MANAGING OPEN-SIDED HOUSING

Key considerations for optimal welfare and performance

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INTRODUCTION

Breeder flock management styles and techniques are dependent on multiple variables regarding the ability to control the environmental conditions within a housing system.

Open-sided and controlled-environment housing allows for the management of broiler breeder flocks during the rear and production periods. The preference for housing type is based on geographic and environmental factors, electricity access, and/or initial investment. This document will detail the key differences between breeding stock management in these two housing systems (***Table 1***) and provide best practices specifically related to managing broiler breeder stock in open-sided housing.

Controlled-environment houses are designed to control light hours and intensity, as well as the appropriate temperature and air quality for birds—according to age—via a dynamic ventilation system (e.g., fans, inlets, pressure control). Also referred to as blackout housing, controlled-environment houses are typically light-proof, allowing complete control of light duration and intensity. They are equipped with automatic power ventilation systems, heaters, and, in some cases, evaporative cooling pads. In fully automated systems, a computer will manage the fans, inlets, heaters, and cooling pad water pumps to maintain age-appropriate set points for temperature, humidity, and airspeed. In houses that are not fully automated, management intervention via control panel input is needed to react to observations on the environment and bird behavior.

Open-sided houses differ because exposure to external conditions means control of the internal house environment can be more challenging in relation to external temperatures, humidity, and daylight inside the house (i.e., photoperiod and light intensity). The use of an open-sided house for breeding stock may be preferred in many parts of the world due to the availability of electricity, limited infrastructure, or the level of initial investment.

Controlled-environment housing allows greater control of the light environment for dissipation of juvenile photorefractoriness. The word "photo" is derived from light, and "refractoriness" refers to resistance, meaning broiler breeders are hatched resistant to light stimulation, and, as such, are required to be reared for 18 weeks at a constant daylength of 8 hours on a controlled body-weight standard. After this period, the birds are considered photosensitive; thus, egg laying is initiated when an increase in daylength is provided via light stimulation (an increase in light hours). Sexual development will be delayed and egg production will be significantly reduced if they are reared on long days or are transferred to long days before they have dissipated juvenile photorefractoriness.

Table 1
Comparing controlled-environment and open-sided housing.

	CONTROLLED-ENVIRONMENT	OPEN-SIDED
Lighting	Lighting program control allows for photoperiod control in rearing (8 hours with 10–20 lux [1–2 fc]) and in producing birds which are sensitive to light stimulation at 21–22 weeks of age. This helps synchronize the onset of lay and have similar feed requirements for all birds in the population.	The lighting program is imposed mainly by natural daylight. Ensure minimal light intensity inside by supplemental artificial light, even during the day, to avoid light variations (e.g., cloudy days). For out-of-season birds the onset of lay will be under less control with lower peaks and higher egg weights.
Bird Comfort	Automatic power ventilation allows better control of the effective temperature inside the house. At optimal thermal comfort levels, birds will utilize feed most efficiently for adequate physiological development in rear and optimal biological performance in lay. Cooling capacity is widely better through tunnel ventilation.	External temperatures will affect the internal environment, especially in zones with a significant seasonal temperature fluctuation. Minimal equipment (e.g., circulation fans and water sprinklers) are necessary to ensure a comfortable effective temperature for the birds.
Stocking Density/Space Utilization	Stocking density during production up to 5.5 birds/m^2 (2.0 ft^2/bird).	Stocking density should not exceed 3.5 birds/m^2 (3.1 ft^2/bird) in production.
Non-Winchable Chain/Feed Distribution	Non-winchable chain for feed distribution — Lights can be turned off during distribution to aid uniformity of feed intake in the flock.	Non-winchable chain for feed distribution can be problematic due to poor uniformity of bird distribution along the feeding trough.
Mating Activity/ Fertility	Provides controlled management to promote synchronization between males and females.	In production houses, there is evidence of improved mating activity due to the presence of ultraviolet A (UV-A) in natural light.

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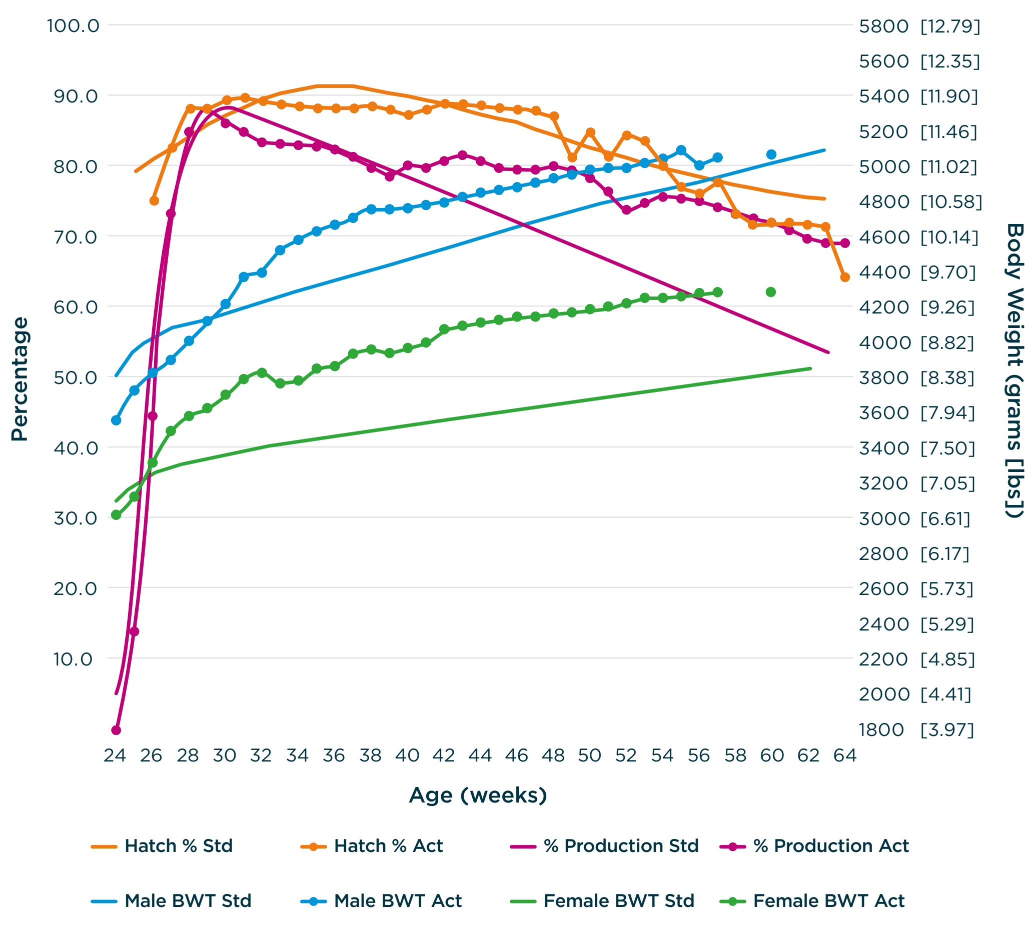
FLOCK PERFORMANCE

Compared to open-sided houses, controlled-environment houses are at an advantage when it comes to flock uniformity, space utilization, and flock synchronization.

Open-sided houses can have an advantage in terms of male mating activity during production; still, uniformity is key and this is more easily managed in controlled-environment houses. ***Figure 1*** is an example of a parent stock production graph in an open-sided house performing above standard for egg production.

Figure 1
Parent stock flock performance in an open-sided house.



**Aviagen does not consider different performance outcomes (i.e., egg production, chicks, etc.) for breeders raised in open-sided housing versus controlled-environment housing. Open-sided houses will require different management techniques, but they are always evaluated with the same standard performance objectives of the breed. However, differences will exist when considering if the flock is in-season or out-of-season.*

3

LIGHTING

3.1 LOCATION AND GEOGRAPHY

Latitude refers to a location's distance, either North or South of the equator, expressed as degrees and minutes. It is this distance from the equator, that determines the daylength and seasonality. This means that at a latitude of 0° (i.e., the equator), the daylength is termed quasi-stable at 12 hours throughout the year without true seasonality, whereas at a latitude of 80°, the daylength can vary from 24-0 hours depending on the season. This should be considered an important aspect during the planning stage for an open-sided house.

Figure 2
Natural daylengths at latitude 10° or 30° North or South.

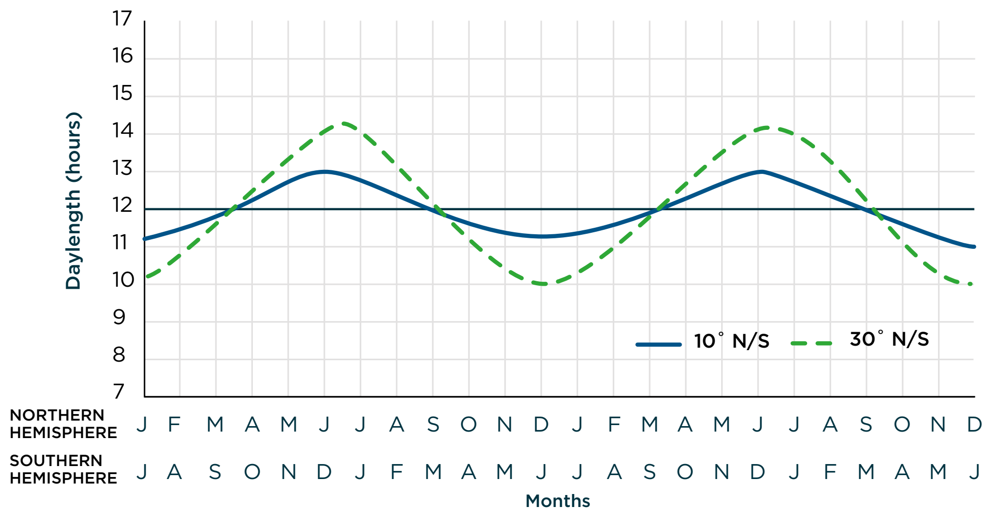
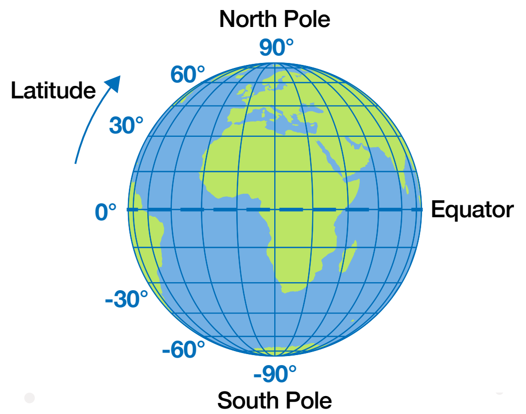


Figure 2 shows the monthly variation in daylength dependent on latitude in both the Northern or Southern Hemispheres. It should be noted that even within a region—Sub-Saharan Africa, for example—two locations can experience different daylengths. To illustrate this difference, Cape Town, South Africa (33.9249°S, 18.4241°E), is not exposed to the same natural length of daylight as an open-sided house in Nairobi, Kenya (1.2921°S, 36.8219°E). The latitude, or distance from the equator, is determined to accommodate these differences in natural daylight photoperiod. The map in ***Figure 3*** shows global latitudinal variation which will affect seasonality.

Figure 3
Latitude lines — Where locations on the same latitudinal line will experience similar daylengths.



Breeder flocks reared in locations close to the equator with 12 hours of daylight typically react to light stimulation between 21 and 22 weeks (147-154 days) of age when artificial light hours are added in order to reach 14 hours per day. Juvenile photorefractoriness is not dissipated for flocks exposed to daylength of 13 hours or more during the rearing period.

3.2 FLOCKS EXPOSED TO SMALL FLUCTUATIONS IN DAYLENGTH (LONGEST DAY <13 HOURS)

These flocks are generally placed in countries near the equator, such as Brazil, Indonesia, and Kenya, for example. During rearing in open-sided houses, they will be exposed to an average of 12 hours of natural daylength per day. The fluctuation is slight, and the flock will not experience more than 13 hours of daylight in a 24-hour period. All flocks should be considered in-season in this situation. Light stimulation should take place by evaluating body weight, body condition (fleshing, pin-bone spacing, etc.), and flock uniformity, and thereafter adding additional light hours by artificial light to equal 14 hours in daylength. There is no advantage to exceeding 14 hours where the longest natural daylength is <14 hours (***Table 2***).

Table 2
Lighting programs for open-sided house rearing and laying.

NATURAL DAYLENGTH at 10 Days (Hours)									
		9	10	11	12	13	14	15	
AGE (Days)		**BROODING DAYLENGTH (Hours) ‡**							**LIGHT INTENSITY†**
1		23	23	23	23	23	23	23	80–100 lux (7–9 fc) in brooding area.
2		23	23	23	23	23	23	23	
3		19	19	19	19	19	19	19	
4		16	16	16	16	16	16	16	
5		14	14	14	14	14	14	15	
6		12	12	12	12	13	14	15	>60–80 lux (6–7 fc) in brooding area
7		11	11	11	12	13	14	15	
8		10	10	11	12	13	14	15	
9		9	10	11	12	13	14	15	
AGE (Days)		**REARING DAYLENGTHS (Hours)**							
10–146 days		Natural Lighting							Natural light intensity
		NATURAL DAYLENGTHS (Hours) at 147 Days (21 Weeks)							
		9	10	11	12	13	14	15	
Days	**Weeks**	**REARING DAYLENGTHS (Hours)**							
147	21	12#	12#	14	14	14	14	15§	Supplementary artificial lighting 30–60 lux (3–6 fc), but 60 lux (6 fc) for spring-hatched flocks.
154	22	13#	14	14	14	14	14	15§	
161	23	14	14	14	14	14	14	15§	

‡ Constant 8-hour daylengths should be achieved by 10 days. However, if problems have regularly occurred with early body-weight gain, reaching the constant daylength may be delayed until 21 days.

† Average intensity within a house or pen measured at bird-head height. Light intensity should be measured in at least 9 or 10 places and include corners, under lamps and between lamps.

 # The daylength may be increased abruptly in a single increment without adversely affecting total egg production (although peak may be higher and persistency slightly poorer), provided the body weights are on target and the flock is uniform (CV% < 8 or ≥ 79% uniformity).

§ There is no benefit from exceeding a daylength of 14 hours. If the longest natural daylength exceeds 14 hours, the combination of natural and artificial light should be increased to equal the expected longest natural daylength.

¶ If problems occur in out-of-season flocks (i.e., delayed sexual maturity), the flock may be photostimulated at 140 days (20 weeks) provided the body weights are on target and their CV% is no more than 10 (no less than 70% uniformity).

3.3 FLOCKS EXPOSED TO LARGE FLUCTUATIONS IN DAYLENGTH (LONGEST DAY >13 HOURS)

Flocks placed in open-sided houses in locations which experience larger fluctuations in daylength over their cycle should use brown-out housing with black nets/curtains to manage the amount of light entering the rearing building. This will reduce the amount of light entering the rear house and manage birds on a daylength between 8–10 hours. Birds reared in true open-sided houses should be allowed to experience whatever changes occur in the natural daylength; never rear birds in artificially long days (>11 hours), as this will delay sexual maturity.

Flocks reared in open-sided houses and exposed to decreasing daylength after 16 weeks of age are considered out-of-season flocks. The daylength provided to the birds will need to consider the longest natural daylength. This will mean artificial lights should be used to provide supplementary lighting to match the longest natural daylength to avoid birds experiencing a decrease in daylength at any stage during the lay period. Out-of-season flocks are no different from in-season flocks in terms of their biological performance objectives in production. However, some differences should be considered when managing an out-of-season flock.

- Higher female body weight during rear (refer to ***Parent Stock Performance Objectives***); this will dissipate juvenile photorefractoriness more rapidly.
- Female feeding into lay (refer to ***Parent Stock Performance Objectives***).

3.4 DETERMINING IF THE FLOCK IS IN-SEASON OR OUT-OF-SEASON

The following table (***Table 3***) from the ***Parent Stock Handbook*** is suggested as a guide to know if the flock is in-season or out-of-season. In all cases, a minimum light intensity must be provided to avoid fluctuation during the day due to natural weather variation.

Table 3
Classification of months of placement as in-season or out-of-season.

IN-SEASON		OUT-OF-SEASON	
Northern Hemisphere	**Southern Hemisphere**	**Northern Hemisphere**	**Southern Hemisphere**
September	March	March	September
October	April	April	October
November	May	May	November
December	June	June	December
January *	July *	July *	January *
February *	August *	August *	February*

**These 4 months are difficult to define. The degree of seasonal effect in these months will depends on latitude. Slight modifications of the lighting programs and body-weight profiles may be necessary.*

4

VENTILATION

Open-sided houses rely on natural ventilation.

Continuous ventilation management is needed to assess the house conditions and react accordingly—such as curtain height, fan, and water sprinkler control. Open-sided houses are found in areas where daytime temperatures can be as high as 35°C ± 5°C (95°F ± 10°F) and 20°C ± 5°C (68°F ± 10°F) during the night, and where extreme diurnal variations in temperature can exist. Relative humidity ranges from 20–90% and seasonal effects such as monsoons or cooler temperatures (during winter) may reduce temperatures to below 10°C (50°F). For this reason, planning a new open-sided house should consider the climate of the intended location.

4.1 PLANNING A NEW BREEDER HOUSE/FARM

Open-sided is sometimes the preferred housing type due to limitations in accessing adequate electrical infrastructure and ensuring sufficient and continued energy supply. In this case, an open-sided house will pose less risk than a controlled-environment house, which relies on a powered ventilation system.

In choosing the location for the house, a history of local weather patterns should be considered using the following points:

- Locations closer to the equator experience lower temperature fluctuation throughout the year.
- Locations that experience true winter and summer seasonal changes should avoid open-sided houses. Generally, these locations also have a significant daylength fluctuation.
- Avoid micro-climates with consistent patterns of high humidity.
- All housing types should be positioned East–West to minimize solar heat gain through the side wall.
- Be mindful in choosing the roofing material. It should not transfer the sun's radiation to heat the inside of the house. Painting the roof white maximizes sunshine reflection and installing insulation under the roof using foam material both aid in temperature control. A water sprinkler system on the roof can help with reducing solar radiation transfer and thereby the house temperature. Care must be taken as this can raise humidity inside the poultry house.
- Vegetation on the ground helps reduce solar radiation. However, be mindful that each house should be clear of vegetation 1.0–3.0 m (3.3–9.8 ft) around the perimeter of the structure.
- Construct units to a specified width of 9.0–12.0 m (29.5–39.4 ft) wide with a minimum roof height of 2.5 m (8.2 ft) at the eaves to ensure adequate air flow.
- It is desirable for roof eaves to extend 1.5–2.0 m (4.9–6.6 ft) past the wall of the house to provide shade from direct sunlight inside the house.
- Provide a distance of at least 15.0 m (49.2 ft) between units to allow free flow of air.

4.2 MANAGING VENTILATION CHALLENGES

The objective of ventilation is to achieve a uniform in-house environment that will optimize bird comfort, achieve the best biological performance, and maintain bird health and welfare. This is achieved through:

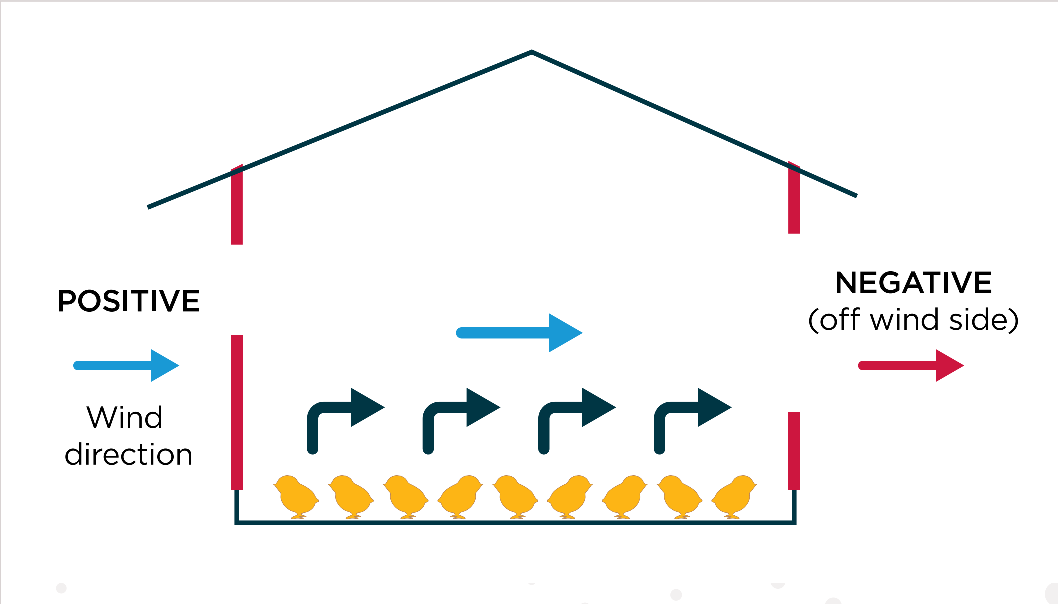
- Supplying adequate fresh air into the poultry house.
- Removal of excess moisture, gases, and airborne by-products.
- Maintaining the correct temperature and relative humidity.
- Wind chill — This is the cooling effect felt by the bird when there is air movement over them. The actual cooling effect experienced will be dependent on several factors such as feathering, health, and nutrition status.

4.3 NATURAL VENTILATION CONSIDERATIONS

Natural ventilation as a system does not offer full control over in-house conditions. It relies on lowering or raising sidewall curtains, flaps, or doors correctly to allow outside air and inside convection currents to move air into and throughout the house. Management of open-sided housing needs to be continuous and proactive in responding to the ambient conditions as they change throughout the day. The key points for natural ventilation are:

- Natural ventilation will work best when outside conditions are close to the desired in-house conditions.
- Natural ventilation requires constant, 24-hour curtain management.
- Air exchange rate depends on outside winds. In cold weather, the colder outside air will drop directly onto the birds when entering the poultry house if not correctly managed.
- Circulation or stirring fans can help improve in-house conditions, making use of the natural movement of air into and out of the poultry house.
- Curtains should be lowered on both sides of the building to provide cross ventilation (***Figure 4***).
- Volume and speed of air movement is regulated by managing the curtains and velocity of the wind entering the house.
- With natural ventilation, the curtain is secured to the side wall at the bottom and opened from the top–down. This minimizes the wind/drafts blowing directly onto the birds.
- If required, double curtains can be used to manage the temperature of incoming air.

Figure 4
Airflow in an open-sided house.



5

CIRCULATION FANS

For locations without electricity supply issues, circulation fans are useful during warmer periods in the absence/reduction of prevailing winds to enhance the movement of air inside the house.

The main reason for using circulation fans is to create air movement in the house, and therefore, uniformity of conditions throughout. There is also the advantage of creating wind chill on warm days for additional cooling. The use of variable-speed circulation fans has additional capacity to ensure the correct air movement for the individual house.

For circulation fan placement, ***Figure 5*** and ***Figure 6*** present two options on fan placement and how these can affect the birds' effective temperature. The method in ***Figure 5*** illustrates circulation fans which do not introduce fresh air to the house but circulates the warm, humid air around. This will promote uniformity of conditions, but does not remove any waste gases. The benefits of using this set up are limited. ***Figure 6*** shows the placement of circulation fans which draw fresh air in from outside the house and direct this to the center of the house, thus creating air exchange. This set up is more suited to rear houses as it does not create an obstacle.

Figure 5
Circulation fans placed in the middle of the house above the birds.

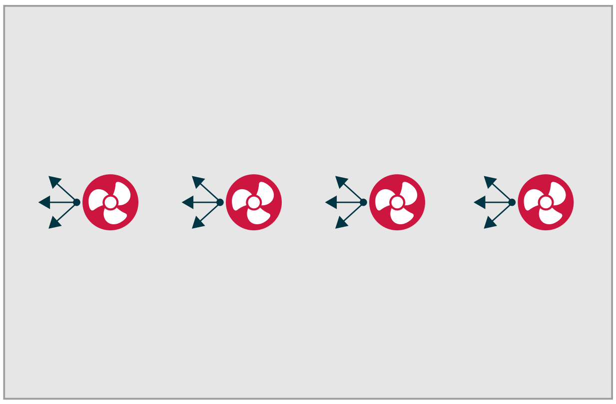
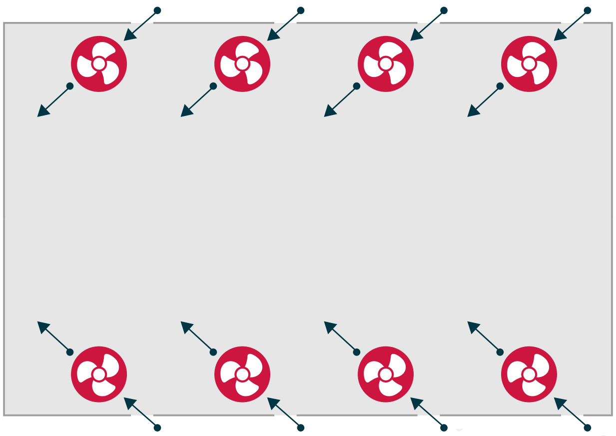


Figure 6
Circulation fans placed to the side of the house directing air to the middle of the house.



6

FEEDING

Rearing breeding stock in open-sided houses can be challenging when it comes to feed distribution techniques—one of the main drivers in flock uniformity.

Feeding space recommendations for open-sided and controlled-environment houses do not differ. However, management of feeding can prove difficult due to extended natural light hours and the need for achieving darkness for feed distribution; this can impact the birds and feed distribution in the house, thereby affecting uniform access to feed. The following points should be considered for feeding in open-sided houses:

- Maintain smaller population sizes with independent feeding systems per population.
- Feed distribution time should be less than 3 minutes.
- If feed distribution time exceeds 3 minutes, additional satellite hoppers can be placed along the track to reduce this time.
- Winchable feeders which can be filled with feed and lowered to the population will ensure uniform feed presentation within 3 minutes; these feeders will be raised after all feed has been consumed.
- Feed birds during the coolest part of the day (within 30 minutes of lights-on) for better feed intake and to minimize the impact of metabolic heat production coinciding with the warmest part of the day.

7

CONCLUSIONS

A controlled-environment house with automatic power ventilation remains the preferred housing type for breeding stock.

However, open-sided housing can be managed effectively with optimal curtain and feed management. Curtain control is especially important since the environment inside an open-sided house is affected by the outdoor elements (temperature, humidity, daylength, etc.). The management techniques provided in this document for open-sided housing reinforce the importance of good stockmanship through proactive and reactive management based on bird comfort and their interaction with their environment.

NOTES

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Every attempt has been made to ensure the accuracy and relevance of the information presented. However, Aviagen accepts no liability for the consequences of using the information for the management of chickens.

For further information on the management of stock, please contact your local Aviagen representative.

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