses rely on natural airflow through the shed for ventilation (Daghir, 2001). Where required, meat birds and layers are given radiant heating early in their lives, to maintain body temperature. Laying hens may be kept in commercial wire cages in open sheds, or in sheds with wire sides to exclude wild birds, scavenging poultry and predators.

Small-scale commercial (improved genotype stock and supplementary feeding): Houses of various shapes and dimensions are typically constructed using local building materials consisting of timber or mud bricks and bamboo. These small-scale commercial facilities may have several rooms or compartments where chicks are brooded, pullets are reared and layers are housed in a floor-based system or in cages. Meat birds are often kept in single-age groups of 50 to 100 chickens within the house. The house can



Sector 1 large-scale broiler operations

Photo Credit: I. Aini

Photo Credit: Olaf Thieme

Photo Credit: I. Aini

Sector 2 medium-scale layer and broiler operations

Photo Credit: Karma Nidup

Photo Credit: Karma Nidup

Sector 3 small-scale commercial houses

be used as night shelter for birds that forage under free-range conditions or that are confined to an outdoor pen during the day.

Small-scale semi-scavenging system using indigenous birds: When provided, shelters are made from various materials, including wood and leaf material from local trees or shrubs. Birds in the household flock are typically housed overnight in the shelter, and are let out in the morning to forage during the day (Ahlers *et al.*, 2009). If no special structure is provided, the birds sometimes shelter overnight under the farmer's house or even inside the house with the family. Where provided, the usually rudimentary house comprises posts, a thatch or scrap iron roof, and thatch or scrap wire netting walls. Feeders, perches, drinkers and nest boxes made from local materials are sometimes provided, and special shelters of a wide variety of designs and constructions are sometimes used to house broody hens with their chicks.

Photo Credit: Viengsavanh Phimphachanhvongsod

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Sector 4 small-scale, semi-scavenging poultry production

Ventilation management

All poultry houses need some form of ventilation to ensure an adequate supply of oxygen, while removing carbon dioxide, other waste gases and dust. In commercial operations, minimum ventilation is often practised in colder climates, but not generally in tropical ones (Glatz and Bolla, 2004).

In large-scale automated operations, correct air distribution can be achieved using a negative pressure ventilation system. When chicks are very young, or in colder climates, the air from the inlets should be directed towards the roof, to mix with the warm air there and circulate throughout the shed. With older birds and in warmer temperatures, the incoming air is directed down towards the birds, and helps to keep them cool. Evaporative cooling pads can be placed in the air inlets to keep birds cool in hot weather. Tunnel ventilation is the most effective ventilation system for large houses in hot weather.

Tunnel ventilation: These systems are popular in hot climates. Exhaust fans are placed at one end of the house or in the middle of the shed, and air is drawn through the length of the house, removing heat, moisture and dust. Evaporative cooling pads are located at the air inlets. The energy released during evaporation reduces the air temperature, and the resulting airflow creates a cooling effect, which can reduce the shed temperature by 10 °C or more, depending on humidity. Maximum evaporation is achieved when water pumps are set to provide enough pad moisture to ensure optimum water evaporation. If too much water is added to the pads, it is likely to lead to higher relative humidity and temperatures in the shed.

Photo Credit: Robert Pym

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Tunnel-ventilated broiler house: exterior and interior views

Fogging systems: Fogging systems are sometimes used to reduce the shed temperature. Fogging works best in dry climates, and usually involves several rows of high-pressure nozzles that release a fine mist throughout the house. The cooling effect is significantly increased by airflow from the use of fans within the shed.

Natural ventilation is common in medium- and small-scale operations and in areas where the climatic conditions are similar to the temperatures required by birds. Ventilation is usually provided by prevailing breezes. Natural ventilation works best in poultry sheds where the long axis runs east to west, to avoid heating of the sidewalls by the sun during the morning and afternoon.

POULTRY MANAGEMENT

The aim of management is to provide the conditions that ensure optimum performance of the birds (Bell and Weaver, 2001). Given reasonable conditions, broody hens are very successful at hatching their chicks, but good hatchability using artificial incubation (both large and small) relies on careful management of temperature, humidity, ventilation, position and egg turning. During incubation, the egg loses water vapour through its shell. The rate of water loss depends on both the shell structure and the humidity of the air surrounding the egg. The quality of the hatch also depends on the age and health of the breeder flock, and on the evenness and cleanliness of the eggs set.

Factors involved in poultry management

Poultry management involves monitoring poultry health; ensuring that the poultry house is maintained with appropriate brooding, rearing, growing and laying conditions; and ensuring that recommended vaccinations are given and appropriate feeding programmes are used. In developing countries, it is often difficult to achieve optimum performance from birds, owing to less-than-optimal housing conditions and lack of quality feed, vaccines and trained staff.

Breed effects

Owing to their superior production, commercial hybrids of high genetic merit are often used in developing countries, but are not well-suited to tropical environments (see Poultry Development Review on Poultry genetics and breeding in developing countries). These birds are sensitive to changes in the diet and to high ambient temperature, and require skilled stockpersons to manage them. Indigenous poultry can cope better with the harsh conditions often prevailing in developing countries, and good management will improve their performance. This can be achieved by using good housing, protecting the birds from predators, and providing them with the environmental conditions that allow them to achieve maximum profitability.

Temperature effects

Farmers need to compensate for undesirable climatic conditions by manipulating control systems or modifying the house to ensure that the welfare and environmental needs of the birds are satisfied. Environmental extremes (heat and cold stress, excessive or inadequate ventilation, poor air quality) can be managed if the design of the poultry house is appropriate for the conditions. Birds require adequate space, sufficient feed to meet their nutritional requirements, and an adequate supply of good-quality

water. Use of a stringent quarantine programme to prevent disease is an essential element of good management, and farmers must be able to recognize disease and treat it as soon as possible. A suitable vaccination and medication programme is essential in commercial operations.

Effects of nutrition

Managers need to ensure that the diets provided to birds in commercial operations meet the nutrient requirements of each age group and strain of chickens (see Poultry Development Review on Poultry feed availability and nutrition in developing countries). Smallholder systems in developing countries typically place less emphasis on achieving maximum production, and more on maximizing profitability by using diets comprised mainly of local feedstuff ingredients, rather than imported feeds. Key management practices by farmers who mix their own feed include ensuring that micro-ingredients are kept cool, mouldy ingredients are not used, and storage facilities are weather- and rodent-proof.

Importance of good hygiene

An essential management task is to maintain clean sheds, surroundings and equipment. A clean shed improves health and limits parasites, dust and microbial contamination, while clean shed surroundings reduce vermin and fly loads. This is important not only for litter and manure management but also for biosecurity. Removal of residual feed from feeders is an important practice critical to the health of the flock. Another important management task is to sanitize sheds to minimize the risk of disease to incoming flocks of birds. Maintaining high flock health status is essential, and routine vaccination programmes for a number of diseases are typically in place, particularly in larger-scale operations. Some vaccinations are carried out at the hatchery, but it is essential that a proper vaccination schedule be established and that vaccination protocols be complied with.

Litter materials and management

Broiler litter is the material used as bedding in poultry houses to absorb faecal waste from birds and to make the floor of the house easy to manage. Common litter materials are wood shavings, chopped straw, sawdust, shredded paper and rice hulls, and a wide range of other materials are used in different regions around the world. Litter should be light, friable, non-compressible, absorbent, quick to dry, of low thermal conductivity and – very important – cheap. After use, the litter comprises poultry manure, the original litter material, feathers and spilled feed. The litter quality in a shed is determined by the type of diet, the temperature and the humidity. The recommended depth for litter is between 10 and 20 cm. Sawdust can result in high dust levels and respiratory problems. Dust particles in the litter capable of causing health problems in the birds are derived from dried faeces, feathers, skin and litter; their adverse effects arise because they carry or incorporate bacteria, fungi and gases.

Management of lighting

Poultry have seasonal and daily biological rhythms, both of which are mediated by light, particularly day length. For day length to exert its controlling effect, there needs to be a dark phase (night) when light levels should be less than 0.5 lux. Day length and light intensity during the breeder bird's life have an important role in development of the reproductive system. The difference in day lengths and light intensities between the rearing and the laying phases is the principal factor responsible for controlling and stimulating ovarian and testicular development (Lewis and Morris, 2006). The response to increases in day length and lighting intensity depends on the body weight profile during rearing, which in turn depend on the nutritional regime. The effects of light are predominantly on the rate of sexual maturation and egg production.

The two types of artificial lighting commonly provided are incandescent and fluorescent. Incandescent globes are cheaper to install, but have lower light efficiency and a shorter life. Fluorescent lights are three to four times as efficient and last about ten times as long, but have variable performance in cold weather. The colour of the light rays has an effect on chickens' productivity. For example, green and blue lights improve growth, and lower age at sexual maturity, while red, orange and yellow lights increase age at sexual maturity, and red and orange lights stimulate egg production. Birds are calmer in blue light, so blue lights are recommended for use during depopulation in commercial operations.

Lighting programmes for broilers: Lighting programmes for commercial broiler operations vary widely from company to company, and depend on the strain of bird used, the housing type (naturally ventilated versus controlled-environment), the geographical location and the season. Where light can be excluded from sheds, birds are typically reared under low-intensity (5 to 10 lux) lighting, to keep them calm and to prevent feather pecking. During early brooding, 25 lux is used to stimulate feeding.

Lighting programmes for layers and breeders: Light is critical for the onset and maintenance of egg production. Increasing day length (from winter to summer) during the rearing period stimulates the onset of sexual maturity, whereas shortening day length (from summer to winter) has the opposite effect. Early onset of lay may not be beneficial as it may predispose to reproductive problems. Where artificial lighting is possible, a constant day length (of between 12 to 16 hours per day) during the rearing period has been shown to result in a delayed onset of lay, and is the preferred rearing treatment. Shortening day length or too little light will discourage egg production, and must be avoided once the birds are in lay.

Stockpersonship

Farmers and their staff play a critical role in looking after the birds and maximizing productivity. They need to empathize with and care about their birds, and to avoid exposing them to adverse situations that may cause stress (see Poultry Development Review on Poultry welfare in developing countries). The people responsible for the care of poultry should be well trained, experienced and dedicated. The first task for poultry staff is to learn how to carry out routine checks on the birds, so they can identify what is normal in the flock and what the signs of trouble are. Good stock attendants minimize the risks to their animals' health and welfare. By doing this, they allow production to reach its potential, while treating the animals with care (Barnett and Glatz, 2004). This is sometimes called "stockpersonship". Staff should be able to identify quickly

any changes in the flock and in the birds' environment, and any physical, chemical or microbiological threats, such as damaged equipment, mouldy feed or infectious disease, and should prevent problems from escalating. The more sophisticated the poultry farming system, the greater the management skills required.

Records

Record keeping and meeting production targets are good management practices that allow the identification and solution of problems. When a problem is identified, the next step is to attempt to fix it. Identifying the cause of and fixing a problem is an important part of the farmer's knowledge base, and is likely to assist in preventing a recurrence of the problem (Barnett *et al.,* 2001). Records kept over time can help identify some of the possible causes of problems. One of the most useful record-keeping documents is a diary, which can be used in combination with record-keeping sheets to record major activities, problems identified, equipment repairs, deviations from equipment settings, and any staff issues.

Records of production, growth, feed, egg weights, mortalities, treatments given, and response to treatments should be maintained to assist investigations of sub-optimal performance. In all production systems, signs of ill health can be detected when poultry reduce their food and water intake; reduce production or growth; undergo a change in appearance, behaviour or activity level; or have abnormal feather condition or droppings.

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