

Lesson # 5

Broiler Production

Core Area: Animal Science

Unit: Poultry Industry

Lesson # 5: Chicken Production

California CTE Standards (Agriculture):

C4.3 Understand the modern-day uses of animals and animal by-products.

D1.1 Understand appropriate space and location requirements for habitat, housing, feed, and water.

D1.2 Understand how to select habitat and housing conditions and materials (such as indoor and outdoor housing, fencing materials, air flow/ventilation, and shelters) to meet the needs of various animal species.

D2.2 Understand the principles for providing proper balanced rations for a variety of production stages in ruminants and monogastrics

D3.2 Understand the animal management practices that are likely to improve the functioning of the various systems.

D10.1 Know how to synthesize and implement optimum requirements for diet, genetics, habitat, and behavior in the production of large and small animals.

D12.2 Understand the relative importance of the major meat classifications, including the per capita consumption and nutritive value of those classifications.

FS 4.1 Understand past, present, and future technological advances as they relate to a chosen pathway.

FS 5.3 Use critical thinking skills to make informed decisions and solve problems.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. To understand the organization of the commercial broiler industry.
2. To understand broiler breeder management and their role in the commercial broiler industry.
3. To understand how commercial broilers are raised and managed.

List of Resources. The following resources may be useful in teaching this lesson:

1. United State Department of Agriculture (USDA) – <http://www.usda.gov>

List of Equipment, Tools, Supplies, and Facilities.

- ✓ Power Point Presentation
- ✓ Computer

Terms. The following terms are presented in this lesson (shown in bold italics):

- Broiler
- Ration
- Starter
- Grower
- Developer
- Uniform Flock
- Deformity
- Shank
- Body Conformation
- Hatchery
- Setter
- Hatcher
- Sanitation
- Cross Contamination
- In Ovo
- Lighting Program
- Ventilation
- Brooders
- Litter Condition
- Culling
- Vertical Integration

Interest Approach. Use an interest approach that will prepare the students for the lesson.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: To understand the organization of the commercial broiler industry.

- I. A typical commercial company has different production segments that are involved in the production and processing of meat-type chickens, or **broilers**.
 - A. Broiler breeders
 - i. **Broiler breeders** consist of male and female chickens that are of reproductive age (approximately 20 weeks of age).
 - ii. Broiler breeders produce fertile eggs that are used to produce offspring that are raised for meat production.
 - a. Offspring are raised for approximately 45 days in an open house and are not confined to cages.
 - B. Hatchery
 - i. The **hatchery** is responsible for the incubation and hatching of chicks from fertile eggs obtained from broiler breeders.
 - ii. The hatchery consists of incubation equipment responsible for maintaining ideal environmental conditions for embryo development.
 - a. **Setter/Incubator**
 - i. Fertile eggs are incubated in the setter for 18 days.
 - ii. The setter provides ideal temperature and humidity conditions for embryo development.
 - iii. The eggs are stored on trays that are secured to incubator racks.
 - iv. The setter also rotates eggs to ensure proper orientation of the developing embryo in the egg.
 - b. **Hatcher**
 - i. After 18 days in the setter, eggs are transferred from trays to hatching baskets and are moved to the hatcher.
 - ii. The hatcher provides ideal temperature and humidity for late-stage embryo development and hatching.
 - iii. Unlike the setter, the hatcher does not rotate eggs.
 - iv. The chicks hatch after 3 days in the hatcher, resulting in a total incubation period of 21 days.
 - v. While in the egg, chicks use their beak to break out of the shell, a process referred to as pipping.
 - vi. Chicks are damp when they exit the shell, or hatch, and the warm temperature in the hatcher plays an important role in drying the chick and maintaining their body temperature.

- iii. Once hatched, chicks are removed from the hatching baskets and egg shell debris is discarded.
- iv. Chicks are inspected and are serviced (vaccinated, loaded into boxes, etc.) prior to delivery to a grow-out ranch.
- v. Chicks are counted into trays that are used for delivery to grow-out ranches.
 - a. The chick trays are loaded into an environmentally controlled delivery vehicle and are transported to the ranch where they will be raised to market weight.

C. Grow-out ranches

- i. Grow-out ranches/farms are where broiler chickens are raised.
- ii. Grow-out ranches typically contain a number of houses on site.
 - a. Grow-out houses are specialized buildings that allow age-appropriate control of temperature, humidity, food delivery, water delivery, and lighting for the broilers.
 - b. The grow-out house is completely enclosed to prevent predator entry and to promote biosecurity.
 - c. The grow-out house provides birds the freedom to move throughout the house as they want.
 - d. Grow-out houses are either curtain-sided or tunnel-ventilated.
 - i. Curtain-sided
 - a. These houses contain a curtain that runs along both sides of the house that can be raised or lowered depending upon external temperatures to maintain desired environmental conditions in the house.
 - ii. Tunnel-ventilated
 - a. One end of the house contains large exhaust fans while the other end of the house contains large cool cells.
 - 1. The exhaust fans function to exchange air within house.
 - b. The cool cells function to cool air that enters the house.
 - c. Cooling – ventilation fans draw air through the poultry house, creating enough airspeed to cool the temperature in the barn.
 - d. To keep the broilers warm, minimum ventilation is used. This allows for fresh air but does not drastically drop temperatures.
 - e. These houses contain solid walls on all sides of the house.
 - f. Along the length of the house at the top of the side walls there are small openings, called vent boards.

1. The vent boards control the direction of air entry into the house.
 2. Vent boards direct fresh air to the top of the house so it can be warmed.
 3. This prevents the broilers from encountering cold air or drafts.
- e. Grow-out houses contain automated feed lines that provide birds with access to feed at all times.
- i. The automated feed line contains feed pans for feed presentation.
 - ii. The number of feed pans along the feed line is sufficient in number to provide chicks access to feed at any time.
- f. Grow-out houses also contain water lines that provide birds with access to water at all times.
- i. The water lines contain nipples that the chicks activate in order for water to be released.
 - ii. Use of water lines improves the quality of the bedding substrate used in the facility. Proper use of water lines maintains the quality of the bedding substrate used in the facility.
 - iii. The number of nipples along the water lines are in sufficient number to provide chicks with immediate access to water at any time.
- D. Processing plant
- i. The processing plant is the location where market weight broilers are delivered for processing.
 - ii. The processing plant is a highly automated facility.
 - iii. Most companies have a slaughter plant as well as further processing.
 - a. Further processing can refer to cut-up and cooked product.
- E. Feed mill
- i. The feed mill is responsible for preparing finished feed.
 - ii. Commercial broilers are fed 4-5 different diets during their life.
 - a. Feeding the birds a diet that closely matches their nutritional needs for good health and maximum growth.
 - iii. The raw ingredients used to formulate the diets (corn, soy, etc.) are typically delivered by railcar or trucked in from local grain suppliers.
 - iv. The feed mill contains large storage bins for holding ingredients used in broiler diets.
 - v. The feed mill contains delivery trucks that transport the feed to the grow-out ranches.

- F. Animal health
 - i. Many commercial broiler producing companies employ veterinarians to develop, maintain, and implement an animal health plan.
- G. The vast majority of the commercial poultry industry is vertically integrated
 - i. **Vertical integration** means that companies are buying and owning all the divisions involved in poultry production (e.g., broiler breeders, hatchers, grow-out ranches, processing plant, feed mill).
 - ii. This provides the company with more production control and provides economic benefits as well.
- H. The industry continues to depend upon suppliers outside their company to provide service.
 - i. These may include contract growers that are paid by the company to raise broilers at their ranch.
 - ii. This may also include a contract feed mill that is paid by the company to mill their diets.
- II. The commercial broiler industry is predominantly located in the southeast.
 - A. The top broiler producing companies are located in the southeastern United States.
 - B. Georgia is the top broiler producing state.
 - C. California is routinely in the top 10 broiler producing states, but the number of broilers produced in California is orders of magnitude lower than that of Georgia.
- III. Per capita consumption of chicken meat is the highest of all protein sources in the United States.
 - A. Per capita chicken consumption has increased consistently over the past 100 years.
 - i. In 1900, per capita chicken consumption was 1 lb per year.
 - ii. In 1965, per capita chicken consumption was 26 lb per year.
 - iii. Today the per capita chicken consumption is nearly 87 lb per year.
 - B. Consumption of chicken meat has increased due to many factors:
 - i. Fast food chains have offered more chicken product.
 - ii. Chicken is an affordable source of protein. Chicken costs less than other meats, such as beef or lamb.
 - iii. Chicken is a healthy meat protein source.

Objective 2: To understand broiler breeder management and their role in the commercial broiler industry.

Anticipated Problem: Where do broiler chickens come from?

- I. Broiler breeders are defined as male (rooster) and female (hen) meat-type birds that are of reproductive age.

- A. Broiler breeders are not used for meat production, but rather for the production of fertile eggs.
 - B. The offspring of broiler breeders are the meat-type chicken, or broiler, that is raised for meat production.
 - C. Broiler breeders are an extremely important component of the industry since they are the source of all meat-type birds used in production.
- II. Broiler breeder facilities are separate operations that are isolated from grow-out ranches.
- A. Given the importance of broiler breeders to the industry, broiler breeders are maintained at a separate site for biosecurity and management purposes.
 - B. Unlike broilers that are raised for meat production, broiler breeders are raised under unique management conditions that collectively promote optimal reproductive development.
 - i. Housing
 - a. Broiler breeders are maintained in pullet houses during the period of reproductive development.
 - i. Broiler breeders are maintained in pullet houses for approximately 20 weeks since this is the amount of time required for reproductive maturity for the male and female.
 - b. Broiler breeders are maintained in breeder houses during the period of reproduction and egg lay.
 - i. A typical reproductive period for a broiler breeder flock is 10 months.
 - ii. Breeder houses are stocked with 10 females per male.
 - c. Breeder houses are designed to promote reproductive behavior.
 - i. Breeder houses are open space houses with a central scratch area where breeding takes place and a raised slat area that contain nest boxes for hens to lay their eggs.
 - ii. Eggs are gathered daily, either by hand or by automated egg gathering equipment.
 - ii. Environment
 - a. The environment is managed to optimize reproductive development and production.
 - b. Light duration is a major regulator of reproductive development and performance.
 - i. Once birds are moved to the breeder house, light duration is increased to stimulate hens to initiate egg lay.
 - c. Feeding regimes are also utilized to control body weight since this has a major influence on development of the reproductive system and on fertility.

- i. Grower houses contain male and female feeders to ensure that they are obtaining the optimal nutrients for reproductive performance.
- III. Broiler breeders are intensively selected for specific performance and livability traits.
 - A. Improvements in genetic selection over the past 50 years have resulted in tremendous improvements in broiler production efficiencies.
 - B. During their development, broiler breeders are constantly evaluated and selected for criteria that will result in improved performance of their offspring.
 - i. Typical selection criteria include:
 - a. Body weight
 - b. Feed conversion
 - c. Resistance to disease
 - d. Breast yield
 - e. Skeletal integrity
 - f. Body conformation
 - C. Due to the short generation intervals of chickens, genetic improvements in broiler performance can be made quickly.
 - D. Breeding companies, such as Cobb or Aviagen, develop and/or maintain the genetic lines and perform the selection(s).
 - E. Commercial broiler producers purchase broiler breeders that have the desired performance and livability traits that are best suited for their operations and market.

Teachers: Refer to *Genetics and Breeding* for more information on broiler breeders. Teachers may use available power point on broiler breeders to show students while further explaining objective #1.

Objective 3: To understand how commercial broilers are raised and managed on the farm.

Anticipated Problem: How are meat-type broilers raised for food production?

- I. Meat-type broilers are raised in environmentally controlled grow-out houses contained on grow-out ranches/farms.
 - A. It is typical in the commercial broiler industry for grow-out ranches/farms to contain many grow-out houses.
 - i. It is typical for a ranch to contain tens of thousands of birds at any one time.
 - B. Broilers are placed in a grow-out house after hatching.
 - i. Once hatched at the hatchery, broiler chicks are transferred by vehicle to a grow-out ranch.
 - ii. Chick trays are carried into a grow-out house and chicks are placed on the floor.

- iii. Grow-out houses do not contain cages and broilers are allowed to walk throughout the entire house.
- C. Broilers of the same age are placed into a grow-out house.
 - i. This is referred to as all-in-all-out housing.
 - ii. The broilers placed into a house are collectively referred to as a flock.
- D. Grow-out houses are thoroughly cleaned on a regular basis.
 - i. In addition to cleaning, the house is left vacant for sufficient down-time.
- E. Grow-out houses contain specific equipment to control environmental conditions and to provide feed and water.
 - i. Flooring substrate
 - a. Rice hulls or wood shavings are often used as flooring substrate material for broilers.
 - ii. Heaters
 - a. May be forced air heaters or radiant heaters.
 - iii. Feed lines
 - a. Provide feed into feeding pans located along the length of the house.
 - b. Feed pans are automatically filled when feed levels drop below a minimum level and trigger an activator switch.
 - iv. Feed Bins
 - a. Provide an enclosed and safe storage site for feed.
 - b. Feed silos are located outside the house and contain an automated delivery system that moves feed into the house for delivery into the feed lines.
 - v. Water lines
 - a. Provide water via nipple drinkers located along the length of the house.
 - b. Provide a fresh source of water for birds at any time of the day.
 - vi. Exhaust fans
 - a. Located at the end of the house opposite the cool cells.
 - b. Exhaust fans facilitate air exchange in the house by pulling in fresh air via the vent boards or cool cells.
 - vii. Cool cells
 - a. Located at the end of the house opposite the exhaust fans.
 - b. Cools cells are used as an evaporative cooler.
 - c. Water runs through the cool cells and air is cooled as it moves through the cool cell and into the house.
 - viii. Vent boards
 - a. Located at the top of the walls along both sides of the house.
 - b. Provide directed air inlet to promote proper air mixing, heating and ventilation.

- ix. Curtains
 - a. Run along the length of the house and are raised and lowered in order to alter the flow of air in and out of the house.
 - x. Computer
 - a. A computer monitors and controls all automated equipment in the house to ensure proper environmental control at all times.
- II. Broilers require specific management conditions for optimal growth.
 - A. Depending on the age of the broiler, proper ventilation, lighting, and nutritional programs are implemented to ensure optimal growth and welfare.
 - i. Temperature
 - a. Heating
 - i. Broilers are not capable of regulating their body temperature during the first 10-14 days of life.
 - ii. The grow-out house must provide supplemental heating to ensure that the birds maintain their body temperature and remain comfortable.
 - iii. Heating is achieved through radiant pancake **brooders** and/or forced air heaters.
 - b. Cooling
 - i. During the last few weeks of life, broilers produce significant amounts of heat and the house requires cooling.
 - ii. Cooling during hot weather is achieved primarily through increased ventilation and/or use of cool cell pads or fogging systems.
 - ii. Ventilation
 - a. The rate of air exchange has a major impact on temperature control within the grow-out house.
 - b. Ventilation rates when broilers are young are geared to maintain a comfortable brooding temperature and designed to cool birds broilers approach market weight.
 - iii. Lighting
 - a. Lighting programs are used to help improve broiler health and growth.
 - iv. Nutrition
 - a. Broilers are fed in phases in order to more closely meet their nutrient requirements for growth.

Teachers: Teachers may show students slides of the different aspects of the broiler house in conjunction with explanation of Objective #3

Review/Summary. Focus the review of the lesson around the student learning objectives. Ask students to explain the content associated with each objective. Use their responses as the basis for determining any areas that need to be covered again.

Application. Application can involve student activity with the provided labs.

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as a written test. A sample test is attached.

Answers to Sample Test:

Part One: Matching

H	1. Vertical integration
R	2. Culling
I	3. Litter condition
K	4. Brooders
L	5. Ventilation
F	6. Lighting program
N	7. In ovo
T	8. Cross contamination
O	9. Sanitation
C	10. Hatcher
U	11. Setter
P	12. Hatchery
S	13. Body conformation
E	14. Shank
A	15. Deformity
G	16. Uniform flock
B	17. Developer
M	18. Grower
Q	19. Starter
D	20. Ration
J	21. Broiler

Part Two: T / F

- | | |
|-------|-------|
| 1. T | 14. T |
| 2. T | 15. F |
| 3. F | 16. T |
| 4. T | 17. T |
| 5. T | 18. T |
| 6. T | 19. F |
| 7. F | 20. T |
| 8. F | 21. F |
| 9. T | 22. F |
| 10. T | 23. T |
| 11. T | 23. T |
| 12. T | 25. T |
| 13. T | |