CAGE-FREE LEGHORN MANAGEMENT GUIDE

HY-LINE NORTH AMERICA

Hy-Line.

LOHMANN BREEDERS

A BIRD FOR EVERY SYSTEM.

SUPPORT FOR EVERY NEED.

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A BIRD FOR EVERY SYSTEM.

SUPPORT FOR EVERY NEED.

Introduction

Alternative systems have been developed to satisfy the increasing customer demand for eggs produced outside of conventional cages. This type of production requires different management to optimize production and bird welfare. Alternative production systems fall into three broad categories:

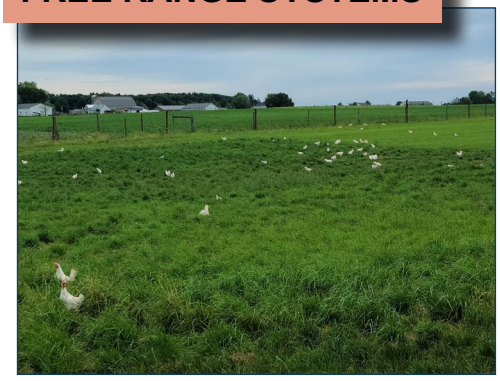
BARN SYSTEMS

Barn systems allow birds free movement. Floors can be slatted, littered, or a combination of both. Birds are allowed to freely move within the facility. An elevated slat area with nests, feeders, perches, and waterers is provided. Automatic and hand-collected nest boxes are utilized for egg collection.

AVIARY SYSTEMS

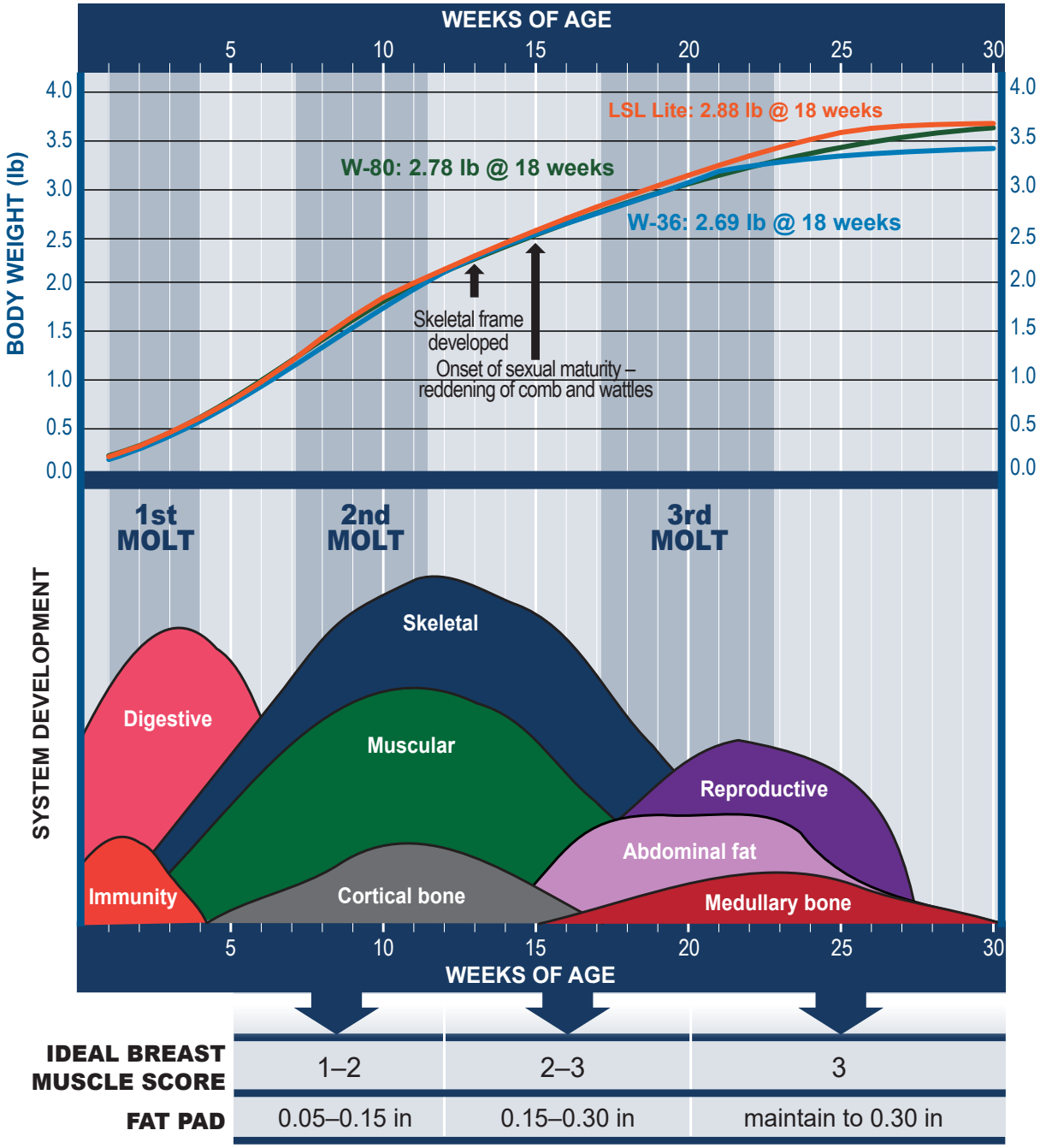
Multi-tier structures over a litter floor which utilize the vertical space within a facility for efficiency and to provide environmental enrichments to increase bird welfare, including nests, feeders, waterers, and perches. Manure belt disposal systems are provided on elevated levels. The top level is typically for birds to rest/sleep.

FREE RANGE SYSTEMS

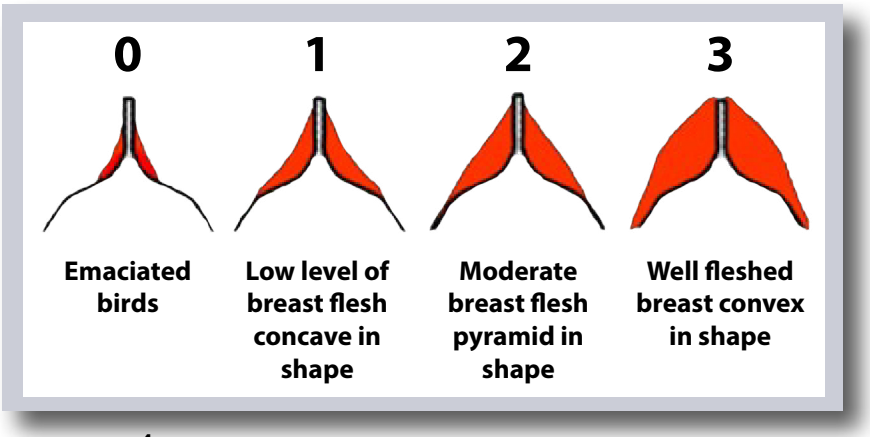


Barn or aviary systems where birds have access to the outside range or pasture during the day and return to the facility for feed, water, and sleep at night. Birds have outside pasture areas with perimeter fencing, or summer porches or verandas which are enclosed with fencing and a roof.

Development of the Organ Systems in Pullets



IDEAL BREAST MUSCLE SCORE	1–2	2–3	3
FAT PAD	0.05–0.15 in	0.15–0.30 in	maintain to 0.30 in



Growth and Development Tips

The design of the rearing facility should closely match that of the layer facility to which the flock will be transferred. Drinker type, feeder type, and perching should be the same. When the rearing feed, water, and facility design do not match the production facility, the birds may be slower to adjust to their new environment. These changes result in more stress on the birds, which in turn can affect production in various forms.

- Chicks' body weight should double between arrival and 7 days-of-age.
- Achieving the 6, 10, 14, 18, 24, and 30 week body weight targets will help ensure optimum development of the bird's muscular and skeletal structure and production potential.
- Aim for the high end of the pullet body weight standards throughout rear.
- Change rearing diets only when the recommended body weight with good uniformity (90%) is attained. Delay diet change if birds are underweight or have poor body weight uniformity.
- Changing diets based on age can result in poor uniformity or overweight flocks.
- By 12 weeks of age, match the first and last feeding timings to what will be used in the production facility.
- By 12 weeks of age, have a maximum of 5 feed runs per day, including stimulations.
- By 12 weeks of age, start monitoring abdominal fat pad development. The goal is to maintain a fat pad thickness of 0.25–0.30 in throughout life.
- Anticipate rapid increases in ambient temperature during summer and adjust bird's diet accordingly. Birds will eat less when exposed to a rapid temperature increase.
- Delay diet changes until after a stress-inducing event, such as catching birds for an injected vaccination.

Facility Preparations Before Chick Delivery

For more information, see Pre-Housing Cleaning, Disinfection & Maintenance Checklist at hylinena.com.

- Allow 2–4 weeks downtime between flocks to complete a thorough cleaning and disinfection.
- All-in, all-out (single age) management provides the best control for sanitation and disease prevention.
- All feed and manure should be removed from the facility before cleaning.
- Clean and disinfect feeding system, allowing it to dry before new feed is delivered.
- Wash the upper portion of the facility and work downward toward the floor.
- Thoroughly clean air inlets, fan housing, fan blades and fan louvers.
- Use foam/gel disinfection/detergent to soak into organic matter and equipment.
- Use high pressure warm water to rinse.
- Allow the facility to dry. After it is fully dry, apply foam/spray disinfectant or fumigation.
- Apply insecticide, not in combination with disinfection or fumigation.
- Update rodent control program and ensure adequate mitigation strategies are utilized. If using bait, place out of reach when birds are placed.
- Effectiveness of cleaning and disinfection can be confirmed with environmental swabs.

Chick Management

Chicks adapt well to both floor and aviary system brooding environments. Hatchery services/treatments are performed as requested by the customer.

Before Chick Delivery

- Pre-heat the brooding facility prior to chick delivery: ensure that brooding house is up to temperature 72 hours prior to chick delivery.
- Establish proper system and environment temperatures of 91–94°F and 60% humidity depending on variety. W-80 and LSL-L chicks need a little warmer temperatures.
- Ensure light intensity of at least 3–5 footcandles measured at the water nipple.
- Check water system and adjust to the correct height for chicks.
- Sanitize and flush water lines.
- Check to make sure equipment is working properly and is adjusted to the correct height.
- When fumigating, take into account environmental conditions and the amount of time it will take to clear the disinfectant safely from the house before chick placement.
- Add clean bedding material before final fumigation. Allow bedding material to warm up with the house at least 24 hours prior to chick arrival.
- Add chick paper under feed and water lines. If starting chicks on the floor, use paper for entire chick area.
- Place supplementary feed onto papers or trays.
- Fill feeders to their highest feed level, allowing easy access for the chicks.
- Use a ratio of 80 chicks/tray feeder. Clean egg trays and box tops can also be used.
- Drinking water should be tested for quality and cleanliness from source and end of the water line.

Day of Chick Delivery

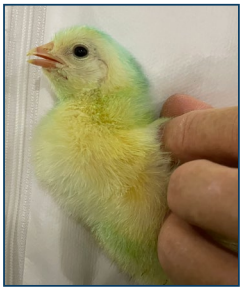
- Double-check that facility temperatures are appropriate for brooding chicks.
- When using nipple drinkers, adjust the water pressure to ensure there is a droplet of water visible on the nipple.
- Brood chicks in groups of similar aged breeder flocks when possible.
- Unload chick boxes quickly and gently place the chicks in the system or brooding area.
- As chicks are placed, trigger nipples or cups to encourage drinking.

Rearing Recommendations

The first 14 days of the chick's life are critical for establishing future success and reaching genetic potential. The following sections on feed, light, air, and water should be followed to help start the chicks and throughout the pullet period.

CROP FILL – ARE THE CHICKS EATING?

Hours after chick placement	Chicks with feed in crop
6	75%
12	85%
24	100%



Chick with starter feed in crop

Chick without starter feed in crop

FEED

Starter

- Starter feed is preferably in the form of a mash with a particle size distribution between 1 to 2 mm and minimal levels of fine material (particles less than 1 mm) to support feed intake.
- Starters are formulated using ingredients which are both highly palatable and digestible for the chick with particular emphasis on protein contributors.
- If necessary, a second stage starter diet (Starter 2) can be used as an intermediate diet between the first stage starter (Starter 1) and grower diet to further support development.

Grower

- Typically given during the period of rapid growth in pullet body size between 6 to 12 weeks of age.
- Sufficient levels of protein, essential amino acids and minerals are required for muscle growth and skeletal development during this period.
- Attention should be given to ensure that the energy of the grower diet, needed for development of the fat pad, is sufficient to compensate for any stress event which may compromise feed intake.

Developer

- Typically introduced at 12 weeks of age, providing that body weight objectives have been achieved.
- The Developer diet should be fed up to the Pre-Lay period and be lower in density to encourage feed intake and increase enteric capacity.
- The Developer diet can have a wide range of nutritional levels, since it can be used either to increase or to control body weight gain.
- Avoid excessive levels of choline (> 150 ppm/bird/day) in the Developer and Pre-Lay phase to facilitate fat accumulation for the onset of lay.

Pre-Lay

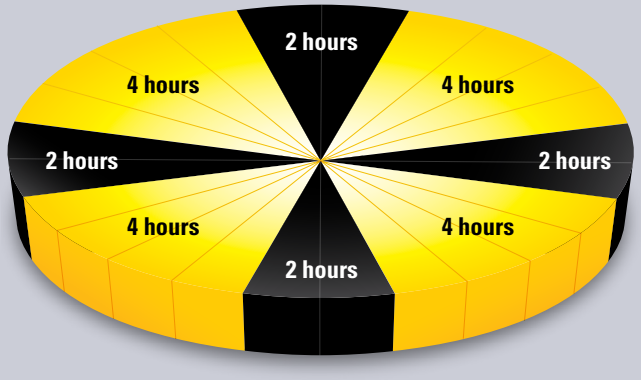
- The Pre-Lay diet contains increased calcium and phosphorus levels relative to the Developer diet to increase medullary bone reserves in pullets preparing for egg production. Medullary bone contains minerals that are quickly mobilized for eggshell formation and vital for development of the first egg.
- Pre-Lay diets can be started when most pullets show reddening of combs, but not before 15 weeks-of-age.
- Plan to feed for a maximum of 10 to 14 days before point of lay.
- Introduce large particle calcium sources, such as limestone, into the Pre-Lay diet in order to familiarize birds to large particles. Ideally, the Pre-Lay diet should have at least 50% of coarse limestone.
- When fitting, the Pre-Lay diet can be synchronized with light stimulation.
- Discontinue feeding the Pre-Lay diet with the start of egg production.

LIGHT

- Bright light (3–5 footcandles) during 0–7 days helps chicks find feed and water and adapt to the facility environment. Ensure that the light (measured at the level of the water nipple) is uniform in the brooding area. Avoid shadows and dark areas.
- An intermittent lighting program for chicks is strongly preferred. If not using an intermittent lighting program, use 20 hours of light and 4 hours of dark for 0–7 days.
- Utilizing 24 hours of light for chick starts is strongly discouraged.
- After the first week, reduce light intensity and begin slow step-down lighting program.

Intermittent Lighting Program for Chicks

- Preferred lighting technique.
- Use from 0–7 days (can be used up to 14 days of age).
- Intermittent dark periods provide rest periods for chicks.
- Synchronizes chicks' activities and feedings.
- Establishes more natural behavior of rest and activity.
- Helps improve 7-day livability and pullet body weight.
- Some dark periods may be shortened or removed to accommodate work schedules.



Lighting for Pullets

Light Intensity

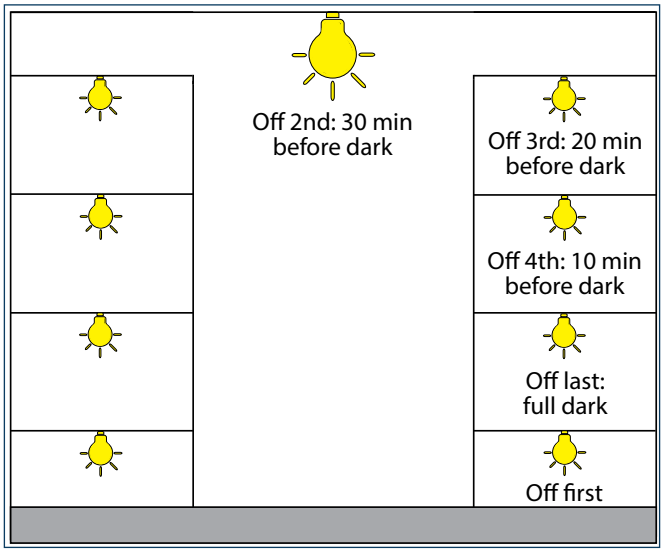
- Starting chicks should be 3–5 footcandles (5–7 footcandles for IRBT birds).
- By 4 weeks-of-age, have lights fully dimmed to approximately 1 footcandle on the floor and less than 3 footcandles at the water nipple in aviaries, and an even 1 footcandle across a floor house.
- In the 1–2 weeks before transfer, gradually increase light intensity to match the layer house (typically 2–3 footcandles in the aisle).

Sunrise

- For slat, floor, and aviary systems, all lights turn on at the same time.
- If the house has a sunrise feature, go from dark to desired intensity in 2–5 minutes.

Sunset

- For slat and floor systems, turn the outside or litter lights off first, in 5-10 minute dim down if available, followed by inner or slat lights dimmed down in 10-15 minutes. Without dimmers, turn outside lights off followed by slat lights 10-15 minutes later.
- For aviaries, turn the under system lights off first; then dim ceiling light (10 to 15 minutes), followed by the system lights (15-30 minutes).
- The total time from the start of sunset until complete dark should be no more than 45 minutes in full.
- If there are still birds on the floor after full dark, turning the bottom row back on for another 5 minutes can help minimize the number of pullets that need to be picked up.



Sunset lighting sequence

Light Spectrum

- Cool (5000–6000K) or warm (2700–3000K) lights can be used in the pullet house.
- Cool lights, or lights with more blue/green spectrum, have been shown to help increase pullet growth.
- There are many types of LED bulbs with different features, spectrums, and benefits. Use consistent lighting throughout the house with the same type of bulb and spectrum on each individual level.

Rope lights can provide uniform lighting to brooding sections in aviary systems.

Lighting Schedule

- A quicker light step down (constant light by 6–8 weeks of age) will generally control body weights, while allowing for uniform muscle mass, skeletal, and fat pad development.
- A slower light step down (constant light by 10–12 weeks of age) will allow for better body weight growth and optimal egg size.
- Constant light can be between 10 and 12 hours per day. A 10-hour constant day length will give pullets less time to consume feed. A longer constant day length will allow more time for feed consumption and may be necessary for flocks reared in the summer. Ideally, the constant light duration should be 12 hours or shorter to allow for a proper light stimulation and step up in the layer period. The constant light should be in place for a minimum of 3 weeks.
- Chickens are responsive to changes in day length, and this has a significant effect on egg production and egg size. Age of light stimulation and body weight are interacting factors that help determine the onset of egg production, as well as egg size (see table on previous page). Light stimulation should be done based on the flock's body weight and uniformity. Generally, early light stimulation at lighter body weights will accelerate maturity and decrease egg size; later light stimulation at heavier body weights will delay maturity and increase egg size.
- The lighting program should be developed so the total light time is from complete dark in the morning until complete dark at night. Any sunrise/sunset or dimming features should be fully incorporated into the lighting program.
- In open houses, the lighting schedule needs to take into account the seasonality of outside light. A lighting program found at Hy-Line Lighting Program can help develop this program.
- The sunrise and sunset after the intermittent period should be developed to match the layer program to help train the pullets.

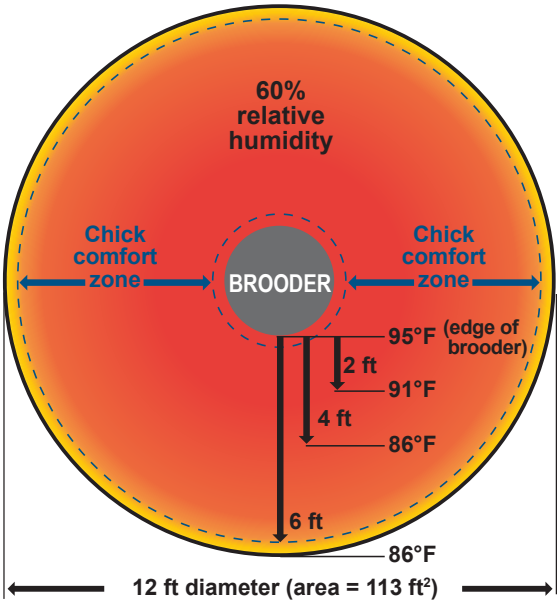
Recommended Lighting Programs

	LSL-Lite	W-36	W-80
Weeks to step down lights during rearing	8 weeks	12 weeks	8 weeks
Hours of constant light during rearing	10 hours	12 hours	11 hours
Body weight at first light stimulation for egg numbers	2.70 lb	2.70 lb	2.70 lb
Body weight at first light stimulation for balance	2.80 lb	2.80 lb	2.80 lb
Body weight at first light stimulation for egg weight	2.90 lb	2.90 lb	2.90 lb
Age to reach full light in lay	16 hours at 28 weeks	16 hours at 28 weeks	16 hours at 28 weeks

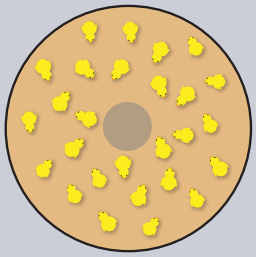
AIR

Brooding Temperature and Relative Humidity

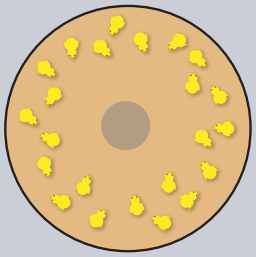
- Find optimum balance of temperature, humidity, and ventilation rate for chick comfort.
- Chicks are unable to fully control body temperature during the first week of life and depend on proper environmental temperature.
- Adjust brooder temperatures according to relative humidity. Lower temperatures should be used with higher humidity. For every 5 percentage points above 60% relative humidity, reduce brooding temperature 2°F.
- After the first week, reduce temperature weekly 4–6°F until reaching 70°F.



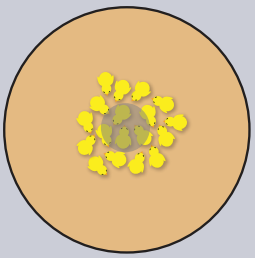
ARE THE CHICKS COMFORTABLE?



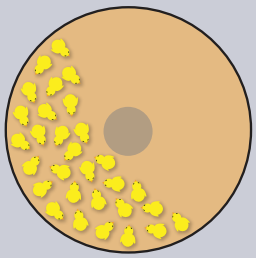
CORRECT
Chicks evenly distributed in brooding area, active and sounding content



HOT
Chicks spread out, lethargic, appear sleepy

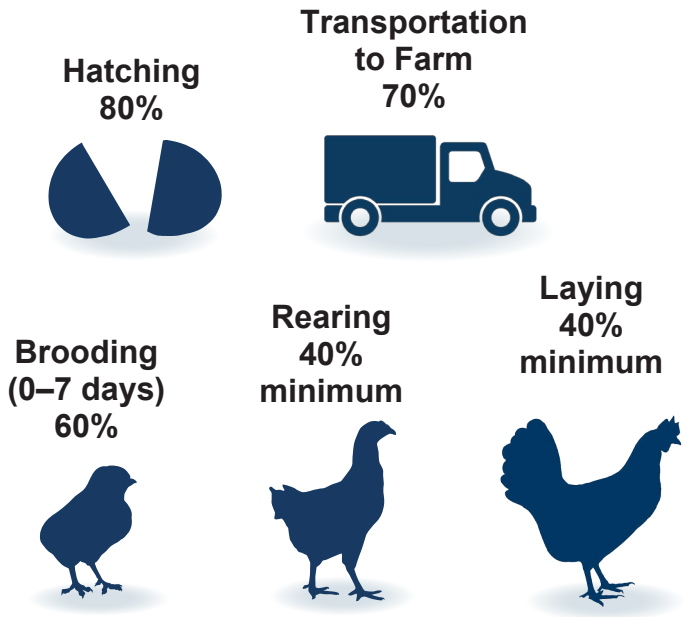


COLD
Chicks gathered into groups, sounding distressed



UNEVEN VENTILATION
Chicks congregated in one part of brooding area, avoiding drafts, noise or uneven light distribution

RELATIVE HUMIDITY



Low humidity

- Reduces bird comfort
- Increases dehydration
- May result in pasty vents in chicks
- May increase agitation and possibility of pecking
- Adversely affects feather cover
- Increases dust

Excessive humidity

- Increases ammonia
- Causes poor litter and air quality

Use lower end of temperature range for W-36; use higher end of temperature range for W-80, LSL-L, or IRBT chicks.

AGE	0–3 days	4–7 days	8–14 days	15–21 days	22–28 days	29–35 days	36–42 days
AIR TEMP. (FLOOR)	91–94°F	89–91°F	84–88°F	81–84°F	79–81°F	73–77°F	70°F
LIGHT INTENSITY	3–5 fc	3–5 fc	2.5 fc	2.5 fc	2.5 fc	0.7 fc	0.7 fc
LIGHT HOURS	Intermittent Program or 20 hours	Intermittent Program or 20 hours	Intermittent Program or 18 hours	16.5 hours	15 hours	13.5 hours	12 hours

Air Movement (ft³ / minute per 1000 birds)

AMBIENT TEMP. (°F)	WEEKS OF AGE				
	1	3	6	12	18
90	200	300	600	1500	3500
70	100	150	300	750	1500
50	70	100	200	400	1100
32	40	75	140	300	750
10	40	60	100	200	300
-10	40	60	100	200	300

Acknowledgment: Dr. Hongwei Xin, Professor

Cloacal Temperature

- Target body temperature for chicks is 103–105°F.
- Measured using a digital infant ear thermometer by gentle insertion at the chick's vent.
- Cloacal temperature correlates well with the core body temperature.
- Chilling or overheating chicks during the brooding period can result in poor growth and increased susceptibility to disease.

An infant ear thermometer being used to measure the chick's body temperature via the vent.

WATER

- Trip nipples 3x per day for the first 3–5 days.
- Flush water lines prior to chick arrival.
- Maintain ambient water temperature during brooding period.
- Be careful when flushing water lines for chicks. When possible, flush water lines when lights are off to limit chicks' exposure to cold water.
- Use a ratio of one nipple/cup per 12 birds for the first three weeks.
- Chicks should not need to move more than 3 feet to find feed or water.

Drinking Systems

- The type of drinkers used during rearing should be the same as in the production facility. Use the same nipple type in rearing and production facility (vertical vs. 360° activated nipples). In general, 360° activated nipples are required, especially for IRBT flocks.
- Ensure that palatable water is available to the birds at all times. Water should be kept fresh and clean by flushing water lines weekly during rearing and production periods. Flush water lines during the night, before lights come on in the morning.
- Regular water treatment with a bird-safe sanitizer is recommended.

Cup or Bell Drinkers

- Cup drinkers should be manually filled during 0–3 days to train chicks to drink.
- Open drinkers (bell, supplemental chick drinkers, trough) are easily contaminated and should be cleaned daily.

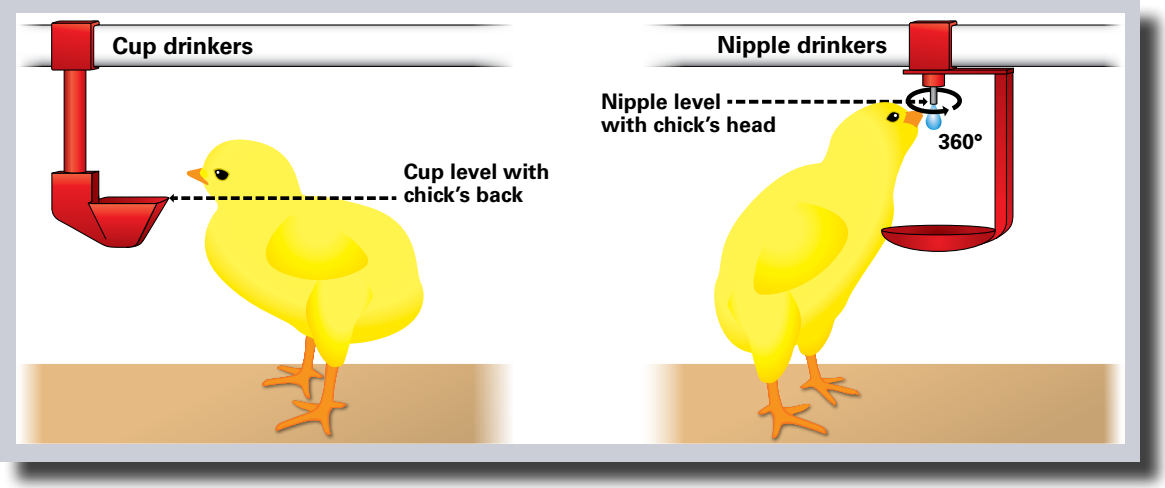
Record daily flock water consumption. A drop in water consumption is often the first sign of a serious problem in the flock.

Nipple Drinkers

- Nipple drinking systems are preferred because they are a closed system and more sanitary.
- Adjust nipple water system pressure to create a hanging drop to help chicks find water for 0–3 days and in layer facility at transfer for 7 days. Seeing a hanging drop after the first 7 days is an indication that the water pressure is too low and should be adjusted to the appropriate level for the age of the flock.
- Test flow out of the beginning, middle, and end of the line to ensure consistency of water availability. Consult with your water line manufacturer for recommended settings.
- Splash cups are useful during brooding period and in hot climates.
- 360° activated nipples make drinking easy for chicks.
- Use only 360° activated nipples for IRBT chicks, as well as supplemental chick drinkers.

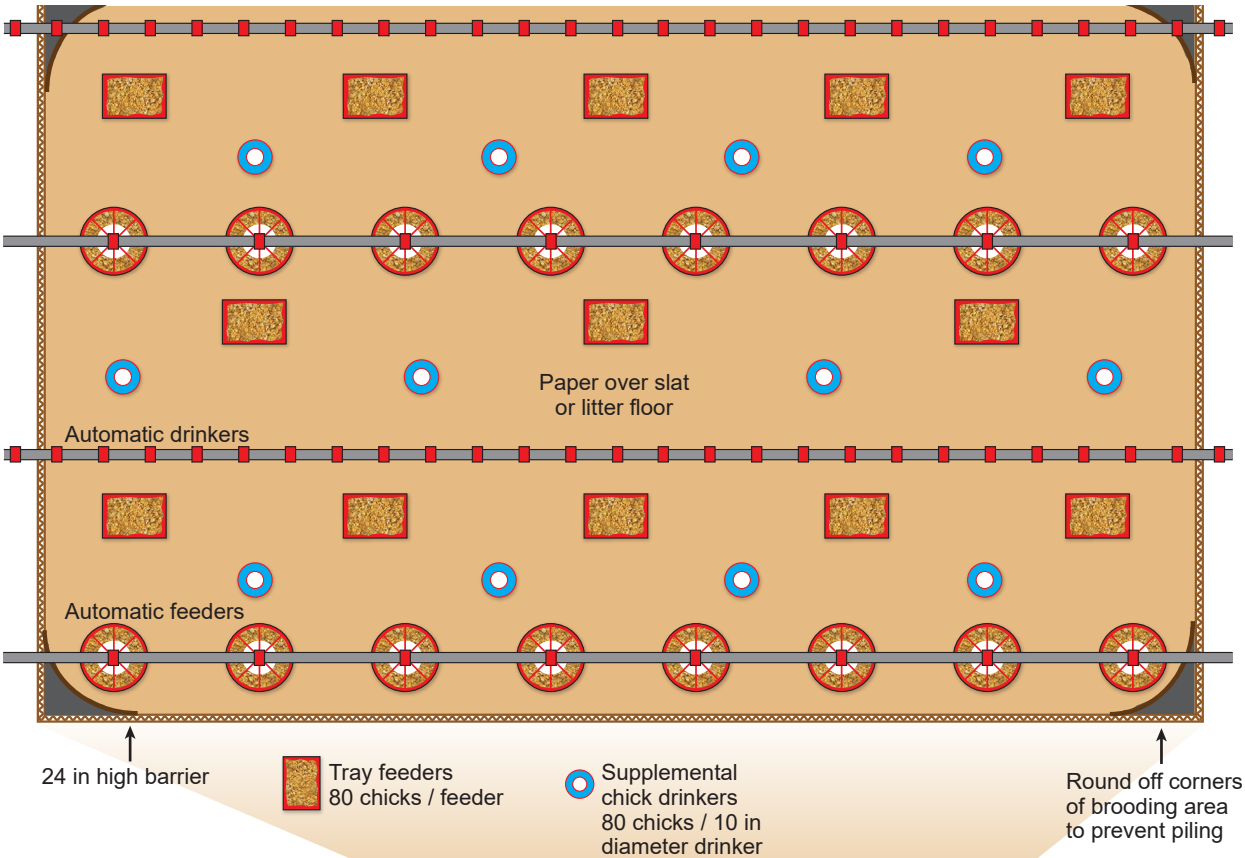
PAPER

- Cover entire floor of brooder ring, house area, or system with paper. In partial facility brooding, place feed on the paper near the permanent feeders.
- Place starter feed on paper for 0–5 days. For beak-treated chicks, feed on paper for the first 7 days.
- If using a vaccine for coccidia on slats, keep paper or trays to allow for coccidial vaccine cycling until 28 days of age.



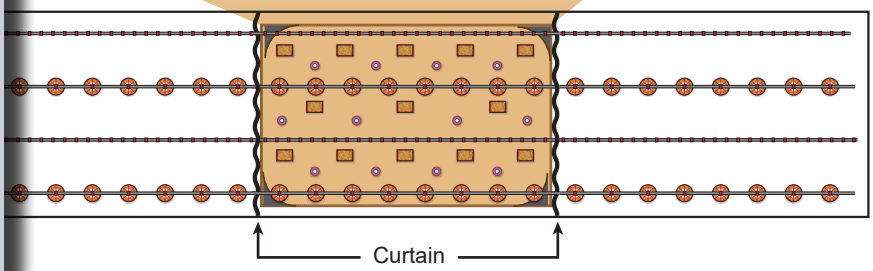
Partial Facility (Floor) Brooding - Full paper wherever chicks are started

- A section of the facility is partitioned and used for brooding.
- When using brooding stoves, pancake heaters, or radiant heaters, ensure the area under the heater is at least 91°F. The temperature in the rest of the house not under the stoves should be maintained at a minimum of 86°F.
- Eliminate all drafts from the brooding facility.
- Use a ratio of 80 chicks/circular drinker (10 in diameter).
- Enlarge brooder rings at 3 days to increase group size.
- Continue enlarging brooder rings until all rings are removed by 14 days.
- Gradually remove supplemental drinkers and tray feeders beginning at 7 days.



AVIARY SYSTEMS

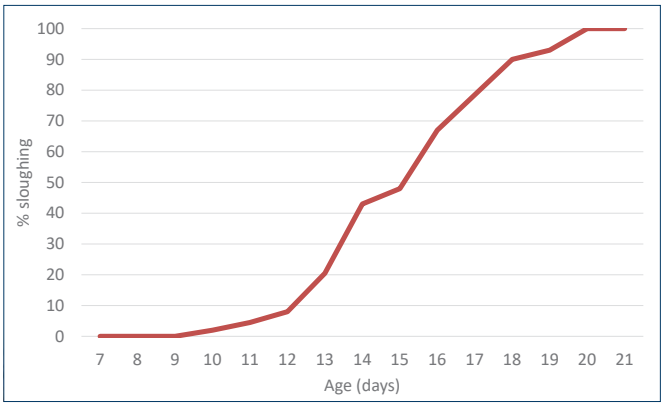
- Chick paper in an aviary system should remain for at least 14 days (28 days if using coccidia vaccine) to keep chicks comfortable on the wire or slat floor.
- Introduce chicks to the entire aviary system as soon as possible. Follow the equipment manufacturer's recommendations on optimal time to introduce chicks to the whole system.
- Within the first 7–14 days, chicks are separated into the other levels of the system to decrease density and increase access to feed and water.



Infrared Beak Treatment

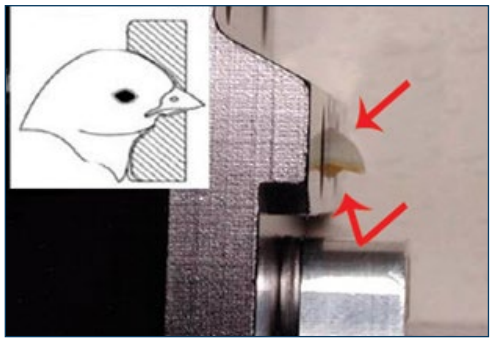
- Infrared beak treatment has been proven a successful, non-invasive method of controlling the growth of the beak in laying hens.
- The tip of the beak will wear off gradually between 10–21 days.
- Infrared treatment is adjustable to manage differences in breeder flock age, chick size, climate, and variety of birds.

For more information, see Infrared Beak Treatment at hylinena.com.

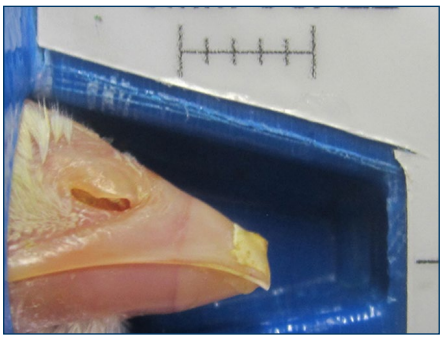


IRBT healing times

Loading chick



Infrared beak treatment can be modified according to local conditions.



One day post-treatment

Additional care for successful IRBT chick starts:

- Water intake is the most important factor for success with IRBT chicks. Chicks require immediate and easy access to water.
- Lower water pressure so the nipple triggers more easily for the chick.
- Set up water system so the nipple triggers more easily for the chick.
- If using nipple drinkers, use only 360° activated nipples for IRBT chicks, as well as supplemental chick drinkers.

Properly trimmed beaks

- Nipple drinkers with splash cups provide additional support for IRBT chicks.
- Trip nipples 3x per day for 3 days.
- In floor or aviary brooding, supplemental drinkers may be used for the first 3 days to help chicks drink. If supplemental drinkers are used:
  - » Ensure they are cleaned of shavings, feed, and manure every day.
  - » Start gradual removal by 3 days of age. Complete removal by 7 days of age.
- Keep feed at the highest level in the feeder for several days after beak treatment. Feed depth should be maintained a minimum of 1 in above the chain or pan for the first 7 days to help encourage feeding behavior with IRBT treated chicks.
- Feed on paper for 0–7 days.
- Provide extra light (5–7 footcandles) on nipple drinkers after beak treatment.

Monitoring Weekly Flock Body Weights & Uniformity

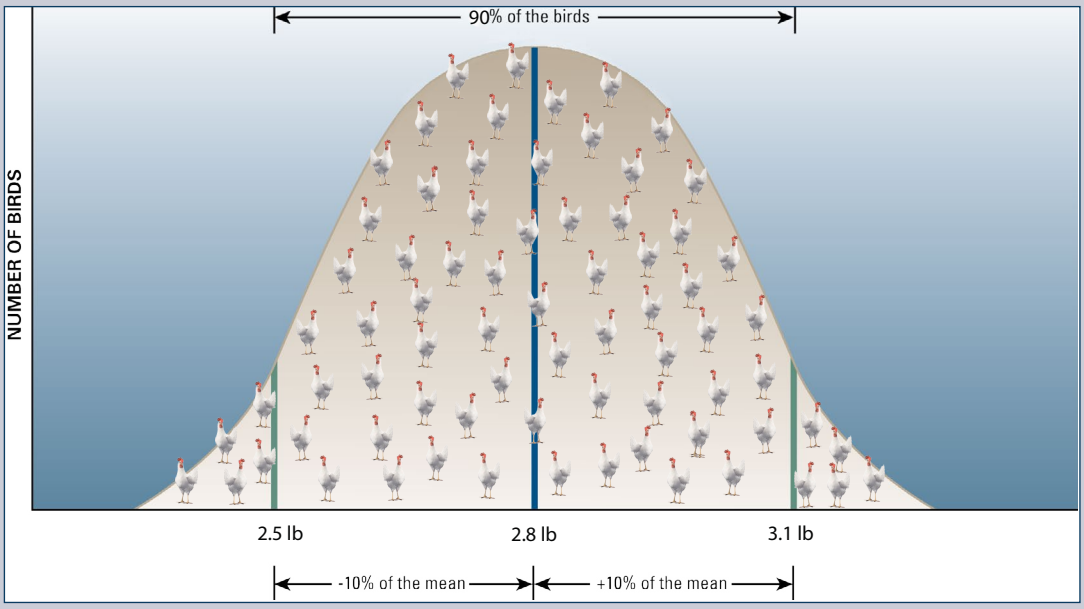
Weighing birds weekly will help to identify when a flock deviates from the body weight standard in either weight or uniformity.

- Body weights should be monitored weekly up to 30 weeks of age and thereafter every five weeks. For cage-free leghorn varieties, body weights should be monitored every week for the duration of the flock.
- If the body weight or the uniformity is not appropriate, there are several actions that can be taken to correct the problem, such as stimulating the birds to eat more often or changing the diet. Birds with poor body weight or uniformity could struggle to achieve good peak production, strong persistency, or have other production-related issues. It is essential to find these issues early and take corrective action.
- Weigh birds individually.
- A minimum of 100 birds should be weighed. In order to get the best representative sample, all birds caught in the pen should be weighed even if the number is more than 100.
- Always weigh birds on the same day of the week and at the same time of day.
- For pullets, it is critical to weigh birds prior to a scheduled feed change. If a flock is below target for body weight, it should remain on a high nutrient density diet until target weight is reached.

Uniformity

- The uniformity of body weights within a flock is an indicator of flock development.
- Prior to point of lay, flocks should have an optimal goal of 90% uniformity.
- Uniformity of body weights makes accurate feeding and management of the flock easier.
- Body weight gains and uniformity may be negatively affected by bird handling, vaccination, transfer, and disease outbreak.
- A Uniformity Calculation Tool is available at hylinena.com.

Weigh birds using a digital scale that calculates uniformity.



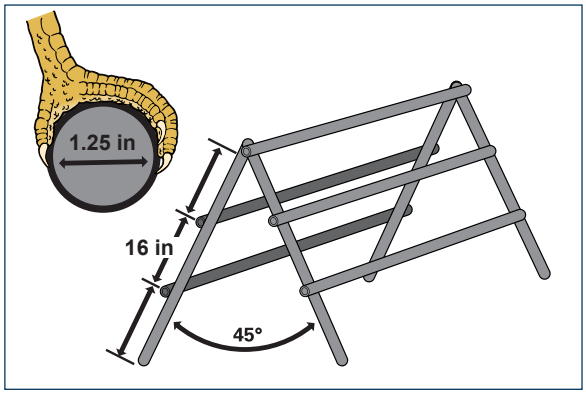
NORMAL DISTRIBUTION OF BODY WEIGHTS

A desirable goal is for 90% of birds to fall within ±10% of the average weight. For example, if a flock average weight at 18 weeks is 2.82 lb, 90% of all birds should weigh between 2.54 lb and 3.10 lb.

Environment of the Bird

PERCHES AND RAMPS

- Perches are essential for rearing birds that will go into an aviary system.
- Perches enrich the birds' environment and allow expression of normal behaviors.
- Perches encourage jumping habits, which develops leg and breast muscles, increases bone strength and calcium content of bone. Birds able to jump will have better nesting behavior and be more mobile in multi-tier aviary systems.
- Perches reduce social stress by providing safe resting sites.
- Perches increase living space in the facility.
- Perches allow birds to roost at night.
- Use of perches may reduce piling behavior in flocks.
- Ramps help train birds to move up and down aviary systems in rear and after transition to the lay house.



A-frame perch design


Perch in aviary system


Wall perch (not recommended for pullets; be careful in layers)


Ramp


Perch over feeder

Perch Design

- Floor-reared birds should have access to perches and slats no later than 10 days of age.
- Provide 4–6 inches perch space per bird (check certifying agency).
- Separate perch rails by at least 12–16 inches to prevent pecking by birds on adjacent rails.
- Place perches on slats to maintain good litter conditions and control floor eggs.
- Avoid slippery perches.
- Perches should support the bottom of the foot and be comfortable for the bird.
- If possible, use the same perch style in rear and lay facilities.
- Perches should be easy to clean and disinfect between flocks.
- Seal open ends of pipes for biosecurity and to reduce hiding areas of mites or other parasites.
- Perches are ideally placed over feed lines and on the top level in aviaries.
- Perches in grow should be placed where the nests would be in the lay house to familiarize birds with jumping in that area of the house.

LITTER

- Litter is used in a poultry facility to dilute manure, absorb moisture, and provide bird welfare such as the opportunity to dust bathe.
- Birds can express foraging and scratching behaviors on litter.
- The ideal litter should be absorbent, non-caking, non-toxic and resist mold growth. It should have high carbon levels to make it easily compostable.
- The key aspect of litter management is moisture control. The ideal litter moisture level is 25–30%.
- Litter moisture above 30% can result in excessive ammonia in the facility and allow the growth of pathogenic microorganisms. Drinker lines, foggers and evaporative cooling pads, if not managed and maintained can cause wet litter problems.

Litter selection is a balance of animal welfare, costs and egg sanitation. Each litter substrate has benefits and weakness to its use. It is important to expose the flock to litter during the pullet period.

Keys to Maintaining Dry Litter

- Use a good litter material with high moisture absorbency.
- Maintain sufficient minimum ventilation rate in the facility.
- Maintain leak-free water systems, replace leaking nipples and maintain proper water level in bell drinkers.
- Maintain proper drinker height and water pressure to prevent water spillage.
- Ensure good drainage of rain water away from the facility.
- Remove caked litter frequently and replace with clean dry litter.
- Occasionally rake the litter to keep it friable and prevent caking. Encourage the birds to break up litter by placing small amounts of whole grain on top of the litter.
- Remove extra litter to prevent floor eggs and maintain good air quality (less dust).

Types of Base Material

NONE

Advantages: Pullets do not eat litter instead of feed; less harborage for parasites and rodents; lower moisture levels in house
Disadvantages: Can be slippery until enough manure has built up; not advisable for dirt floor houses; floor can be too cold for chicks less than 4 weeks of age
Note: More attention to floor temperature is needed

WOOD SHAVINGS

Advantages: Common, compostable litter material with good moisture absorbency
Disadvantages: Shavings may splinter, injuring the bird (sawdust is less absorbent than shavings and cakes when wet); cleaner to use for day-old chicks when kiln-dried
Notes: Shavings should be made from soft wood trees; limited availability and expensive in some areas

BARK MULCH/WOOD CHIPS

Advantage: Good moisture holding capacity
Disadvantages: Particles larger than 1 in lead to excessive caking; excessive moisture can cause mold problems
Note: Very similar to wood shavings

STRAW

Advantage: Absorbs more moisture than wood shavings
Disadvantages: More frequent caking than shavings or bark; this can cause foot pad lesions and feather pecking; poor quality straw may increase mold such as aspergillus
Notes: Wheat straw is the most common; barley, Bermuda grass, flax, oat, rye are also used; should be chopped to 1 in or less

RICE HULLS

Advantage: Does not hold water well, most liquids quickly sink to the bottom
Disadvantage: Less moisture holding capacity

Conditioning the Pullet for Egg Production

Pullet conditioning are those management programs used to prepare the pullets for the smooth, low-stress transfer to the laying facility and for the commencement of egg production.

Management Tips for Effective Pullet Conditioning

Facility			
Factor	**Practice**	**Result**	**Tips**
Drinker and feeder systems; elevated water tables	Drinker and feeder type should be matched in the rearing and production facility.	Smoother, low stress transition from rearing to production. After transfer the pullets can better navigate the aviary environment.	The configuration of drinking and feeder lines should be similar in rear and production facilities.
Floor type and litter type	Floor type should be matched in the rearing and production facilities (e.g. slats in rear, slats in the production facility).	Smoother, low stress transition from rearing to production. Avoids misplaced foraging behavior and reduces feather pecking and aggression.	If litter is used, then the litter type (i.e. wood shavings, straw, rice hulls etc.) should be the same in both rearing and production facilities.
Perches	Provide perches in grow. Habituates jumping behavior in pullets.	Improves nesting behavior and reduces floor eggs. Reduces feather pecking and aggression.	Use the same type of perches and configure in the same locations within the rearing and production facilities.
Water tables	Provide water tables for pullets reared on the floor going to aviaries.	Trains birds to jump in a system and to seek out feed, water, and nests.	Put a water table under every water line. Use the same flooring material the birds will move to (wire or plastic).
Lighting Program			
Factor	**Practice**	**Result**	**Tips**
Light intensity	Two weeks prior to transfer, gradually start increasing the light intensity so it matches the layer facility by the time of transfer.	Prepares pullets for transfer to the laying facility and for light stimulation after transfer.	By transfer, the number of light hours and light intensity should be matched with the lights in the production facility.
Time of light stimulation	Provide light stimulation when the pullet flock reaches their target average body weight with 90% uniformity.	Improves flock uniformity. Uniform flocks respond more evenly to light stimulation and higher consumption of Pre-Peak and Peaking diets.	Underweight pullet flocks should delay light stimulation. If the pullet flock has a large spread in hatch ages and/or poor bodyweight uniformity, then light stimulation is based on the oldest hatch date or heaviest birds.
Heat Stress Tolerance - see Managing Heat Stress in Layers at hylinena.com.			
Factor	**Practice**	**Result**	**Tips**
Heat stress tolerance	Exposure of pullets to high environmental temperatures.	Results in production of heat shock proteins which can mitigate future heat stress.	Anticipate rapid increases in environmental temperature to prepare nutrition and management for the flock.

Transfer to the Laying Facility			
Factor	**Practice**	**Result**	**Tips**
Age of transfer	Transfer flocks on time to prevent overcrowding in the rearing facility.	Late transfer may restrict feed, water, and living space, and could result in loss of pullet body condition.	Transfer flocks by 16 weeks to allow time to acclimate to the new laying environment.
Bird Behavior - see Understanding Nesting Behavior, Managing Fully Beaked Flocks at hylinena.com.			
Factor	**Practice**	**Result**	**Tips**
Accustom pullets to noise, color, human presence	Playing music, walking in the flock frequently and changing the color of workers' clothes can help acclimate the birds.	Desensitizes the birds to these stimuli, resulting in less fear responses and behavior problems.	Provide toys and shiny objects in the pullet environment. Make noise while walking in pullet flocks.
Letting birds out of system	Should be done at 5-6 weeks of age. Open bottom tier first. Open both sides to system in each section so the birds have full access to bottom tier. Pick up birds every night until trained and then open top tier and pick up birds every night until trained.	Birds will be trained when small to easily pick up birds and old enough to jump easily back into system.	Have enough people to pickup birds in a hour or two. Training should take 3 to 4 days per tier.
Nutrition			
Factor	**Practice**	**Result**	**Tips**
Feeding schedule	Match the feeding schedules used in rear and the production period.	Smoother, low stress transition from rearing to production. Improves feed consumption in young laying flocks.	Run the feeders 4–5 times per day, more often feedings can minimize the usefulness of feed stimulation. Set the first feed within 1 hour of lights on and the last feed 2 hours before lights off. After 12 weeks of age, ensure the feeders are empty at least once a day.
Feed presentation and particle size	Feed presentation (i.e. mash or pellet) should be the same in rearing / production diets.	Improves feed consumption in young layer flocks.	Manage feeders to avoid accumulation of fine feed particles.
Large particle calcium	Introduce large particle calcium beginning in the Pre-Lay diet, not prior to 15 weeks.	Builds medullary bone in pullet flocks. Early introduction of larger calcium particles will ease the transition to consuming Pre-Peak and Peaking diets.	At the start of lay, have 50% large particle and 50% fine particle calcium source.
Higher fiber in pullet feed	Beginning in the Developer diet, increase the amount of fiber.	Improve digestive tract development. Increases feed intake at commencement of egg production.	Higher fiber diets increase feeding time and reduce feather pecking behavior.
Vaccination Program - see Vaccination Recommendations at hylinena.com.			
Factor	**Practice**	**Result**	**Tips**
Pullet vaccination program	Avoid a stressful vaccination just before transfer.	May result in loss of pullet body condition.	Design vaccination program to minimize the number of times birds are handled.

Transition from Grow to Lay Farm

- Barn, aviary and free-range birds should be transferred to the lay facility a minimum of 14 days before the first egg. Transfer should occur between 15 and 17 weeks of age for the best transition.
- Earlier transfer, but not before 15 weeks of age, makes it easier for birds to adapt to their new laying environment prior to the onset of egg production.
- Light hours of rearing and production facility should be matched at transfer.
- Three days before moving pullets to the laying facility, water-soluble vitamins and electrolytes in the drinking water can be used to relieve stress.
- For multi-level houses, many farms will transfer the pullet farm from the bottom level to the top, then fill the layer house from the top level down. This minimizes bird stress by never having the crew and carts working above a section that has chickens in it.
- Water consumption during the last week on the rearing farm should be noted and compared with water consumption in the laying facility immediately after transfer. The time taken to match the previous level of water consumption and subsequently exceed it will be an indication of how well the birds have adapted to their new environment. Birds should be drinking normally by 6 hours after transfer.
- Keep nipple drinkers lowered after transfer to slightly above the bird's back before raising them to head level for the first week.
- Additional management may be required if there is a mismatch of water systems between pullets and layers, especially if moving from 360° to vertical nipples or from bell drinkers to any kind of nipple.
- When possible, keep temperatures the same or lower than the pullet farm. Cool temperatures (65–70°F) will help stimulate birds to eat.
- While other sections are being housed, take time to walk the birds already in the house to observe behavior and prevent migration.
- When moving between mismatched systems:
  - » Anticipate spending extra time training the birds after transfer (walking, placing birds after dark).
  - » Production may be delayed while birds try to learn the new system.

Transfer birds to the layer facility as quickly as possible, taking the welfare of the birds into account.

Barn Systems (Flat Deck Systems)

- In barn systems with both litter and elevated slat areas, place pullets on slats when moving to the production facility.
- Fill floor houses back to front.
- Place any birds found on the litter after lights out back on the slats for one week.
- Use a blue headlamp for going into the house after lights off.

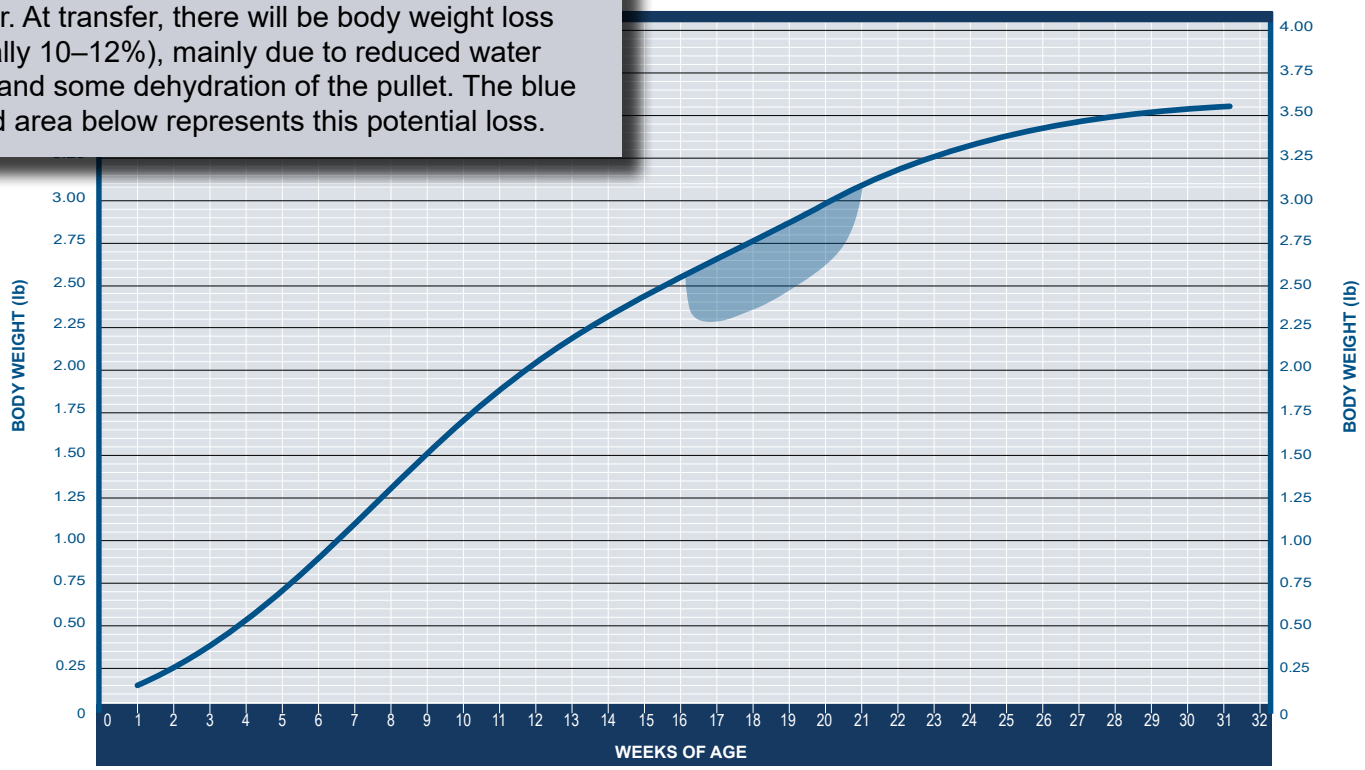
Aviary Systems

- Place birds inside the aviary system when transferring the flock. It is important that all birds are in the aviary system before lights go off at night. This may require manually placing floor birds into the system until they are trained to sleep in the system.
- Place birds inside the level of the aviary system that has both feed and water when transferring the flock.
- Fill the house from back to front and each pen at a time.
- Place any birds found on the litter after lights out back in the system for one week.
- Use a blue headlamp for going into the house after lights off.

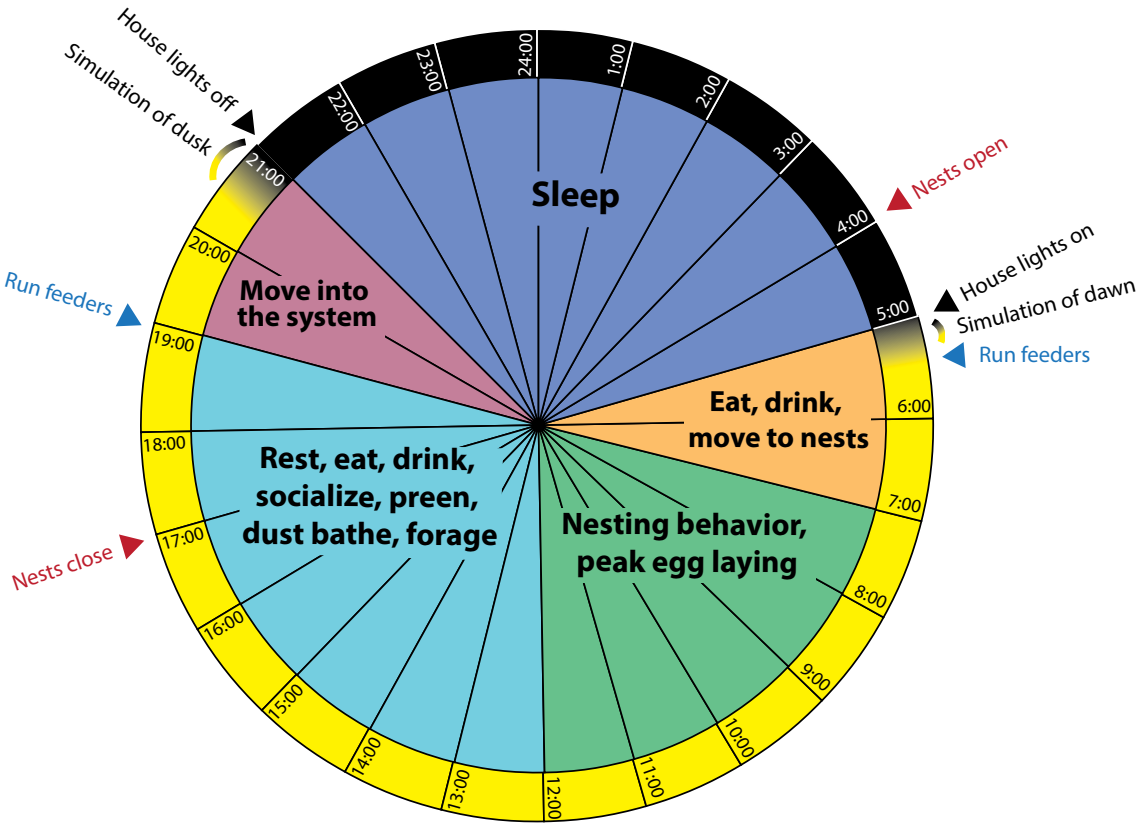
The best aviary layers are those that are raised in an aviary pullet house.

Body Weight Loss in Transit

Weigh prior to transfer and monitor weight loss during transfer. At transfer, there will be body weight loss (normally 10–12%), mainly due to reduced water intake and some dehydration of the pullet. The blue shaded area below represents this potential loss.



Cage-Free Management Wheel



Phase Feeding in Production

Pre-Peak

- Pre-Peak diets are intended for flocks with low feed intake and fed for a limited period from first egg to the beginning of peak production. The nutrient specification of the Pre-Peak diet should be dense enough to allow for lower feed intake and also cater to the increased nutritional needs of the bird entering egg production. Continue to feed the Pre-Peak until feed intake has developed sufficiently to allow transition to the Peak diet.
- Feed a Pre-Peak ration until the flock reaches at least 20 lbs/day consumption or 50–70% hen-day production.
- Pre-Peaking diets are also useful in situations where local conditions may result in reduced feed intake, such as hot climates where feed intake may be depressed.
- Increasing the vitamins and trace mineral inclusion to 30% can be useful to cope with the lower feed intake during the Pre-Peak phase.

Peaking Ration

- Peaking rations need to be formulated according to actual flock feed consumption and egg mass output. Increase vitamin and trace mineral levels in these low intake diets if not already increased during the Pre-Peak phase.
- Begin feeding the Peaking diet at the onset of lay, if a Pre-Peak diet is not given.
- Manure may be wetter the first few weeks of the peak or pre-peak diet due to some birds not in lay yet.
- Ensure that the Peaking diet is in the feeders when first eggs are laid, not in the feed bin.
- Birds will continue to grow during the Peak production period. Inadequate nutrient intake in this period can lead to loss of body weight (or insufficient body weight gain), soft bones, and loss of performance after peak.

Monitor keel bone development during the Peaking period. See Understanding the Role of the Skeleton in Egg Production at hylinena.com.

Phase Feeding during the Egg Production Period

- As the flock progresses through lay, the diet specification should be based on the bird's feed intake and egg mass output. In laying hens, the calcium requirement increases while the phosphorus requirement decreases with age. Maintaining good eggshell quality through adequate provision of minerals is key to successful extended cycle egg production.
- Around 32 weeks of age, the medullary bone is completely formed and filled, and the phosphorus levels can be decreased.

Control of egg size is critical in maintaining eggshell quality in older laying flocks.

Egg Size Management

- Closely monitor egg weight of each flock and make nutritional changes as needed to ensure the target egg weight profile is achieved. If smaller eggs are desired, egg weight should be controlled at an early age.
- Along with management practices, egg weight control is achieved by managing amino acid and energy intake and ensuring that feed intake is not too high.
- Adjust amino acids to maintain the ideal ratio in the diet. Reducing only the methionine or sulfur-containing amino acids is not the best way to control egg weight, since it can lead to poor performance and reduced feather coverage.
- Monitor egg weight—as frequently as possible. Start plans for controlling egg weight when average egg weight is within 1.5 lb/case of target egg weight, starting at 10% hen-day production.
- For more information, see Optimizing Egg Size in Commercial Layers at hylinena.com.

Grit

Grit is given to the flock to increase development of the crop and gizzard. Grit improves gizzard function and helps to grind up ingested forage material and increases the digestibility of nutrients in the feed.

There are two types of grit:

- **Soluble grit**—Soluble grit is added to every poultry diet in the form of limestone or oyster/marine shell. To ensure proper shell formation and to reduce the risk of soft bones, soluble grit should be added to the diet to achieve Hy-Line North America recommended calcium specification levels.
- **Insoluble grit**—Insoluble or flint grit is an indigestible stone that is either added to the diet or picked up while foraging. Pastured birds can receive grit to help them break down grasses, seeds, and insects they consume.

AGE	PARTICLE SIZE OF GRIT	AMOUNT
< 3 Weeks	0.2 mm	0.22 lb/100 birds in feed
6–11 Weeks	3–5 mm	0.44 lb/100 birds in feed
11–16 Weeks	5–6 mm	0.88 lb/100 birds in feed or separate feeders
Layers	6–8 mm	1.54 lb/100 birds per week

For more information regarding feed distribution, feeder types, and other granulometry factors, see Feed Granulometry and the Importance of Feed Particle Size in Layers at hylinena.com.

Feeding Programs for Alternative Systems

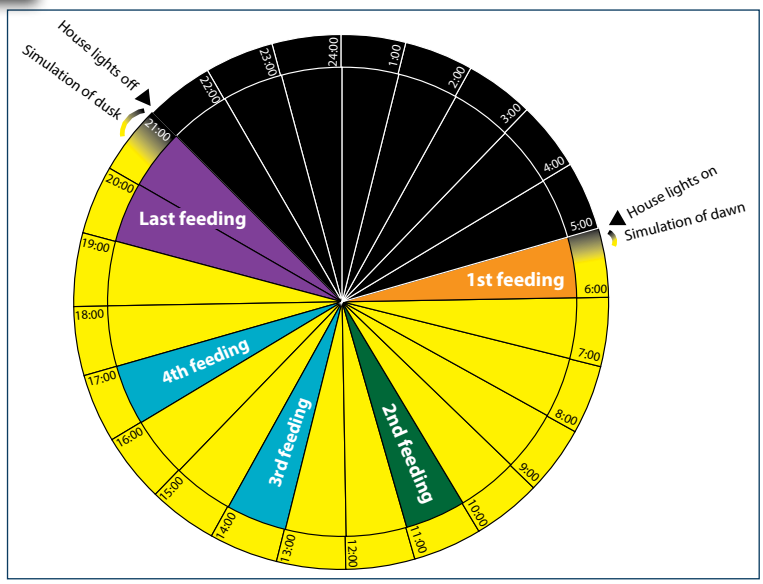
Feeding birds in alternative systems is generally regarded as more challenging than feeding birds in conventional systems. There is additional competition between birds for feeder space, as well as greater fluctuations in facility temperature. Birds in alternative systems generally have higher nutrient requirements than birds in cages or colonies.

- Key points to remember:
  - » Calculate accurate feeding space according to manufacturer recommendations, and manage the house so the hens remain well distributed. Make sure that feeding space is adequate and that the distribution of feeders allows good access by the birds.
  - » Ensure feed is adequately distributed around the entire feeding system quickly to avoid separation of components.
  - » Seasonal changes in temperature can exert a major influence on feed intake, particularly in poorly insulated facilities. The bird's feed intake can change by as much as 6–10 lb/day (per 100) from summer to winter. Ensure birds have good access to feed to allow for increased consumption during cold weather. Seasonal changes in the concentration of nutrients should be considered when intake of the birds falls below requirement levels.
  - » The same feeding schedule used in the rearing facility should be repeated in the laying facility to train feeding behavior. This will encourage higher feed intake during the Pre-Peak and Peak period.
  - » Utilize a calcium boost program by adding extra large particle limestone to the ration every 10–20 weeks throughout lay to help with shell quality and skeletal structures. See Soft-Bone in Caged and Cage-Free Layers at hylinena.com.

BASIC FEEDING PROGRAM FOR LAYERS

Morning Feeding (First feeding)

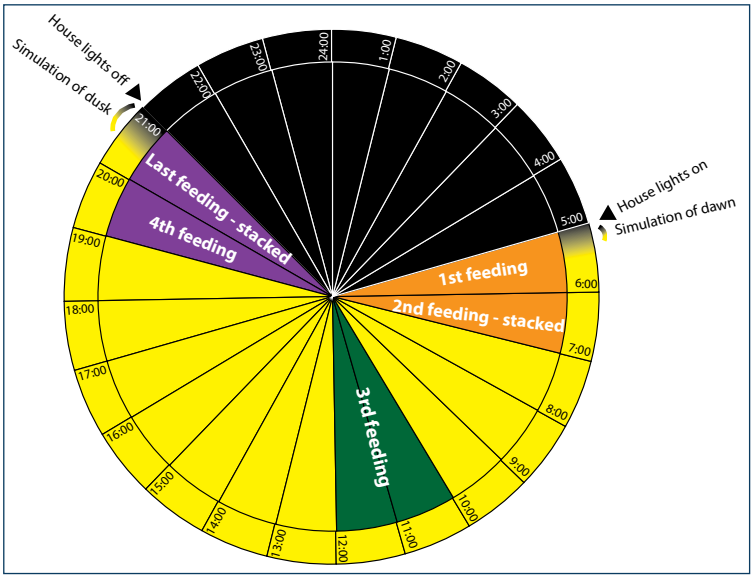
- First feeder run is usually scheduled with lights-on or just after.
- Fresh feed should be available as birds become active and are coming down from resting sites.
- **Stacked morning feeding program** is an optional feeding program that provides two morning feedings one hour apart. Stacked morning feeding provides more feeding opportunities to ensure good nutrient intake in all birds. Stacked morning feeding may reduce floor eggs by reducing crowding in the nest area. The second feed in a stacked feeding schedule attracts early laying dominant hens off the nests to the feeders. This may create more nesting opportunities for other less dominant hens.



Basic feeding program

Second Feeding

- The second feeder run should occur at the end of the peak egg laying period, usually 4–5 hours after lights on. This time can vary between flocks.
- This feeding is important after the 4–5 hour gap following the morning feeding. At this time, try to have the flock eat as much of the fine particles as possible. The trough/pans should be emptied once a day and this is the ideal time.



Stacked feeding program

Afternoon Feedings

- One to two afternoon feedings can be scheduled depending on the type of feeding system, climate, flock performance, body weight, and feed accumulation in the trough/pans.
- During periods of heat stress, afternoon feedings can be adjusted or removed to avoid birds eating during the hottest time of the day.
- Typically, the flock will consume 60% of the daily total feed in the afternoon.

Last Feeding

- The last feeding is typically 1.5–2 hours before lights off. Last feeding should coincide with the closing of nests.
- Last feeding is critical to ensure good nutrient supply for eggshell formation overnight.
- **Stacked afternoon feeding program** (two feeder runs one hour apart) is an optional program to encourage feed consumption before lights go off. Stacked feedings provide more feeding opportunities to more hens.

Good Lighting Practices

The key to cage-free lighting is consistency and flexibility.

- Have each level or area on its own timer and dimmer to allow for flexibility in controlling light hours and intensity.
- Sunrise and sunset times are included in the total light hours.
- Keep light bulbs and covers clean to prevent loss of light intensity.
- Shiny or white surfaces reflect light and contribute to more uniform light distribution.
- Take local conditions into account which may require adaptations of lighting programs.
- Light hours of rearing and production facilities should be matched prior to transfer.
- Light stimulation period should extend into the peaking period (achieve 16 hours of light by approximately 25–28 weeks).
- Light intensity should gradually increase for the 2 weeks before flock is transferred to the laying facility (but not prior to 15 weeks of age). Final rearing facility light intensity should match the production facility light intensity.
- Light intensity should be measured in several places to understand the lighting environment:
  - » Aisle at bird height
  - » First level perch
  - » First level feed
  - » First level water
  - » In front of nest
  - » Repeat if system has more than one level
- Light intensity can be maintained or reduced to 1–1.5 fc after peak to help with good behavior and feather cover.
- Free range flocks should use lighting programs designed for open housing. It is important that lights are on when birds are returning from pasture. Birds will not return to a dark facility.
- For human caretakers, lights may be turned up when walking then turned back down after the flock inspection is finished. If lights have a heavy blue or red spectrum, white headlamps may be necessary to see during inspection.

Light Spectrum

- All laying hens need sufficient red spectrum to achieve optimal performance.
- The ideal warm color temperature is 2700–3000K for laying hens.
- New LED lights may show a lower color temperature on a spectrometer due to more emphasis on red diodes.
- Cool lights (5000–6000K) should be used under the system to help prevent floor eggs.

Lighting for Aviary Flocks

Simulating Sunrise and Sunset

- Simulation of sunrise and sunset using sequential lighting is used to move birds within the aviary system. Sunrise lighting moves birds through the aviary system for nesting. Sunset lighting moves birds into the system prior to lights off to encourage roosting in the system at night.
- 30–45 minutes before the scheduled time for facility lights to turn off, turn off the lights at the floor level. 15 minutes later, turn lights off in the aisle, then the in-system lights. This simulation of sunset within the facility brings the birds up into the system to sleep on the upper roosting level.

Tube lights ensure even distribution of light, especially in aisles or systems less than 8 ft tall. Under system lights should always be tube or string bulbs.

- In the morning, this lighting sequence is reversed to bring birds down from the upper level to nests, feed and water in no more than 5–10 minutes.

Lighting for Barn Houses

Light step up and stimulation

- Stimulate flock based on body weight and uniformity.
- There are many theories and programs for light step up that are based on external light, system, and variety.
- For stimulation, add 1–2 hours of light to the constant light. If the constant light is 11 hours or longer, 1 hour is sufficient. If the constant light is 10 hours, a 1 or 2 hour jump is acceptable.
- Some options for step up include:
  - » One hour jumps for two weeks in a row, then 30 minutes until 15 or 16 hours
  - » One hour jump, then 30 minute increases until 15 or 16 hours
  - » One hour a week until 14 weeks, then 30 minutes until 15 or 16 hours
  - » Morning or night step up
- Light increases are variable based for brown-out and open houses and must take the outside light into consideration.

- Have at least two zones of light—one for the litter or outside area, and one for the slat/nest area.
- Ensure the light intensity is even to a little higher over the litter area to help with nest compliance.
- Sunrise is less important in barn houses; lights can come on fully.
- Sunset should start with the outer lights being dimmed down first over 10–15 minutes, then the slat/nest lights should be dimmed to dark over 10–15 minutes.

- Generally add light in the evening, but save 1 hour of increase for once the flock reaches 50% production to add in the morning.
- Stepping up to 15 hours then holding the last hour for 50–70 weeks is a possibility. When adding light, add 30 minutes two weeks in a row.

Air

- Production facility should be at 64–77°F and 40–60% humidity.
- The general rule for determining required fan capacity—1.0–1.5 ft^3/minute/lb body weight.
- Positive pressure facilities where exhaust air is exiting through vents and popholes prevents cold damp air in winter from entering the facility and causing wet litter.
- Allowable levels of noxious gases at floor level in the facility are based on local regulations; however, the minimum standards are: ammonia (NH_3): < 25 ppm; carbon dioxide (CO_2): < 5000 ppm; carbon monoxide (CO): < 50 ppm (measured over 8 hours)

AMBIENT TEMP. (°F)	Air Movement (ft^3/minute per 1000 birds)
90	4500–1500
70	2500–3000
50	1500–2000
32	500–750
10	350–500
-10	350–400

Courtesy of Dr. Hongwei Xin

- When walking houses, constantly check for hot or cold spots, which can encourage bird gathering.
- In northern climates, purge fans are helpful for exchanging fresh air without losing house temperature.

Ventilation is essential to:

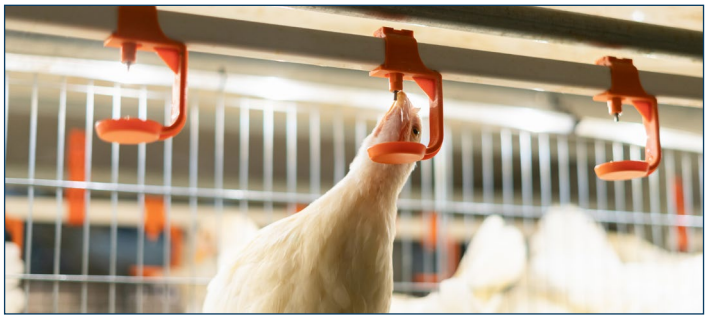
- » Provide each bird with adequate oxygen
- » Remove moisture from facility
- » Remove carbon dioxide produced by birds
- » Remove dust particles
- » Dilute aerosolized pathogenic organisms

Water

- Good quality water must be available to birds at all times.
- Water and feed consumption are directly related—when birds drink less, they consume less feed and production quickly declines.

As a general rule, healthy birds will consume 1.5–2.0 times more water than feed. This ratio will increase in high ambient temperatures.

- Drinking water should be tested periodically (at least once a year) for quality and cleanliness by taking two samples: One from the water source prior to entering the poultry facility and a second sample from the end of the water line. Testing water from the source is a measure of bacterial load coming into the farm and should be managed by addressing the water source directly. Testing at the end of the line and comparing to the water source value is a measure of how effective the line cleaning has been and the current status of the water birds are drinking.
- When collecting a well water sample, let the water run for 2 minutes prior to collecting the sample. Water samples should be kept below 50°F and submitted to the lab in less than 24 hours.
- Surface water requires more frequent testing, as it is more affected by season and rainfall patterns.



Nipple drinkers should be adjusted to the proper height, allowing easy intake of water.

- Closed wells taking water from aquifers or deep artesian basins will be more consistent in water quality but are generally higher in dissolved mineral content.
- The presence of coliform bacteria is an indicator that the water source has been contaminated with animal or human waste.
- Some water sources contain high levels of dissolved minerals such as calcium, sodium and magnesium. When this occurs, amounts of these minerals in water have to be considered when formulating feed.
- Preferable drinking water temperature for layers is 59–68°F.
- Ideal water pH is 5–7 to promote good water sanitation, increase feed consumption, and improve upper gastrointestinal health.
- Poor water quality can have a significant impact on intestinal health which will lead to poor utilization of nutrients in feed.

Nest Training

Preventing Floor Eggs in Aviary/Barn Systems

- Rear pullets in compatible aviary or barn systems that best match the production system.
- Train pullets to jump early, by giving access to the aviary system by 3–6 weeks of age. In floor (barn) operations, provide perches or elevated slats.
- Light should be evenly distributed within the facility, avoiding areas of shadows. Use bulbs with good light dispersion to eliminate dark spots under feeders and in corners.
- Under system lights should be 15–20% brighter than the rest of the house lights.
- Lighting in the facility should keep the entrance to the nests well lit, but the inside of nests dark.
- Eliminate corners, where hens like to lay eggs.
- The use of electric deterrent wires is effective if allowed by the certifying agency.

For more information, see Understanding Nesting Behavior at hylinena.com.

It is important to train newly housed birds to roost in the aviary system and not on the litter.

Open nest boxes and pull open a few curtains on nests after transfer for birds to explore and become accustomed to nests. Slats can be inclined to the nest opening to make access easier.

Nest Training

- In aviary systems, walk the birds in the evening to prevent birds from sleeping on the floor.
- Manually place floor birds in the system until they are trained to sleep in the system.
- In barn systems having automatic colony nests, open nest boxes an hour before first light (either natural or according to the lighting program, whichever is first).
- Lift a few curtains to encourage nest exploration from the first day after transfer.
- Frequently walk through the barn in the morning for the first 8 weeks after birds are moved to the production barn. While walking, move birds away from resting areas, out of corners and toward nests. If you notice that walking is drawing the birds out of the nest, reevaluate this practice.
- During the first week of production, leave a few eggs in the nest to encourage hens to use nests.
- For W-36 birds, wait for 2 weeks before starting the walking routine to allow birds to acclimate to the system.
- Do not give birds access to the outside range until they are consistently using the nests to lay eggs (if allowed by the certifying agency).
- Adding light in both the morning and evening according to the stimulation plan can help spread out the laying time as hens come into production.

Collect floor eggs frequently. Floor egg collection must be done more frequently at the beginning of lay. Birds will lay eggs on the floor if other eggs are present. Be sure all floor eggs are removed before lights go out at night.

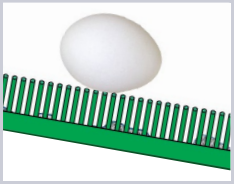
Nests

- Ensure there is sufficient nest space (6 birds per nest or 12 birds per ft^2 in colony nests) and that hens are using all the nests. Partition the facility if it appears only a few nests are being used.
- Have a ramp or perching area at the entrance of the nest to allow for easy access by the birds.
- Remove any obstruction to accessing the nest. Feed lines should not be directly in front of nests.

Nests should have a staging area at the entrance to allow hens to examine the nests with easy access and sufficient space for movement.

- In aviary systems with nest boxes within the system, position the water lines in front of nests and in lower levels but so as not to create a barrier for movement into the nest.
- Swinging drinker lines can discourage bird from going towards the nests, secure the drinkers accordingly.
- Do not place the water lines on levels above the nest boxes.
- Nests should be dark (< 0.25 footcandles), secluded, warm, and free of air drafts.
- If the nests do have lighting, turn nest lights on 1 hour before barn lights are turned on to encourage nest investigation. Turn nest lights off 1 hour after barn lights come on. Rope lights work well in this application.
- End nest light usage after 26 weeks of age.
- Close nests around 4 hours before lights out. Do not allow birds to sleep in nests.
- Replace worn nest floor mats.

A good nest floor mat:



- Provides comfort for nesting hen
- Cushions egg to prevent damage
- Keeps egg clean
- Separates dirt and feathers from egg surfaces
- Allows egg to roll easily to egg belt

Facility Management

- Use < 2 in litter depth. Litter deeper than 2 in may result in brooding behavior in hens. Remove excess litter if needed.
- Wet or caked litter should be removed immediately.
- Flocks housed in all-slat production facilities should also be grown on slat or wire floors.
- Solid perches above water and feed lines are preferred.
- Schedule feed lines to run when the first light comes on and again 4 to 5 hours later (around mid-day) after most of the eggs have been laid.
- Program the lights to encourage birds to sleep on the slatted area or within the aviary system.
- Ensure good ventilation throughout the facility. Cooler temperatures make the flock more active, while warmer temperatures make them more sedentary.

Ramps make elevation changes easier and reduce crowding in front of the nests. Use ramps when the elevation change is greater than 3 ft.

Drinker lines should not obstruct access to the nest.

Factors Affecting the Incidence of Floor Eggs	
Facility Design	• Hens' movement to nests is blocked by water lines, feeders, or enrichments • Litter depth • Elevation changes not properly ramped
Nests	• Insufficient number of suitable nesting sites • Nests located in areas with more mechanical noise or vibration • Worn nest floor mats, making nests uncomfortable • Dirty or malodorous nests (this can occur when nests are not closed at night or are soiled with egg contents) • Interior of nest too bright
Environment	• Overcrowding of birds, blocking movement toward nests • Uneven ventilation, causing nests to be too cold and drafty; in summer, uneven ventilation may cause some nests to be too hot with stale air • Uneven light distribution • Heat stress • Stray voltage (new construction, recent electrical repairs)
Feed Management	• Avoid running feeders during peak nesting time which may attract hens away from nests
Bird Health	• Leg problems from infections (*Staphlyococcus*, *Enterococcus*, *Mycoplasma synoviae*) • Leg injections from vaccination • Injuries during handling, transfer or within the aviary system • Nests infested with insects (red mites, northern fowl mites, fleas, bed bugs) • Nests infested with rodents

Behavioral Issues

PILING

Birds may pile without a discernible cause, resulting in suffocation. Identifying time periods when birds tend to gather or pile can provide important clues to identify the reason for piling. Walking in the flock during these times may prevent piling and smothering.

Potential causes of piling:

- Panic in the flock, caused by a flight response to a predator or wild bird in the house, or rodents.
- Hot and poorly ventilated areas within the facility environment.
- Sunlight shining directly into the facility creating bright spots on the floor.
- The search for a nesting area.
- High light intensity or sudden changes in the lighting program.
- Flickering of the lights for any reason, such as a generator test.
- Human or other activity that attracts the birds to gather in one location.

If birds are overcrowding in corner nest boxes, adding false walls or partitions (perpendicular to nests and spaced every 15–25 ft) may reduce this behavior.

Management steps to prevent piling:

- Round off corners to prevent birds from congregating there.
- Install partitions to reduce piling in some nest boxes.
- Playing music in the facility may keep birds calm and less reactive to sounds, this is good practice to begin from the rearing phase.
- An afternoon feeding before lights go out will spread the birds out in the facility.

FEATHER PECKING

Good feather cover is an important welfare trait in layer flocks. Feather cover protects the skin from injury and direct sunlight. Good feather cover provides insulation of the body from cold and improves feed efficiency.

Birds have a social hierarchy called the pecking order. Some pecking is normal behavior to establish a stable social structure. In their natural environment, birds spend a significant portion of the day foraging for food. Environments that limit foraging behavior may result in feather pecking. In extreme cases, cannibalism of other birds can occur. Feather pecking is managed with light intensity (maintained or reduced to 1–1.5 fc after peak) and beak treatment, which attenuate, but do not address the cause of the behavior.

Tips for Preventing Excessive Feather Pecking

- Prevention measures taken during the rearing and early production periods are more effective than in older flocks already exhibiting excessive feather pecking behavior.
- Match rearing and production facility environments as closely as possible. Provide sufficient perch space in both. In order to prevent vent pecking, avoid perches which present the vent at bird eye-level.
- Provide the recommended levels of light intensity in the facility. In flocks exhibiting excessive feather pecking behavior, reduce light intensity to calm the flock.
- Ensure that nests are dark (< 0.25 footcandles).
- Reduce bird density, if possible. Reduce bird group size with the use of partitions.
- Minimize heat stress during the summer months. See Understanding Heat Stress in Layers at hylinena.com.
- Provide pecking blocks or objects to help blunt the beak in addition to occupy the bird's time.
- Enrich the facility environment by adding bales of hay or alfalfa on the floor to encourage foraging, or add attractions like string or rope, plastic bottles or other toys to occupy birds' attention.
- Quickly remove injured/dead birds from the flock.
- Creating a hospital pen for injured, sick, or persecuted hens can help reduce the overall aggressiveness in the flock.
- Keep facilities in good repair, eliminating loose wires, sharp edges and areas where birds can be caught.

Factors Affecting the Incidence of Feather Pecking

Nutritional Deficiencies

- Low protein and amino acid imbalance, particularly methionine and arginine
- Low mineral levels, i.e. calcium, sodium

Diet Characteristics

- Low fiber, fine textured or pelleted feed, and restricted feeding practices reduce the bird's feeding time
- Sudden changes in feed ingredients or feed particle size
- Pecking around the preen gland (near the tail) may indicate low salt in the diet or, in pullets 3–6 weeks of age, might be an indication of infectious bursal disease

Environmental Stressors

- Loud noises
- Heat stress
- High light intensity
- Litter substrates, such as fine-particle wood shavings or sawdust
- Large flock sizes have a less stabile social structure
- High stocking density, leading to overcrowding of the bird's floor, feeder, water, and nest space
- Mite or other ectoparasite infestations, even in moderate numbers

Flock Characteristics

- Poor beak treatment
- Poor uniformity

Hens with poor feather cover.

Management of Free-Range Flocks

Pophole/Outdoor Access Management

- Refer to certifying agency for pophole management and design.
- Popholes should be evenly distributed along the outside of the facility and in sufficient numbers to prevent traffic jams as birds move in and out of the facility. Preferably have popholes on two sides of the facility.
- Close popholes during inclement weather, if permitted by certifying agency.
- Begin opening popholes to give laying hens access to the outside after they are consistently using the nests.
- On days with strong wind, only open the popholes on the side of the facility opposite the wind to prevent stirring of dust in the facility, if permitted by certifying agency.
- Introducing birds to pasture too quickly can disturb their eating behavior and reduce their nutrient intake. It is best to introduce the birds to pasture gradually by increasing the amount of time the popholes are open. Transition this process over a week, starting in the afternoon and slowly adding hours onto the beginning.
- Close popholes gradually as birds are returning to the facility from outside. Popholes should close at dusk or when artificial lights are to be turned off.
- Once the flock is given access to pasture, routinely open popholes to avoid bird stress.
- Slats/mesh, a concrete apron, or large stones should be placed outside of pophole openings to prevent muddy areas.

If birds must be retained inside due to inclement weather or disease threat, please follow 8 Tips for Keeping Ranging Birds Indoors at hylinena.com.

Good maintenance of the area around popholes keeps the area dry and dirt out of the facility.

Popholes are opened to give birds access to pasture as soon as possible after transfer.

Pasture Management

- The stocking density in pasture systems will be based on local regulations and certifying agency, soil type and diet.
- Ensure the pasture has good drainage—no puddles for birds to access dirty water.
- The pasture surrounding the laying facility can be divided into paddocks, which the birds use for periods of 6–8 weeks before rotating to a new paddock. Rotation of paddocks provides time to regrow grass in bird-worn areas. Resting paddocks may also reduce the parasite load in the soil. If a rotational pasture system is used, stocking density can often be higher.
- Birds tend to use pasture areas near the facility more than areas away from the facility. Take the time to spread birds over all usable pasture areas.
- Pastures can be maintained in good condition by the judicious use of chain harrows. Harrowing breaks up the soil, restores soil structure and improves drainage. Harrowing the soil may also decrease parasite eggs in the area.
- Use more clover with grass in bird-worn areas around popholes and areas near the facility. Clover is more durable than grasses when faced with trampling by birds.
- Placing shelters in the pasture area encourages birds to move further from the facility and utilize more of the pasture area. Shelters also provide shade and protection from rain and wind.
- Pasture shelters, when used as the only housing, should be able to shelter all the birds at one time, and provide feed and water.
- Trees, shrubs and shelters in the pasture area provide cover for birds to feel safe as they move away from the facility. Chickens are naturally fearful of exposed areas.

- Between flocks, revegetate/seed the pastures with emphasis on heavily used areas near the facility and around popholes.
- Bird pastures can be dual purposed as orchards, woodlands and for livestock grazing, although consideration should be given to biosecurity and disease risk when introducing other animals into the pasture.
- Pasture enrichments like fallen trees for perching and covered sand boxes for dust bathing can be considered.
- Some plants are poisonous to birds (i.e. hemlock, monkshood, privet, yew, nightshade, horseradish) and the pasture should be checked for dangerous species. Other plants may give an off-flavor to the eggs and should be removed from paddocks.




Potential predators include mammals (badgers, dogs, foxes, coyotes), large reptiles (iguanas, snakes), and raptors (hawks, owls). *Photos: "Feral dog," courtesy Heather Paul, licensed under CC BY-ND 2.0. "Gopher Snake," courtesy Eric Sonstroem, licensed under CC BY-SA 2.0. "Fox," courtesy Airwolfhound, licensed under CC BY-SA 2.0. "Red-Tailed Hawk," courtesy Fryderyk Supinski, licensed under CC BY-SA 2.0.*

Predators

Free range layers are attractive to predators. Predators will often kill or injure large numbers of birds—far more than they are able to consume. Predator attacks on the birds cause panic and hysteria in the flock. This can lead to piling (smothering) and trigger outbreaks of feather pecking.

Tips for Dealing with Predators:

- Permanent fencing should be at least 3 ft high, with a 12 in overhang to the outside to prevent predators from climbing over. The fence mesh should be small enough to exclude predators.
- Bury fencing 8 in into to the ground to prevent predators from digging under the fence.
- Overhead netting or wires spaced 1–2 ft apart can be used, if possible, to prevent wild bird predators from attacking, and prevents contact with other wild birds that might transmit disease.
- Keep pastures mowed to prevent predators from approaching the birds unaware.
- Old CDs or other reflective materials can be hung in paddocks to deter predatory birds.
- Use live traps outside the fence when predators are seen.

Electric Deterrent Fencing to Exclude Predators

- Flexible electrified fencing will generally provide satisfactory levels of protection against most predators.
- Two electric wires should be used on the fence: one in the middle of the fence and the other just off the ground.
- Electric deterrent wires should be 8 in above the ground and 2 ft away from the permanent fence. A non-charged grounding wire placed between the ground and the electrified deterrent wire will help direct predators into the electrified wire.
- The fencing and power unit must be well maintained in order to continue to work effectively.
- Grass underneath the fence must be kept cut or sprayed with herbicide to prevent shorting of the electrical system, and regular checks should be made on the connections between sections of fence and the transformer.

Disease Control

A flock can only perform up to its genetic potential when disease influence is minimized. Diseases of economic importance vary between locations, but in every case the challenge is to identify and control those diseases.

Farm Biosecurity

- Biosecurity is the best method of avoiding diseases. A good biosecurity program identifies and controls the most likely ways that pathogens could enter the farm.
- The most biosecure system is all-in/all-out style of flock management, with complete cleaning and disinfection between flocks.
- Downtime between flocks reduces the pathogen load of the facility.

For more information, see Pre-Housing Cleaning Checklist at hylinena.com.

People and Equipment

- Allow only essential visitors onto the farm; provide a questionnaire to ensure biosecurity compliance.
- Visits to the farm should be documented in a logbook.
- When possible, all workers and visitors should shower at the farm, or at least change into clean farm clothes, hairnet, and footwear before entering the biosecure area. Site-specific clothing and facility-specific footwear is advised.
- Visitor and employee vehicles must park outside the biosecure area.
- Enforce compliance of biosecurity program for any outisde crews and equipment used for vaccination, moving birds, beak trimming, or manure removal.
- Outside equipment and materials must be disinfected before entering the farm and stored in insect and rodent-proof storage.

Farm Design and Construction

- Facilities should be designed to prevent exposure to wild birds, insects, and rodents.
- Use a perimeter fence around the farm to exclude livestock and traffic, and to mark the perimeter buffer area.
- Use dedicated vehicles inside the clean area.
- Use footbaths or shoe changes with Danish-style entry to designate the line of separation at each facility.
- Walls, ceiling and floor should be constructed with smooth, impermeable materials whenever possible.
- Build in drains for easy washing.
- Use gravel or concrete outside the buildings to help control rodents.

Dead Bird Disposal

- Quickly and properly dispose of dead chickens daily.
- Dispose of dead birds by rendering, incineration, or composting.

Rodents

- Rodents are known carriers of disease and a common reason for recontamination of a cleaned and disinfected poultry facility. They are also responsible for house-to-house and flock-to-flock spread of disease on a farm.
- The farm should be free of debris, tall grass, and other places that could harbor rodents.
- The perimeter of each facility should have a 3 ft wide area of crushed rock or concrete to prevent rodents from burrowing into the facility.
- Feed and eggs should be stored in rodent-proof areas and any spillages cleaned up immediately.
- Bait stations should be placed around the perimeter of the facility as well as throughout the facility and maintained with fresh rodenticide.
- Fill any gaps in the entrances, walls and roof which could provide rodent access into the poultry facility.

For more information, see Code of Practice for Prevention of Rodent Infestation at hylinena.com.

Vertically Transmitted Diseases

- Some diseases are known to be transmitted from infected breeders to progeny.
- Disease-free breeders are the first step in control of these diseases for commercial layers.
- All breeders directly under Hy-Line North America's control are free of lymphoid leukosis, *Mycoplasma gallisepticum*, *Mycoplasma synoviae*, *Salmonella* Pullorum, *Salmonella* Gallinarum, and *Salmonella* Enteritidis.
- Due to the possibility of horizontal transmission of these diseases, later generations may not remain free.
- It is the responsibility of commercial flock owners to prevent horizontal transmission of these diseases.

Vaccination Programming

For information on vaccination programs, see Vaccination Recommendations at hylinena.com.

Biosecurity Sign

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Always consult hylinena.com for the latest performance, nutrition, and management information.

WWW.HYLINENA.COM

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HY-LINE EGGCEL | BODY WEIGHT UNIFORMITY CALCULATOR

TECHNICAL UPDATES

DISEASES

AVIAN UROLITHIASIS (VISCERAL GOUT)
COLIBACILLOSIS IN LAYERS
EGG DROP SYNDROME (EDS)
FATTY LIVER HEMORRHAGIC SYNDROME (FLHS)
FOCAL DUODENAL NECROSIS (FDN)
FOWL POX IN LAYERS
INFECTIOUS BURSAL DISEASE (IBD, GUMBORO)
INFECTIOUS LARYNGOTRACHEITIS (ILT)
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