

An Introduction to Chicken Production

**A brief insight into the modern
chicken and egg industries**



**by Valerie Brewer
National Chicken Council
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The Integrated Chicken Industry

My, how far we have come! It is hard to imagine that just over 100 years ago, the only chicken for people to eat was found in the backyard. That's right, in their own backyard! Chicken at that time was considered dual purpose, meaning that the birds were used for eggs, primarily, and maybe the meat, but only on special occasions. By the beginning of the twentieth century, a few farmers had begun to sell some of their chickens for meat, thus beginning the revolution that has become the modern vertically integrated poultry industry.

“Vertical integration” has taken much of the guesswork out of poultry production. It has made it possible for the poultry industry to become more efficient, while also allowing for the production of a safer, high-quality product. When we look at how far the chicken industry has come in such a short time, it is easy to see how chicken has become the most consumed meat in the United States, with a bright outlook for the future.

One might ask, “What exactly does vertical integration mean?” As far as the chicken industry is concerned, it means that all of the aspects of production are operated by, or affiliated with, the chicken company. The hatcheries, feed mills, processing plants, and the birds themselves are all owned by the chicken company.

The exception to this rule is the farms on which the chickens are raised. About ninety percent of the chickens are grown on privately owned farms that have contracts with the integrated companies. Another nine and a half percent are produced on company-owned farms. Only one half of one percent of chickens raised for consumption are grown on farms unaffiliated with a larger company.

The chicken company is called an integrator. The integrator provides the farmer with birds, feed, and a market for the birds once they have reached the appropriate age. Before the integrator made all these aspects of production part of one company, it was up to the farmer to find his or her own birds and feed. Furthermore, farmers had no guarantee there would be anywhere to sell the birds once they reached market age. It is obvious that this would have been a difficult situation for farmers who depended on poultry production as part of their livelihood.

Vertical integration first began in the 1940s, when entrepreneurs began to combine different aspects of production. First, the hatcheries were called on to begin coordinating the production cycle; soon feed mills were getting involved, and it was the mills that quickly became the driving force in production and processing.

The way this worked is that the hatchery would provide the chicks, and the mill would provide the feed, based on a note obligating the farmer to pay for the chicks and feed after he had sold the flock. This type of credit arrangement is very typical in agriculture. Hatcheries and feed mills typically had better access to money than individual farmers did, and this is why they became the nucleus of larger operations.

The industry continued on a steady growth curve, and by the 1970s the broiler chicken industry had evolved into the fully integrated industry we see today. About forty integrated companies work with more than 30,000 independent farm families to produce broiler chickens for customers in the United States and around the world.

General Definitions

A number of terms are important in the poultry industry. Some of these are:

Hen – Adult female bird.

Rooster – Adult male chicken.

Chick – Newly hatched or very young bird.

Tom – Male turkey.

Poult – Adolescent turkey.

Pullet – Female bird under 1 year old, usually up to 7 months, that has not yet begun to lay eggs.

RTC – “Ready to cook” – a bird that has been processed and is ready to be prepared for consumption

Classes of meat-type chickens

A number of different terms are used to the chickens produced by the broiler industry. These include:

Broiler – A young chicken, either male or female, grown for its tender meat.

Poussin – A chicken less than 24 days of age and weighing 1 lb or less.

Cornish Game Hen – Approximately 2 lbs ready-to-cook (RTC), less than 30 days of age.

Fastfood Size Broiler – 2 lb 4 oz. – 3 lb 2 oz. (RTC), less than 42 days of age, usually cut-up, without necks and giblets, may have tail and leaf fat removed.

3's and Up – 3 – 4 ³/₄ lb (RTC), 40 – 50 days of age, usually with neck and giblets, used for retail grocery: whole, cut-up, and parts. Typical retail size.

Heavy Young Broiler Roaster – 6 – 8 lb (RTC), less than 10 weeks of age, sold fresh or frozen through retail grocery, both whole and parts. Typical “roaster.”

Broilers for De-Boning – 5 – 9 lb, usually 47 – 60 days of age. Deboned for nuggets, patties, strips, and similar boneless products; most often sold without neck and giblets.

Capon -- Surgically desexed male broiler weighing 7 – 9 lb, about 14 to 15 weeks of age. Once common, capons are now seen only as a specialty item.

Heavy Hens – Usually 5 – 5½ lb, about 15 months of age, spent breeder hens that are no longer commercially productive for laying hatching eggs. The meat is flavorful but chewy and is used for cooked, diced, or pulled meat.

Stewing Hens – Broiler breeder hens that are now longer needed to produce eggs. The meat is flavorful but not as tender as young birds and is used in soup or stew.

Products of the industry

The industry produces a vast range of products. Several product areas stand out:

Fresh retail: Fresh (uncooked) chicken for people to take home and cook. Think of all those chicken parts in foam trays with plastic wrapping.

Convenience: Not much time to cook? No problem! Industry offers all kinds of products that save time in food preparation. Nuggets, patties, boneless strips, and many other “further processed” and “value added” products save time for consumers.

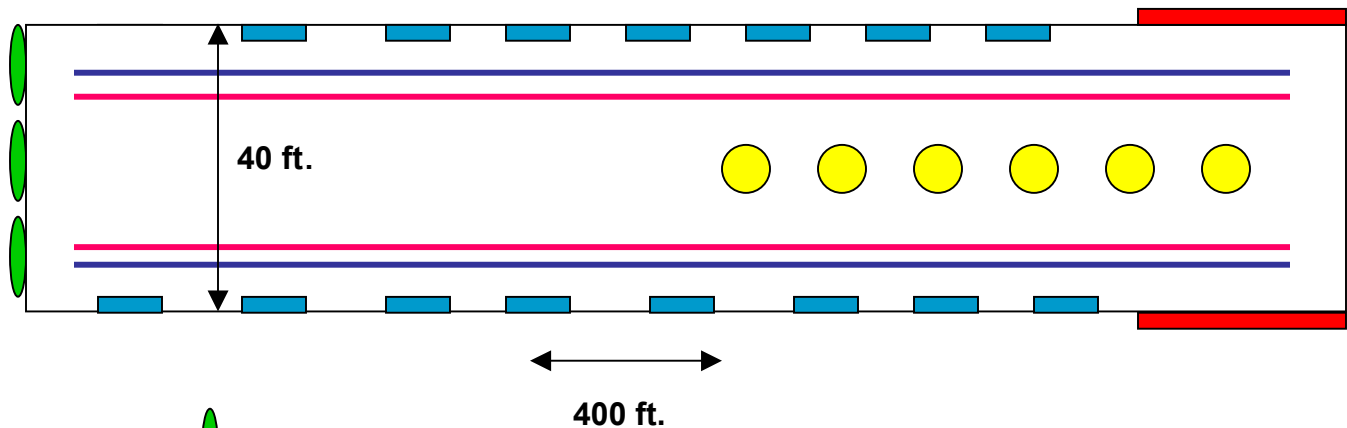
Quick service and casual dining: Fried chicken, chicken fingers, chicken strips, chicken sandwiches, Buffalo wings -- chicken has a huge role in the menus





at fast-food and casual dining restaurants and has a growing presence in fine dining. The single most popular chicken item in foodservice? Caesar salad with chicken.

Broiler and Egg Production

Broiler housing

Broilers are raised in specialized building known as “growout houses.” In the diagram below, the broiler house is 400 ft long and 40 ft wide; however, broiler houses can be as large as 600 ft long and 65 ft wide. It is open inside and the chickens can roam the entire space. ***Broilers are not kept in cages.*** Automated systems are used for heating, ventilation, water and feed. Here is a schematic diagram of a typical house:



-  at the end of the house represent tunnel ventilation fans.
-  represent the air inlets. They run the entire length of the house.
-  are the cool cells which are located at the opposite end of the house from the tunnel fans; they are used for additional cooling, through moisture being drawn into the house by the fans.
-  represent radiant heaters in half of the house, used to keep very young chicks warm.
- The outer bars that run the length of the house represent the feed lines.
- The inner bars represent the water lines.

Older poultry houses had “curtain walls” on the sides that could be rolled up to allow ventilation through a finely meshed screen. New poultry houses that are being built today have solid side walls and utilize tunnel ventilation. This is a system in which air is pulled in through the air inlets and the cool cells by the

tunnel fans. As the air travels the length of the house, it removes heat and excess moisture. The house stays cooler and more comfortable than in the older structures.

In the broiler house, feed and water are delivered to the chickens via automated systems. On the water lines, the number of nipples varies with the capacity of the house. One nipple per nine birds is generally provided. These nipples are a closed form of drinking line; having a closed form reduces the amount of spilled water, resulting in drier litter and improved flock health.



Illustration 1: Typical cool cell seen for broiler houses

The feed lines deliver feed to trays, where the chickens can eat it. These trays come in many shapes and sizes. A rough estimate would be around 80 birds per feeder. However, as with the water lines, the number of feeding trays will vary depending on the number of birds, the period of growth, and the brand of feeder being used.

Illustration 2: Feed and water lines in the broiler house: In the foreground are examples of feeder trays. Guards are placed around the top of trays to keep the birds out so that the feed will stay as clean as possible. In the background, are nipple drinkers that provide water to the birds, which they obtain by touching the nipple with their beaks.



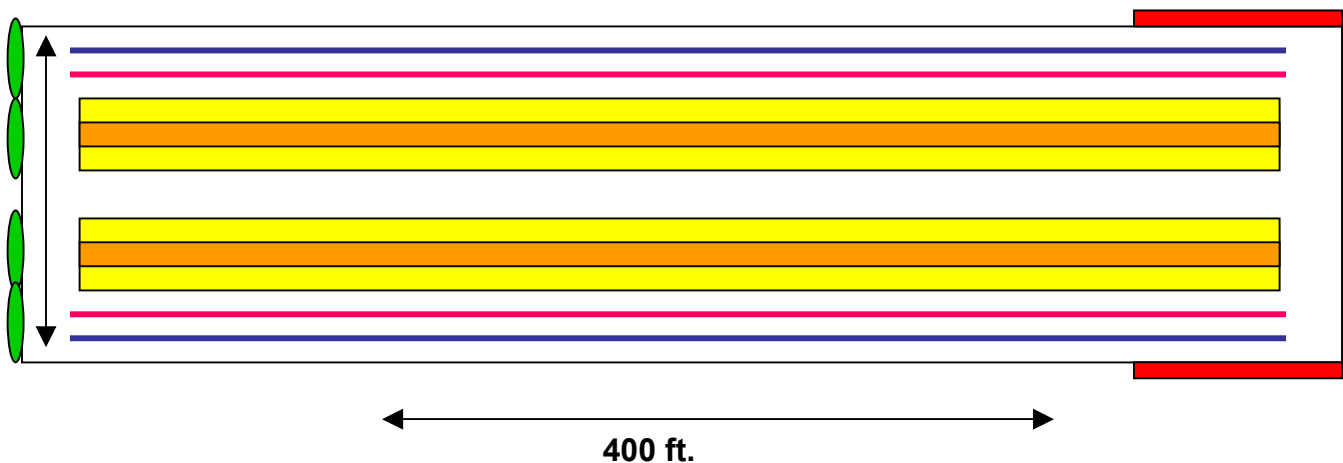
Also, notice in the picture above, the earthen floor is covered by “litter,” an absorbent material that serves as bedding. Many different types of material are used, such as wood shavings and even shredded peanut shells!

Typically, one worker can care for six to eight broiler houses; however, this number also depends on the size of house and degree of automation.

Broiler breeder housing

Broiler breeders are the birds who produce the eggs that hatch into broilers. Broiler breeders housing is different from commercial broiler housing in that breeders are raised in houses that have two different levels, whereas broilers are raised on one level. The “scratch area” is like the area that broilers are raised in; it is covered with litter like a broiler house. The difference is in the nest boxes, which are provided for the hens to lay the eggs that will hatch to become commercial broilers. These nest boxes are elevated above the floor on slats.

Here is a schematic diagram of a typical broiler breeder housing facility.



- As in the broiler housing schematic, the thin bars represent feed and water lines.
- Cool cells and tunnel ventilation fans are the same as in broiler housing.
- The primary differences in broiler breeder housing include: the scratch area, slats and nest boxes. The center area is used as a scratch area where the roosters and hens socialize.
- The larger bars in the center represent the slats with the nest boxes on them.

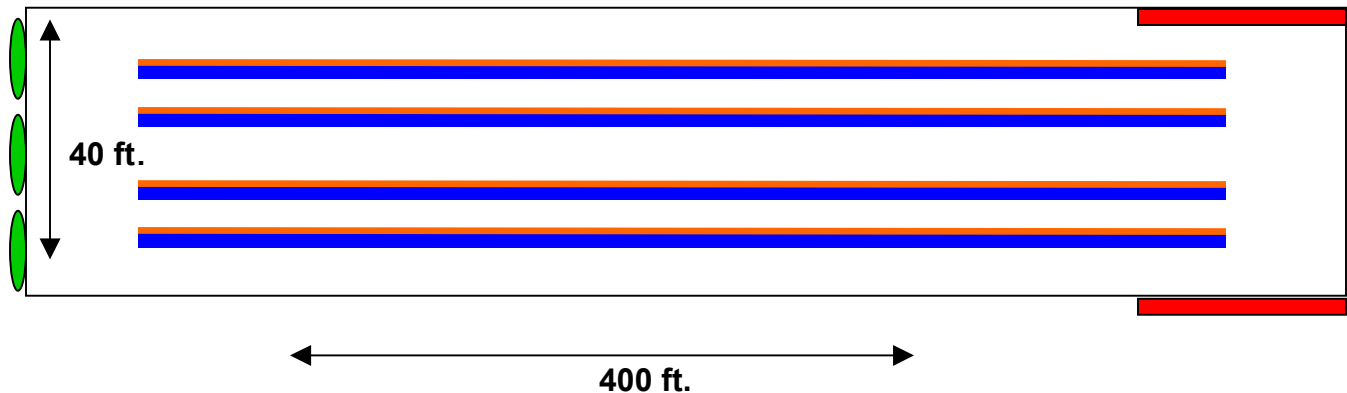
Broiler breeders are the parent birds of broiler chickens raised for meat. In the beginning they are housed much like broilers, except that males and females are often raised separately during the first few weeks of life, if not longer. Light and dark hours must be completely controlled when rearing broiler breeders, because the number of light hours effects egg production, and it is important that pullets reach a specific weight before beginning production. At 20-25 weeks, the birds are moved into the breeder house.

The nest boxes that are provided for hens give them a quiet place away from the scratch area to lay their eggs. Only clean eggs that are laid in the nests are used as hatching eggs. Because of this, it is extremely important that hens lay their eggs in the nests and not on the floor or the slats. When an egg is laid, it is transported on a conveyor belt to the egg collection room. Here the eggs are boxed and sent to the hatchery.

In broiler breeder operations, it is critical that all aspects of production be precisely controlled. If the birds were to become stressed because of something awry in their environment, the first aspect that would suffer would be reproduction. So, it is very important to keep broiler breeders as healthy and peaceful as possible.

Shell egg or table-egg layer housing

The chickens that produce eggs for sale to consumers are called layers. They are not the same as broilers. Here is a schematic diagram of a layer house.



- The darker bars represent the cages; the lighter bars represent the feeders.
- Cool cells and tunnel ventilation fans are shown as in the previous diagrams

Table egg layers are typically housed in cages. Many years of experience and scientific research has shown that housing laying hens in cages is the most effective way to keep layers comfortable and in good health. Housing layers in cages has also proven to be beneficial in egg collection, since collection of the eggs is more efficient and sanitary. Efficient collection is vital in the table egg industry because the quality of the egg begins to deteriorate the longer the egg is kept out of refrigeration temperatures. Cages are typically stacked with a

conveyer belt for manure transport, or they are tiered so that the manure will fall into a pit.

Egg production tends to vary with light or dark conditions, so lighting intensity and the number of light hours can be adjusted for the phase of production. When an egg is laid, it rolls out of the cage and onto a conveyer belt, which transports it to the egg collection room; here the eggs are placed on moveable filler flats, and then transported for grading and shipping.

In the modern shell egg industry, many of the eggs produced on farms that are completely “in-line” operations. This means that the laying, collection, and grading all take place at one facility. After the hen lays an egg, the conveyer belt takes it directly into washing, grading, and packaging. The eggs are refrigerated immediately after grading. Eggs produced at this type of facility can often reach the consumer within 24 hours of lay!

Pullets that are going to be egg-producing hens are initially kept in a house similar to a broiler house. When they are ready to come into production, they are moved into the layer house. Production is often delayed because older birds produce a larger egg. And no, the rooster is not needed for egg production. Adult female birds lay eggs without any help from the male! Roosters are needed only when a fertilized egg is desired, such as in broiler breeder operations.

Feed in layer houses is distributed automatically via troughs that are located in front of the cages. There are usually individual waterers in the cages for the hens; nipple drinkers are often used.

Table egg and broiler production are two completely different sectors of the poultry industry. Companies that produce broilers do not produce eggs for human consumption, and table egg layers are not sold as broilers.

** This information plus more can be found at www.georgiaeggs.com
www.thebigdutchmanusa.com, and www.unitedegg.org*

Environmental controls: ventilation, temperature, lighting

Chickens are kept in houses that protect them from the elements (rain, heat, cold) wild animals, and wild birds. Modern poultry houses have control panels that are set with specifications for flock care. Everything can be set, including the ventilation rates, temperature, lighting, and feeding times.

Illustration 3: An example of a control panel in a modern broiler house. The equipment can be set to operate ventilation, heating, and feeding systems automatically. The technician is wearing coveralls and a hair net for sanitary purposes.



The goal for ventilation is to keep an appropriate temperature in the house while removing excess moisture from the air. An example of a ventilation program would be to set the fans to come on every five minutes. The fans can be run for any amount of time during the five-minute period. The amount of time that the fans are run depends on the temperature and the amount of moisture in the air (the amount of moisture is directly related to the age and size of the flock).

The goal in maintaining the temperature in the house is to make sure the birds are comfortable in their environment. Heat, when needed, is normally provided by gas heaters placed throughout the house; in general, the house needs to be warmer when the chicks are first placed and then gradually gets cooler as the birds age, begin to grow larger, and produce heat of their own. Typically, when the broilers are first placed, the temperature in the house is around 90° – 92° F. This is the brooding phase; birds are brooded in half of the house, and during this phase supplemental heating is provided by brooding units. In a broiler house, the heat is typically decreased gradually as the birds age, with an end temperature of 65°F. The ideal temperature for a shell egg layer house is between 57° and 79°F. Also, the birds' behavior can be a great indicator that the house is at the proper temperature. If the birds are huddling close together or close to heaters, the house may be too cold. If the birds are spread out and panting, the house may be too hot.

Lighting is provided by incandescent lights that run the length of the house. For maximum bird comfort, when the lights are on, they are usually kept at a very low level because chickens can see in the dark much better than humans can. This allows the birds to find their feed and also permits them to rest as desired. Lighting programs for layers are very specific because the length of the light hours indicates to the birds when to begin egg production. To bring hens into production, the hours of light are increased.



Illustration 4: A radiant heater used for brooding is shown above the feed and water lines

Birds are given adequate space to move around, and no cages are used in broiler production. Overcrowding in poultry houses is not practiced in the modern poultry industry, and in fact the space allotted per bird is in excess of the recommendations from the Council for Agricultural Science and Technology (CAST). Overcrowding can cause problems in poultry houses if the birds are frightened and pile on top of one another. Also, if the house is overcrowded, some birds could be unable to get to the feed and water sources and be unable to get enough nourishment. Because of this, even from a purely economic standpoint, it is important to maintain animal care and welfare. For these reasons, and for the general welfare of the birds, more than enough space is provided.

Inspection and Grading

To ensure that only safe and wholesome products are sold to the public, broilers are inspected before and after processing by the U.S. Department of Agriculture, and broiler products and table eggs are graded for quality. The USDA marks of inspection and grading are respected around the world, since many products of the U.S. industry are exported to other countries.

Broiler inspection

After being collected and processed, broilers are inspected for wholesomeness by the USDA Food Safety & Inspection Service. This agency inspects all raw meat and poultry sold in interstate commerce within the United States. Inspections ensure that all products are wholesome and not adulterated in any way.

Carcass inspections are also carried out by the processing plant's Quality Assurance/Quality Control (QA/QC) program. QA/QC personnel in the plants make sure the operation is running smoothly to produce only top-quality products.

**This and more information available at <http://fsis.usda.gov>*

Broiler grading

Broiler inspection is a mandatory program, but product grading by USDA is a voluntary program that is designed to provide information to consumers on the quality of meat that they purchase. Broilers do not have to be graded, and occasionally ungraded broiler meat is marketed. In nearly all cases, these products would be graded "A" if they had gone through the grading process.

In the United States in 2006, USDA provided grading for 3 billion pounds of broiler meat. Broiler carcasses are graded on conformation, fleshing, fat covering, defeathering, exposed flesh, discolorations, disjointed and broken bones, missing parts, and freezing defects, among other factors.

USDA Grade A

Grade A broiler carcasses are the highest quality of carcass; these are the chickens that are found in the supermarket and used in restaurants. Because of the broiler industry's careful organization and management of every aspect of production and processing, the vast majority of broilers are Grade A.

To receive an USDA Grade A, the carcass must have correct conformation and be free of deformities. It must have adequate fleshing, meaning that it has plenty of meat; the carcasses must not appear to be too skinny. It must be clean, with no large feathers present, free of cuts and missing skin over one quarter of an inch, and only one disjointed bone is allowed, but even this is rare.

USDA Grade B

A carcass is graded B when it has moderate deficiencies, but these deficiencies do not affect the appearance of the carcass. These carcasses have moderate fleshing but do not appear to be too thin. A few feathers are allowed on Grade B carcasses but there can only be six less than ½ in. There can be cuts and missing flesh up to one-third the total area of the part, and there can be up to two broken or dislocated bones.

USDA Grade C

Any carcass that does not have the quality to be graded as A or B is typically given Grade C. These carcasses have deformities that detract from the appearance of the carcass, typically have poor fleshing, and insufficient fat covering. There can be eight protruding feathers on C carcasses. If there are tears or missing skin greater than 1/3 the area of the total part, or if there is any combination of three broken or dislocated bones, the carcass is downgraded to C grade.

Carcasses that are given B or C grades are not used for consumption by people but typically go into some other type of product, such as pet food.

*This and more information can be found at <http://www.ams.usda.gov/POULTRY/pdfs/AMS-PYST-2002.pdf>

Table egg grading

Eggs are graded on three different criteria: Eggshell quality, freshness, and size. Only the eggs with the highest quality are found in supermarkets.

Shell quality

The shell egg receives grades of AA, A, and B. AA and A have the same requirements as far as shell quality is concerned. Some shell defects that would cause the grade to be reduced from A to B include: calcium deposits (if larger than the head of a match), body checks (caused when the shell breaks inside the reproductive tract and then is mended), slab sided (when two yolk travel through the reproductive tract together), obviously misshapen, etc. Shell quality can also be reduced if there are stains or dirt on the shell.

**Pictures of egg grading, defects, and more can be found at <http://www.ams.usda.gov/Poultry/pdfs/EggGrading%20manual.pdf>*

Freshness

Freshness grading is attained by “candling” the eggs, which means exposing the egg to a bright light that will permit the observer to judge certain factors that indicate its freshness. The grades for freshness include AA, A, and B. The air cell is located at the large end of the egg and increases in depth as the egg ages. AA is the freshest, B is the least fresh.

- AA quality eggs must have an air cell 1/8 inch or less in depth.

- A quality eggs must have an air cell depth of 3/16 of an inch or less.
- B quality eggs have an air cell depth of over 3/16th of an inch.

On occasion eggs are found that contain “meat spots” or appear to have blood in them. It should be noted that blood or meat spots come from the hen and do NOT indicate that the egg is fertile. You will not find fertilized eggs coming from a modern layer operation, since only female chickens are present.

Size

There are six groups for classifying eggs based on egg size: Jumbo, extra large, large, medium, small, and peewee. They can be defined by the minimum net weight per dozen. The weights (in ounces per dozen) are as follows:

Jumbo:	30	Medium:	21
Extra large:	27	Small:	18
Large:	24	Peewee:	15

**This information plus more can be found at
<http://www.ams.usda.gov/POULTRY/pdfs/AMS-EggSt-2000.pdf>*

In Conclusion

We hope you have enjoyed this brief description of poultry production. For more information, please see the websites below.

www.nationalchickencouncil.com
 www.eatchicken.com
 www.bestfoodnation.com
 www.unitedegg.org
 www.ams.usda.gov
 www.fsis.usda.gov

About the Author

This pamphlet was written by Valerie Brewer, a Poultry Science graduate of the University of Arkansas. She won awards for excellence in research while a student and was a member of the poultry judging team that won the national championship.