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EXTENSION

Institute of Food and Agricultural Sciences

## **Bobwhite Quail Production<sup>1</sup>**

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### **Foreward**

The sudden explosion of a bobwhite covey rising from the ground cover produces an exciting thrill, especially for a quail hunter. But because of extensive land development, there has been a reduction in the amount of habitat available for quail hunting. As a result, the number of hunting preserves in many states has grown rapidly in recent years. The use of quail as a food source, both for home and in many dining establishments, also continues to increase. To satisfy this growing demand, the production of game birds such as bobwhite quail has become a multi-million dollar industry.

This publication was developed to assist the seasoned quail producer, as well as to provide a sound base for the novice. It should provide basic information needed in the production of quail for a hobby or for business.

### **Getting Started**

#### **Management**

In the poultry business, management abilities and practices determine the difference between success and failure. Management problems are far easier and cheaper to prevent than to solve, and the limited availability of effective disease treatments makes proper management an absolute necessity. It has been estimated that 80 percent of all health problems encountered by quail producers could have been prevented by close attention to sound management principles and details. Inexperienced growers should start with small numbers of birds, increasing flock size as experience is gained.

Remember that bobwhite quail are living creatures that are totally dependent on their caretaker for their well-being. If you cannot give the necessary attention and care to the quail, then the quail will suffer, the business will suffer, and you will suffer. Total commitment is the only way to success!

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## Marketing

Marketing possibilities, probabilities and plans should be determined before starting any new business venture. Many producers contract their production of birds and/or eggs for 1 to 2 years in advance. To be successful in marketing, you must produce a high quality product that consistently meets or exceeds the customer's needs. Repeat business and word-of-mouth advertising are the quail producer's best partners.

## Laws and Regulations

In most states, there are rules, regulations and laws applicable to confinement rearing of game birds. A license or permit is usually required to keep quail in confinement, to exhibit them to the public or to operate a hunting preserve. For information, contact your local conservation officer or your state wildlife department. This information should be obtained before purchasing birds or eggs.

Any time quail are transported across state lines, they must be accompanied by a health certificate from a veterinarian. Contact the State Veterinarian in the state of destination for specific details.

## Assistance

Assistance in game bird production is available from several sources, as listed in Table 1. Your local county extension agent or soil conservation service agent can be an invaluable source of information. State extension specialists and state diagnostic laboratories should also be contacted for assistance. State, regional, and national game bird organizations usually offer conferences and publications that are useful.

## Breeders

### Stocks

There are several subspecies of bobwhite quail. The eastern bobwhite (*Colinus virginianus virginianus*) is the most common, both in the wild and in captivity. The eastern bobwhite has been reported to be larger in the northern states than in the southern states (6.9 vs. 5.9 ounces). Four other subspecies are generally recognized: plains bobwhite,

masked bobwhite, Texas bobwhite, and Florida bobwhite. Many of the domestically grown stocks have been selected to some degree for size, appearance, egg production and hatchability. Several varieties are larger than those found in the wild.

### Selection of Breeder Stock

The type of quail selected will depend to some extent upon the use that will be made of the birds. The larger varieties should be used when growing birds for meat purposes. These varieties are also better suited for home use and hobbyists because they tend to be more docile. The larger varieties usually lay fewer eggs than the small varieties. The small and moderate sized varieties (6 to 7 ounces or 170 to 200 grams) generally are desired when growing birds for hunting preserves because they usually fly better and faster than the larger birds.

The following points should be considered when purchasing hatching eggs or birds:

1. Obtain eggs or birds from producers with a good reputation.
2. Select stocks with a history of good egg production, hatchability and livability.
3. Hatching eggs should be uniform in size. Remove very large and very small eggs. Eggs should be clean, free from odd shapes and have a smooth shell without cracks or thin places. Check length and conditions of storage.
4. Newly hatched chicks should be alert, active, vigorous and free from abnormalities. Cull all weak, small, inactive chicks and those with curled toes or "spraddled" legs.
5. Check birds (and parents if possible) for uniformity in size, color and shape; check for abnormalities, injuries and feathering.
6. The birds should be free of disease. Check for past history of disease or mortality.
7. Select stock that has been blood tested for pullorum and typhoid and found to be clean.

8. Always start more birds than needed so that required culling can be done before final selection.

### **Future Breeder Stock**

During the first season of egg production, it will be necessary to begin planning for the next season. Your breeders can be used again for two to three additional seasons. It should be noted, however, that each recycling of the breeders will result in lower egg production, lower fertility, lower hatchability, poorer chick quality, disease build-up and an increased breeder mortality rate. Close observation and culling should be carried out throughout each laying season. The breeders must be rested for a minimum of 3 months between each breeding season. Rest the birds by turning off the lights and providing a maintenance-level diet.

An alternative to recycling your breeder stock is to replace it with offspring from your current breeders. This will be the desired system for most producers. If genetic selection is to be practiced, this system will permit more rapid improvement of the stock. Use birds from hatches before the peak production period. These birds are usually stronger, healthier, more disease resistant and lay more eggs. In large breeder flocks, this type of selection and breeder replacement will not create any inbreeding problems. Small breeding operations (less than 200 pairs) will need to introduce unrelated breeder stock at least every third year.

It is possible to improve egg production in breeder stock without the necessity of pedigree production records. This is done by hatching succeeding generations from eggs laid at 5 to 6 months of production. In this way, breeder chicks are hatched from the old breeders that continue to lay well over a long production period. This is most successful with larger flocks that do not need periodic introduction of new stock.

The best way to introduce new breeder stock is by purchasing hatching eggs. If eggs are not available, day-old chicks can be purchased for future breeding stock. Only as a last resort should adult breeders ever be brought into an existing operation. The risk of introducing disease problems far outweighs any

benefits that may be derived from the new blood lines. Any birds other than newly hatched chicks should be quarantined for at least 3 weeks to ensure the absence of disease. Whenever possible, purchase eggs or stock from dealers participating in the National Poultry Improvement Plan.

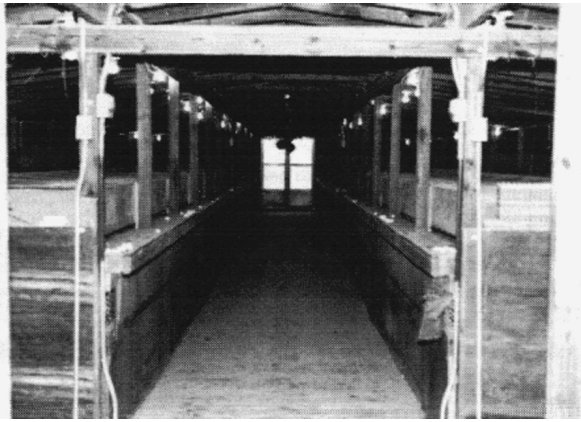
### **Breeding Systems**

There are 3 options available for housing breeders: floor pens, colony cages, or individual cages. Floor pens (Figure 1) are the least expensive and least desirable way to maintain breeders. The major disadvantages of floor systems are increased fighting, dirty eggs, an inability to identify non-productive birds and greater exposure to disease-causing parasites. Even with excellent sanitation and management, floor breeders will not produce as well as caged breeders. On the other hand, floor pen breeding allows more margin for error in feeding and watering because the birds can move from one feeder or waterer to another.

Placing breeders in cages with wire flooring greatly decreases the exposure to disease and produces clean eggs that are very easy to collect (Figure 2). The cage system can be used for colony cages that house several females and males or for individual cages that house a single breeder pair. Colony cages are designed to hold a large number of breeders at male:female ratios ranging from 1:1 to 1:4. Although the front width is not important, the cages should not be any deeper (front to back) than 3 to 4 feet. This will permit easy removal of dead or cull birds and proper cleaning and disinfection. The cages should also have solid dividers (partial) every 3 to 4 feet to prevent the birds from piling in one end of the cage and to discourage cocks from fighting.

Individually pairing breeders makes possible the culling of unproductive or infertile birds and generally results in less fighting, mortality and egg breakage. Individual pairs are also necessary if you practice genetic selection involving pedigree records. This system is most expensive in that greater numbers of males are used, resulting in greater feed consumption and space requirements.

A male to female ratio of 1:1 produces the highest egg production, fertility, and hatchability,



**Figure 1.** Breeder house with colony breeder pens. Each pen has dividers every 4 feet to reduce piling.

regardless of the system. Ratios of 1:2 or 1:3 will result in a lower number of chicks per hen but will produce a greater number of chicks per breeder (counting males and females).



**Figure 2.** Individually pairing breeders allows for culling and selection of breeding stock, but requires additional cage space.

### Breeder Environment

Four major environmental factors that affect breeders are light, temperature, air quality and space.

Light stimulates the breeder's reproductive system which, in turn, initiates breeding. Under natural conditions, quail begin to mate in the spring in response to the increasing day length. By providing artificial light, you can bring the breeders into egg production at any time and maintain production throughout the year, regardless of the natural day length. Artificial lighting should provide 17 hours of light per day. More than 17 hours per day is unnecessary. If you are using a 17-hour day length and your birds are exposed to natural daylight, this will mean more hours of artificial light when the days

are short and less when the days are long. One of the best light-control systems uses a time clock to turn the lights on in the morning and off at night, with an electric eye to turn the lights off at dawn and on at dusk within the schedule of the time clock setting. The light intensity should be approximately five foot-candles. This can be obtained by using 60-watt incandescent lights at 10-foot intervals. *Never reduce the length or intensity of the light* because this will result in a reduction or cessation of egg production.

In response to stimulatory light, some hens will begin egg production as early as 16 weeks of age, but most will begin production between 22 to 25 weeks of age. The eggs should reach settable size within 2 to 3 weeks. If the birds are older and larger when egg production begins, the initial egg size is larger and fewer difficulties (especially prolapsed oviduct or impacted eggs) are encountered. Eggs from young breeders often do not hatch well and the chicks have higher mortality. Near the end of the laying cycle, hatchability tends to decrease; therefore, many producers terminate production before severe declines occur.

For optimal egg production and feed efficiency, the breeders' environment needs to be maintained at a temperature between 50°F and 85°F. Lower temperatures cause an increase in feed consumption, and higher temperatures reduce egg production, fertility and hatchability. Sudden changes in temperature will also cause a decrease in production.

Air quality must be maintained by providing adequate ventilation to remove dust in the winter, heat and humidity in the summer, and ammonia at all times. Ventilation should not cause drafts on the breeders or rapid changes in the temperature. If quail are kept on wire floors in raised pens and are exposed to the cold, drop curtains should be provided to prevent winter winds from circulating beneath the birds. Over-winter the breeders in pens of 20 or more birds to help provide adequate warmth.

While 1 square foot per bird should be allowed for birds in floor pens, 1/2 square foot per bird is adequate for those in individual or colony cages. Breeders should be provided with a minimum of 1 linear inch of feeder space and 1/3 linear inch of waterer space per bird.

## Breeder Timetable

The entire breeder schedule is developed in reverse from the date that eggs from the breeders are needed.

1. Brood the breeders as described under **Brooding** (page 8).
2. Have the breeders tested for pullorum-typhoid disease. To reduce stress on the birds, the testing should be done before egg production begins. You can get a list of approved blood-testing agents from your local county agent or the Poultry Improvement Association in your state.
3. Pair the breeders 4 to 6 weeks before the natural laying season or at least 2 weeks before lights are provided. Natural laying seasons vary for different geographical areas, but the local wildlife conservation officer can provide the approximate times.
4. Move breeders to breeding facilities: floor pens, colony cages or individual breeder cages.
5. Beak-trim the breeders at hatch and, if necessary, before mating (see **Cannibalism** section, page 13).
6. Plan to increase artificial lighting 1 hour per week so that a 17-hour day length will be reached between 24 to 26 weeks of age.
7. Switch from grower feed to breeder feed 2 to 3 weeks before anticipated egg production or no later than when 5 percent production is reached.
8. When egg production drops below acceptable levels, end the breeding season by decreasing the lighting and returning to a low-level grower or maintenance diet. Following a 3-month rest, the breeders can be used again.

It is advantageous to keep individual records on breeders, so that those birds beginning egg production very late, laying at a low rate or having low hatchability can be culled early in the laying cycle. Egg production for a 6-month breeding season should average above 50 percent, or more than 90 eggs per hen. This will vary with strain of bird, lighting

program, and other management factors. The best hens in the flock can produce 160 eggs during the 6-month season. When breeders are maintained under proper conditions for a full year, the average egg production will be from 150-200 eggs per hen.

## Egg Care and Incubation

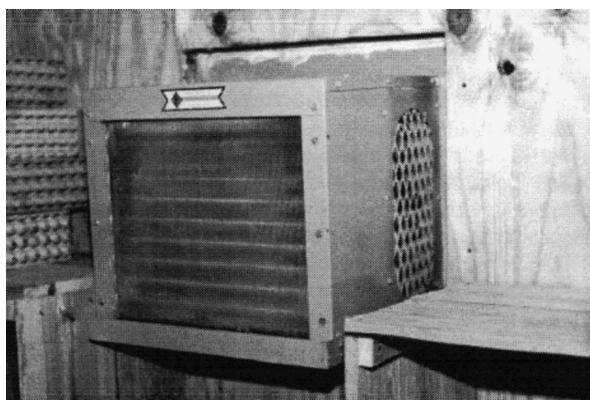
### Egg Care

The eggs your breeders produce represent the final product of all the time, money and effort you have invested. Treat each egg as if it is the only one you have. The embryos within the egg are extremely sensitive to temperature, humidity and position. Remember, nothing you do can improve a hatching egg once it is laid. You can only try to preserve its quality after it is laid.

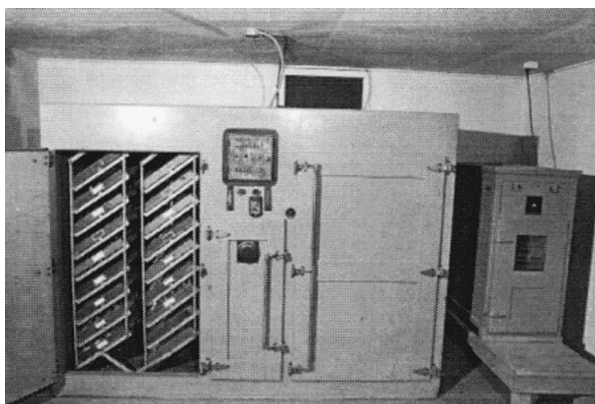
The eggs should be collected a minimum of 3 times per day to limit their exposure to conditions in the breeder house. The last pickup should be late in the day so that the eggs do not remain in the breeder house overnight. Discard all dirty eggs. Attempting to wash or scrub the eggs will remove the outer protective coating of the egg and allow increased contamination and water loss. The problem of soiled eggs should be resolved by improving management and sanitation in the breeder house. Eggs need to be stored with the small end down in a cooler with a temperature of 55°F - 65°F and a relative humidity of 75 - 90 percent (Figure 3). A standard room air conditioner should not be used to cool the eggs. Air conditioners remove moisture from the air, which will dehydrate the eggs during storage. Commercial egg coolers that will maintain the proper temperature and humidity in the egg storage area are required (Figure 4). Storing hatching eggs up to 15 days under ideal conditions will not severely reduce their hatchability. The eggs do not need to be turned during this time. Avoid moving eggs directly from the cooler to the incubator. Allowing them to sit at room temperature for 1 to 2 hours will allow a gradual temperature change that will reduce condensation on the eggs.



**Figure 3.** Eggs should be stored with the small end down in egg flats. Store them in a separate egg room.



**Figure 4.** Proper humidity and temperature are maintained with a commercial egg cooler. Do not use an air conditioning unit for cooling.



**Figure 5.** Using a separate hatcher (shown to the right of incubator) allows better control over conditions during incubation.

### Egg Incubation

Determine the size and type of incubator needed for future business plans. Game bird equipment suppliers can assist with information about various makes and models of incubators

Quail eggs require about 24 days of incubation to hatch, and it is critical that incubator conditions be closely monitored during the incubation process. If the incubator is placed in a room with a constant environment between 65°F - 80°F, it will be easier to control the incubator environment. It is generally best to follow the incubator manufacturer's recommendations; however, it may be necessary to vary from these recommendations for optimal results. If the incubator contains trays, keep all trays, with or without eggs, in the machine at all times during operation to maintain proper air flow and more uniform temperature and humidity.

Both temperature and humidity need to be adjusted to a different setting after 20 days of incubation; therefore, a separate "hatcher" incubator should be used for the last 3 days of incubation (Figure 5). This eliminates the need for changing the adjustments of the "setter" incubator.

For successful incubation, several factors must be closely controlled. The most important of these are temperature, humidity, ventilation, turning, egg position and sanitation. Temperature is by far the most critical. A temperature-monitoring system with an alarm that warns of abnormal conditions is of great value, since a temperature of 1°F - 2°F above or below optimum will cause a reduced hatch and poorer quality chicks. The temperature in a forced-air incubator should be  $100.25 \pm .25^{\circ}\text{F}$  (but may vary with type of incubator) until the last 3 days before hatching begins. On day 21, the temperature should be decreased 1.0°F. Although hatchability will be lower in a still-air incubator (no air circulating fan), many people use incubators of this type for hatching small numbers of quail. Temperatures for still-air incubators are 103°F for the first 20 days and 100°F for the last 3 days. The temperature should be measured at 1/2 inch above the eggs.

Humidity is also important and is usually measured as wet-bulb temperature. It should be 86 - 88°F until the eggs are transferred to the hatcher, at which time it is increased to 90-92°F. Low humidity can result in late stage embryos that stick to the shell or die in the shell, as well as chicks that are smaller and weaker. High humidity can result in late stage embryos that die without pipping, navels that heal poorly, sticky chicks and large, sluggish chicks.

Adequate ventilation of the incubator room and incubators must be provided in order to furnish the proper amount of oxygen and to prevent a buildup of carbon dioxide. Ventilation requirements increase as embryo age increases. Recommendations of the incubator manufacturer should be followed closely.

Eggs should always be set with the small end down. During the first 20 days of incubation, the eggs should be turned a minimum of 3 times each day, but preferably 12 to 24 times per day. The eggs should be turned by rotating the trays from side to side at a 45 degree angle. Setting the eggs with the small end up or turning the eggs improperly causes dead embryos at various ages (especially during the last week) and malpositions (especially having the head in the small end of the egg).

The following is a summary of incubation conditions:

- Period of incubation: 23 - 24 days
- Incubator temperature, days 0 - 20: 100.25°F
- Hatcher temperature, day 21 - hatch: 99.25°F
- Humidity, wet bulb temperature, days 0 - 20: 86 - 88°F
- Humidity, wet bulb temperature, day 21 - hatch: 90 - 92°F
- Turning (times/day): 3 to 24
- Egg position: small end down

The incubator room, egg storage room and surrounding area should be kept clean. Washing and disinfecting these areas periodically will prevent the accumulation of dust and waste materials and the accompanying buildup of molds and bacteria. Keep all used boxes, egg flats, birds and other possible sources of contamination out of the hatchery. Incubators, hatchers and trays must be thoroughly cleaned and disinfected after each hatch. Dirty incubators result in poor hatchability and poor chick quality. Dispose of hatchery waste materials immediately.

Fumigation with formaldehyde gas is an effective method of killing microorganisms in incubators and on eggs. Empty incubators (with trays) running at normal conditions should be fumigated for 3 hours with 0.6 grams potassium permanganate in 1.2 ml of formalin (40 percent formaldehyde) per cubic foot of incubator space. As soon as normal running conditions are reached after the eggs are set, fumigate for 20 minutes with 0.4 grams potassium permanganate and 0.8 ml of formalin per cubic foot of space. *Do not* fumigate eggs that have been set from 24 to 96 hours or when chicks are hatching. Precautions must be taken to prevent skin contact with formalin solution or the breathing of formaldehyde gas. It is important to have a good system of exhausting the gas from the room after fumigation. An incubation timetable is listed below.

### Incubation Timetable

1. Clean and disinfect the incubator, hatcher and egg trays.
2. Two days before setting the eggs, start the incubator, allow it to reach operating conditions, and fumigate\* it. Allow temperature and humidity to stabilize, then make any necessary adjustments.
3. Remove the eggs from the cooler and allow them to warm to room temperature. Discard any eggs that are dirty, cracked, misshapen or of extreme size.
4. Set the eggs in the incubator trays (small end down), allow incubator to reach operating conditions and fumigate\* again.
5. Turn the eggs up to 24 times per day.
6. Monitor and record the incubator conditions frequently.
7. On day 21, either change the temperature and humidity in the incubator or move the eggs to the hatcher. Stop turning the eggs. The hatching trays should have a small mesh screen or rough paper in the bottom to keep the chicks from getting spraddled legs after they hatch.

8. Leave the chicks in the hatcher until they are completely dry.
9. Remove the chicks and place them in clean chick boxes that have rough paper liners.

\*Note: Fumigation is not necessary with a small incubator.

You can expect 70 - 85% of all eggs set to hatch. There are, however, many factors other than incubation conditions that will cause hatchability to fall below this level.

### Possible Causes of Poor Hatchability

#### Breeder Problems

1. Use of breeders that are too old.
2. Use of damaged (crippled, deformed or diseased) breeders.
3. Having an excess number of females to males.
4. Inbreeding for more than 3 years.
5. Improper lighting of breeders.
6. Allowing temperature extremes in the breeder house.
7. Use of old or poor quality feed.

#### Storage Problems

1. Leaving eggs in breeder house too long.
2. Storing eggs in dirty conditions or at incorrect temperature or humidity.
3. Storing eggs too long.

#### Incubation Problems

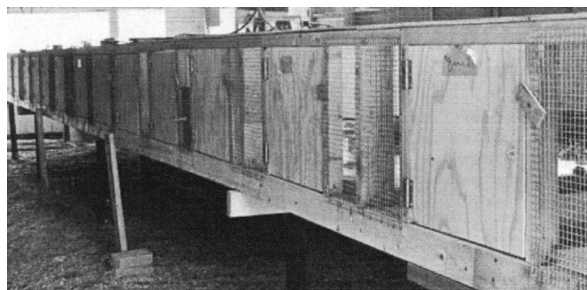
1. Rapid temperature change between cooler and incubator.
2. Improper or badly fluctuating temperature and humidity.
3. Incubator room temperature too high.

4. Improper turning of the eggs.
5. Poor sanitation.

### Brooding

Brooding involves providing warmth, high quality feed, clean water and protection during the first 6 weeks of a quail chick's life. Proper management during this period can eliminate some of the health problems that occur later on. Current and future plans, as well as the availability and cost of fuel, will enter into a decision about which type of brooding system to use.

The brooder building should be built so that it can be closed in cold weather and opened for ample ventilation in hot weather. It should also be rodent-proof, with the floor and lower 3 feet of the walls having no cracks or holes of more than 5/16-inch wide. Brooding can be carried out in floor pens with either litter or raised wire floors. Floor pens with litter are the most common and least expensive. Wire-floored pens eliminate many disease problems but require a tighter house to eliminate drafts, and the birds are more prone to cannibalism (Figure 6). Battery brooders will hold more birds per square foot of floor space, but difficult manure management and high cost have limited their use.



**Figure 6.** Brooding on wire requires a well-insulated, tight brooding house to eliminate drafts.

Heat for brooding can be provided by gas or electric brooders or infra-red heat lamps. Providing adequate feed, water and floor space is critical at all stages of production. Overcrowding and insufficient feed and water will result in higher mortality due to starve-outs, dehydration and cannibalism. Table 2 gives recommended space requirements.



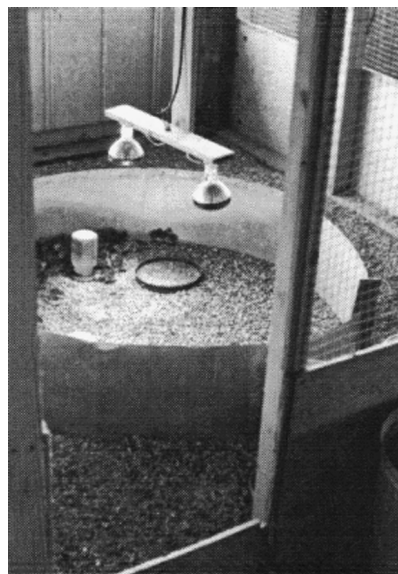
## Brooding Schedule

### *Two Weeks Before Hatch*

1. Thoroughly clean, disinfect and dry the entire brooding area and all equipment. This includes walls, ceilings, floors and wire. An approved disinfectant should be used after a thorough cleaning. Follow label directions for use of each disinfectant.
2. If using floor pens, put clean, dry, absorbent litter to a depth of at least 2 inches in each pen. Litter materials such as wood shavings, pine straw, peanut hulls, sugar cane bagasse or crushed corn cobs are satisfactory. Wood shavings are the best, although hardwood shavings contain materials toxic to young chicks. Materials containing many sharp splinters should be avoided. Sawdust should not be used; it will support mold growth. Chicks will eat both sawdust and sand, resulting in mortality due to starve-outs. Wet litter promotes disease and creates ammonia, which leads to poor air quality and respiratory tract irritation.

### *Two Days Before Hatch*

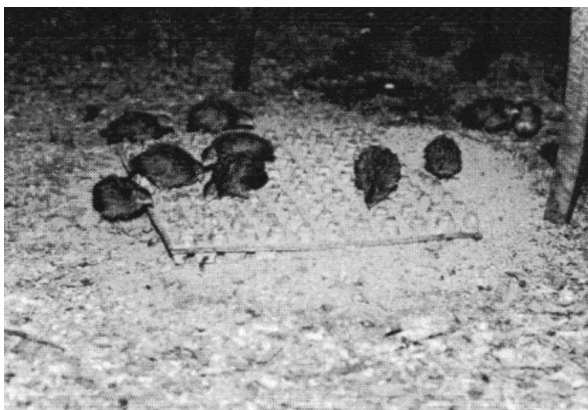
1. Turn on the brooders. Infra-red heat lamps or radiant brooders should be adjusted to about 24 to 30 inches above the floor with sufficient room under the lights for all chicks in that ring. Check the brooders repeatedly until all are operating at the proper temperature, 95°F - 100°F at the edge of the hover or heated area and 1 inch above the floor (the height of the chicks).
2. Set up a brooder ring to reduce drafts and keep the chicks from piling or wandering too far from the heat, feed and water (Figure 7). An 18-inch-high circle of wood, corrugated cardboard or metal placed in a circle around the brooder is commonly used. The circle should be large enough (6 - 7 feet in diameter) to allow the chicks to escape from the heat of the brooder if necessary. A circular brooder guard will help prevent piling by eliminating corners.
3. Check to ensure the litter is free of pests such as fire ants.



**Figure 7.** A brooder ring will help reduce drafts during floor brooding and will also contain the quail close to the feed, water and heat source.

### *One Day Before Hatch*

1. Fill the feeders and waterers and space them evenly around the brooder. A minimum of 3 small feeders and 3 fount-type waterers should be used in each brooder ring. Water fountains for starting chicks should be very shallow; it is preferable to use quart jars with bases made specifically for quail. If using chicken fountains, place marbles or gravel in the bottom to prevent the chicks from getting into the water and drowning. Older quail can use water fountains designed for chickens. The water should be allowed to reach room temperature before the chicks drink it. Waterers should be far enough from the brooders to prevent overheating of the water.
2. To encourage the chicks to eat, additional starter feed should be placed on rough paper, feeder lids, or new quail egg flats (Figure 8). Do not use smooth paper or any slick material that will cause the chicks to slip, resulting in spraddle legs. Cylindrical, hanging-type feeders, manual or automatic, can be used after the chicks are a week old.
3. Recheck brooder temperature.



**Figure 8.** Egg flats can be used to hold feed for chicks during the first days of brooding.

### **Hatch Days**

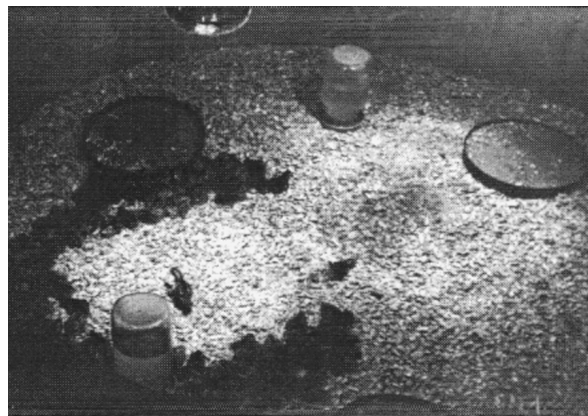
1. After allowing the chicks to completely dry off in the hatcher, they should be counted and moved to the brooding area. Any weak or deformed chicks should be culled.
2. Beak trim the birds before placing them in the brooder area (see **Cannibalism** section, page 13).
3. Check the brooder temperature again.

### **First Week**

1. Check several times daily for mortality, signs of disease or stress, improper brooder operation and other problems. The brooder temperature should be maintained at 100°F. Observe the chicks for signs of comfort. If they pile up directly under the brooder, the temperature is too low; chicks spreading out away from the brooder against the brooder ring means the temperature is too high. The chicks are comfortable if they are evenly spread out around the edge of the brooder (Figure 9).
2. The brooder guard should be removed after about 5 days during mild weather or 8 days during cold weather (Figure 10). The chicks are usually able to fly over the ring after 9 days.
3. Clean and refill the feeders and waterers daily, or more often if needed. Gradually replace feeders and waterers with larger ones, beginning on the 5th or 6th day. Place some of the feeders and waterers on raised (2 - 3 inches) wire-covered platforms at the end of the first

week; have all on platforms by the end of the 2nd week (Figure 11).

4. Promptly remove any dead chicks.
5. Water-soluble vitamins added to the water during the first week of brooding may be helpful in getting the chicks started.



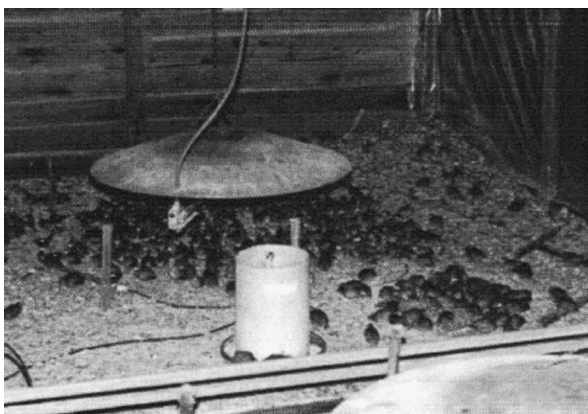
**Figure 9.** The even spread of chicks around the brooder lamp is evidence that the proper brooder temperature has been achieved.

### **Second Week**

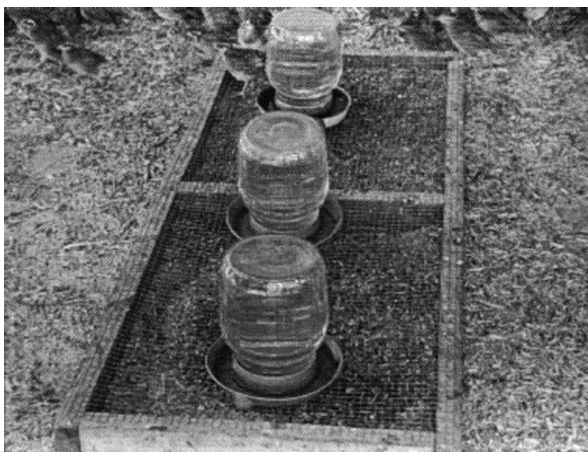
1. Reduce the brooder temperature to 95°F.
2. Continue to gradually remove the small feeders and waterers; never allow them to stay in the brooder area if they are empty. Cylindrical, hanging-type feeders, manual or automatic, can be used after the chicks are a week old. If hanging feeders are used, the top of the feeder pan should be at the same height as the bird's back.
3. Clean the feeders and waterers at least once a day.

### **Third, Fourth, and Fifth Weeks**

Reduce the brooder temperature by 5°F per week until the outside temperature or 70°F is reached. Continue to clean and refill the feeders and waterers daily. Provide as much ventilation as possible while still maintaining proper temperature and without causing drafts.



**Figure 10.** Remove the brooder ring before the chicks begin to fly over it.



**Figure 11.** The litter around feeders and waterers will get wet from spillage and from droppings. Wire stands will help limit the birds' exposure to this wet litter.

### **Sixth Week**

Transfer the chicks to grow-out pens. Cull and trim beaks (if necessary). Change from starter feed to grower feed.

### **Grow-Out**

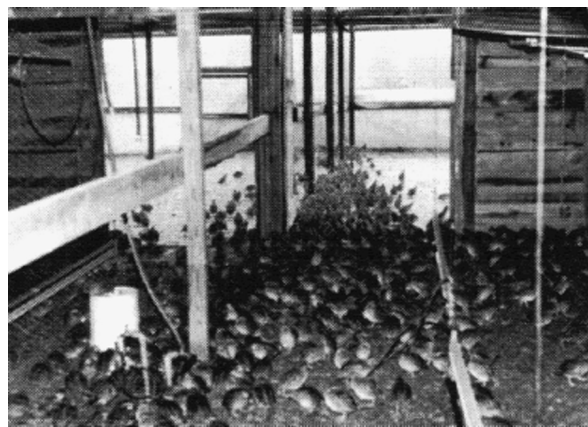
After a brooding period of 5 to 6 weeks, the quail should be moved to the grow-out facility. Quail can be grown on the ground or on raised wire floors. If grown on ground or litter, wire boxes should be used under feeders and waterers. This will keep the feeders and waterers cleaner and allow the concentration of droppings to be under wire. Wire floors for permanent pens should be made in sections that allow for easy clean out of droppings and for cleaning of the wire floor. The floor should be 4 to 6 inches from the ground and the supports should be as narrow as possible to prevent a buildup of droppings. The

height of the top of the pens should be governed by convenience. The birds are usually provided with a fully wire-enclosed outside pen (Figure 12). However, birds grown for meat purposes should, in most cases, be grown in open-sided, wire enclosed, roofed houses with litter floors.

Adequate feeders and waterers must be provided in all areas of the pen and should be cleaned and filled daily. Provide as much ventilation as possible while still maintaining proper temperature and avoiding drafts. Hiding places of pine tree tops or corn stalks in shocks should be provided in all areas of the pen (Figure 13). Do not crowd the birds. Check them daily for signs of disease or cannibalism.

Much of the adult plumage is present when the chicks reach 10 weeks of age; the sex of most birds can be determined by feather patterns at 12 weeks of age; and they are generally considered mature at 16 weeks of age. At this age, the bobwhite can be used for meat or hunting preserve purposes. Breeders can also be paired at this time.

One of the most important considerations during the grow-out period is the proper placement of the grow-out pens. They should be in a secluded location away from people, children, pets and traffic. Birds that have become accustomed to people and noise do not respond well to an approaching hunter in the field.



**Figure 12.** The grow-out pens should be connected to flight pens. When proper weather conditions exist, the birds should be allowed to have access to the flight pens.



**Figure 13.** Cover should be provided in the grow-out and flight pen areas.

## Flight Conditioning

Hunting preserves want a strong, aggressive, fast-flying bird. To get this type of bird, you must condition the bobwhite quail. Allow the bird to preen and condition itself as it would naturally in the wild. Birds for release need to have good feathering, for looks as well as for flying capability.

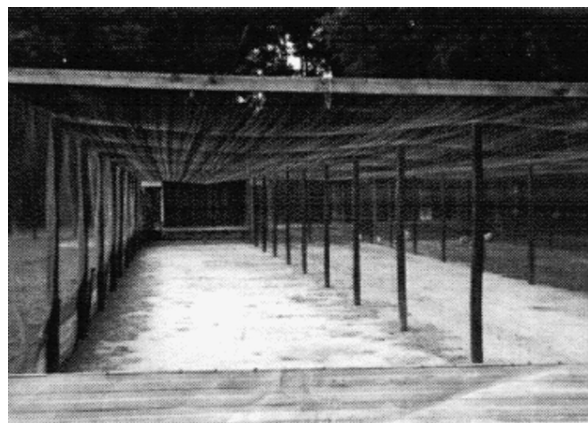
Flight pens are generally 12 to 15 feet wide and from 30 to 150 feet long (Figure 14). They are outdoor wire pens with an enclosed shelter at one end and a catching pen (approximately 12 X 12 feet) at the other end of the run. The pen height should allow tractors to enter the pen and plow the soil. To prevent birds from flying into the wire sides, tops and ends of pens, open-weave burlap or cheesecloth may be fastened to the wire. The material should have an open weave to allow light and ventilation to penetrate. An effective disease prevention program will require enough flight areas to allow for rotation between groups of birds.

Some producers prefer flight conditioning pens that are no longer than 30 feet, are totally covered, and contain regular litter floors. The theory for the short pen is that the birds do not have room to "cheat" on flight exercise by gliding long distances, but must continuously flap their wings. This system does have some advantages in disease prevention because the birds are off of the ground on litter and are protected from the weather. All flight pens should be isolated from people and other animals.

If the flight pens have dirt floors, they should be on well-drained soil with plenty of cover, feed, and

water throughout the area. One good practice is to plant a crop in the pen for food and cover, making sure it doesn't block out sunlight. Shaded, moist ground invites a build-up of molds, parasites and other disease-causing organisms. When the pens are not in use, they should be deeply plowed, allowing the sun to disinfect the soil. If wire floor runs or concrete runs are used, provide dust boxes with clean sand for dusting. This will help produce a better looking, well-preened bird that can take adverse weather conditions. If birds are not exposed to rain or dew, they should be misted with water at least once a day to stimulate preening. This can be done with a hose and nozzle, but most larger operations install a fogging system. Feed stations should be constructed to prevent feed from getting wet or damp from rain or spray. The use of wire stands under feeders and waterers is advisable.

The birds should have at least 2 square feet of space per bird in the flight pen. One square foot of space per bird is an absolute minimum. If flight pens are overcrowded, the birds will be bob-tailed as a result of pecking and pulling the feathers from one another. The birds should be put in the flight pen for at least 6 weeks before release.



**Figure 14.** Flight pens have wire on the sides and top. The sheet metal around the bottom of the pen protects the birds from predators.

## Feeding and Nutrition

Provide a properly prepared and nutritionally balanced feed. Most commercial feed companies make a series of game bird feeds that are designed to be adequate for most species of game birds. Chicks should be fed a game bird starter feed, free choice, up

to about 5 or 6 weeks of age. A grower diet is provided from 5 to 8 or 10 weeks. A game bird flight conditioner or developer should be fed after 10 weeks and up until release time. Breeders should be switched to a breeder feed 2 to 3 weeks before anticipated egg production or no later than when 5 percent production is reached. Examples of these diets can be found in Table 3.

Constant attention should be given to feeder maintenance and the prevention of feed wastage. Quail will eat crumbles or mash, but a change from one to the other may cause problems with acceptance. Making a gradual change by mixing the two types of feed together for a few days may help. Usually, feed wastage is decreased when crumbles are used. The birds will consume 1.3 to 1.5 pounds per bird of feed during the first 8 weeks. Between 8 and 16 weeks, they will consume 2.0 to 3.0 pounds per bird. Feed will lose some of its nutritional value if it is stored improperly or too long. During the hot summer months, feed should not be stored more than 2 or 3 weeks nor allowed to become damp. Molds and mold toxins can be a serious problem with quail because they are very sensitive to these toxins. During cooler months, feed may be stored up to 4-6 weeks with a minimum loss of nutrients. Feed consumption will vary from farm to farm, season to season and formulation to formulation.

Fresh, clean drinking water is extremely important and should be available continuously. The watering system should be cleaned and disinfected frequently.

### Soft-Shelled Eggs

If an individual hen consistently lays thin-shelled or deformed eggs, remove the hen. But if a large number of hens lay thin-shelled (or soft-shelled) eggs, increase the calcium intake through feed formulation changes or by top dressing the feed with pullet or chick-sized oyster shell.

### Cannibalism

One of the major problems of rearing quail in confinement is cannibalism. Quail will pull the feathers or peck the nose, toes, tails and backs of their pen mates. Considerable mortality can result from

this behavior, as well as decreased growth and an increased number of cull birds. Never underestimate the seriousness of the potential problem or the importance of preventing or stopping cannibalism. It is usually much easier to prevent cannibalism than it is to control it once it starts.

Any stress can trigger cannibalism. One of the most common causes of cannibalism is overcrowding, which usually includes a lack of feeder or waterer space. Never crowd the birds, and always provide more than adequate, easily accessible feeder and waterer space. Do not feed dusty, powdery feed, which readily collects on the birds' toes. Watch for beak and toe picking. Chicks brooded on wire floors are more susceptible to toe picking. Another common cause of cannibalism is an uncomfortable temperature in the birds' environment. Even though picking is usually worse in summer than in winter, being either too hot or too cold can trigger cannibalism.

### General Prevention

There are several other suggestions that may help prevent cannibalism. Always brood quail chicks in subdued light; provide just enough light for them to find feed and water. When using heat lamps for brooders, use red lamps rather than white. Place only uniform-sized birds together. Provide cover in the pens so that the quail have a place to hide or to get away from other birds. Large, ladder-like roosts leaned against the wall work well with older quail, providing a place of safety for the pecked birds as well as providing extra space. Placing tightly tied bales of leafy hay in pens will give birds something to peck on and will help prevent cannibalism. When birds must be moved for any reason, move them during the cooler times of the day--early morning or late afternoon. When practical, move birds only under favorable weather conditions. Remove dead and injured birds immediately, and isolate the injured birds until they have recovered. Beak trimming the quail is the most drastic, but most effective, of the prevention methods.

## Beak Trimming

Beak trimming involves removing the tip of the bird's beak so that the beak ceases to be effective as a puncture tool or as a tweezer for pulling feathers. Quail beak trimming is sometimes performed with nail clippers, scissors, or electric debeakers. It is frequently done at 1 day of age and at 6 weeks of age, when the birds are moved to the grow-out pen. Every time birds are caught and handled, there is a risk of injuring them. Keep this in mind when deciding which method of beak trimming is best for you.

Beak trimming with clippers or scissors can be done on schedule or as needed. To beak trim at a day old, snip off 1 quarter of the distance from the beak tip to the nares (nostrils). This should prevent early cannibalism, but beak trimming will have to be repeated every 2 to 3 weeks. Be careful with snips not to split or crack the beak.

The recommended method is to use an electric beak trimmer. With this instrument, the beak can be trimmed in one of two ways. The first method involves cutting off the beak with the blade. The second method, or touch-burn method, involves touching the beak (upper and lower) to the red-hot metal surface of the blade. With either method, the beak should be trimmed back 1/4 of the distance between the beak tip and the nares. Removing 1/4 of the beak is adequate both for breeders and for birds to be released. More severe trimming results in many birds having problems eating and thus becoming culls. All birds should be checked before being housed as breeders or before being released, and any abnormal beak growth should be trimmed. The birds can be beak trimmed at 1 day of age or when needed. The first trim should prove sufficient for the life of the bird, although if cannibalism occurs at a later age, the beaks can be retrimmed lightly. The touch-burn method of beak trimming at 1 day of age is preferred because it allows for sufficient regrowth before the birds are released. Birds should have natural beaks when released, both for looks and, if unharvested, for survival in nature.

Sick or weak birds should not be beak trimmed; the stress will make the problem worse. Be sure the bird's feed level is deeper for 6 days after beak trimming. The bird's beak will be sore, and, if it hits

the bottom of the trough while getting feed, the bird will not eat as it should--another stress.

## Disease Prevention

Any time birds are removed from their natural habitat and raised in confinement, the chance of disease becoming established in the population is greatly increased. Since treatment of a specific disease is not always effective, preventing disease is far more economical than curing it. Because quail seem to be even more sensitive to mismanagement than domestic fowl, good management practices are vitally important in preventing and controlling disease. Regular, close supervision and the ability to recognize disease problems early are both essential. The diagnosis must be verified before the disease is treated. Seek outside help from avian veterinarians in the state diagnostic laboratories when needed. Many of the common poultry diseases can be prevented and/or controlled by observing the following practices.

Use only clean, disinfected crates or boxes to transfer the birds. Quarantine any new stock for a minimum of 3 weeks to reduce the chance of introducing disease into your existing stock. Isolate young stock from adult breeders. Young stock is more susceptible to disease organisms, and may become infected from adult birds. Never add new adult breeding stock to your flock. Do not exhibit birds at fairs or shows and then return them to your facilities. If they must be returned, isolate them for at least 3 weeks.

Sanitation is a must in any good management program. Start with clean, disinfected pens and equipment, and be sure you clean the premises thoroughly and often. Any new equipment or materials should be cleaned and disinfected before being brought onto the farm. Most of the common poultry diseases are caused by organisms that the birds pick up from the ground or from contaminated droppings.

Care for the youngest birds first and the oldest birds last; care for healthy birds first and sick birds last. Quail exhibiting signs of disease should be provided with heat in a dry, draft-free location. Always isolate known infected stock from the rest of

the flock. Remove individual sick and dead birds from the pens daily. Incinerate, bury or dispose of dead birds properly. In some cases, it may be necessary to depopulate the entire farm and thoroughly disinfect the houses, equipment and surroundings. After working with diseased birds, shower and change clothes and shoes before visiting other birds.

Controlling traffic in and out of the facilities is vital to the success of your sanitation program. Do not allow your workers to raise any poultry of their own or to visit other poultry or game bird farms. Visitors should be kept out of the pens and breeder areas. If visitors must enter the facility, insist that they wear protective clothing and plastic boots. The premises should always be locked to prevent unauthorized visitation in your absence. Control rodents, wild birds, flies and other insects, as they can be carriers of disease organisms and external parasites. Do not keep other species of birds on the premises.

Treat with drugs only when necessary and with proper dosage and precautions; drugs are expensive and can be harmful if misused. Mismanagement is probably the most common contributing factor to disease problems. There are no drugs or medications for the prevention and cure of mismanagement. Good records and close observation of the birds will provide an early warning of management problems or disease and are often a valuable diagnostic aid.

## Diseases

Without training, equipment and experience, the average game bird manager cannot read about a disease or look at a picture and then make a diagnosis in the field. Properly equipped and experienced avian veterinarians will be of invaluable assistance. The diagnosis and treatment of disease should be left up to professionals. Please contact your state diagnostic laboratory as soon as you suspect a problem.

The following are some of the more common disease and parasite problems that are encountered. The specific disease information listed here is for reference only. Treatments should be administered under the guidance of a veterinarian.

### Ulcerative Enteritis (Quail Disease)

This is a highly contagious disease that usually causes high morbidity and mortality. It is the most common and destructive disease of quail, and losses may reach 100 percent if not controlled. It is caused by an anaerobic bacterium (primarily *Clostridium colinum*) found in the intestinal tract. The organisms are transmitted by the ingestion of contaminated droppings, feed or water.

Ulcerative enteritis may appear rapidly, causing high mortality within 2 or 3 days following the onset of clinical signs (5 to 14 days after infection). Many of the dying birds will be well fleshed, with feed in the crop. Birds that survive for several days or weeks will sit or stand humped-up, having eyes partly closed, ruffled feathers, watery droppings and weight loss. Internal lesions are seen as small hemorrhages in the inner wall of the lower intestine and ceca, which coalesce and become larger, yellowish ulcerations. The liver may also contain yellow or gray spots and the spleen may become enlarged with hemorrhages.

Several drugs\*, including Lincomycin, Streptomycin, Neomycin, Erythromycin, and Virginiamycin, have been shown to aid in controlling the disease. (\*The use of trade names in this publication is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication do not signify our approval to the exclusion of other products of suitable composition.)

Recovered quail may act as carriers and should be isolated from young stock. Pens, cages and particularly ground or litter runs may remain infected over a long period of time. Proper management is the key to prevention and control.

### Coccidiosis

This is a common disease in quail and is caused by protozoa that invade the walls of the intestine. Mortality and morbidity can be very high. Coccidiosis is transmitted by ingestion of droppings from infected birds. The life cycle of the organism is favored by damp litter and warm temperature. The ingested coccidia invade the lining of the intestine,

causing tissue damage, reduced nutrient absorption, and secondary infections.

Clinical signs of coccidiosis may include decreased feed and water consumption, loss of weight, huddling, droopiness, ruffled feathers, diarrhea with a tinge of blood and mortality. The disease occurs more often in young birds. Older birds are usually more resistant to the problem, even if an immunity has not fully developed.

The incidence and severity of coccidiosis can be lessened by growing birds on wire floors. All litter- and ground-reared birds are exposed to coccidiosis but will develop immunity to the problem. Whether or not the birds get sick as a result of the exposure is in direct relation to the sanitary condition of the pen. Where sanitation is excellent, exposure is not usually overwhelming, and the birds develop immunity without getting a clinical case of coccidiosis. Unsanitary conditions almost invariably result in clinical cases that must be treated. Drugs are available (Monensin) for prevention and treatment, and recovery of infected birds is relatively good with early treatment.

### Quail Bronchitis

This respiratory and intestinal disease is highly contagious, having a sudden onset, rapid spread and a mortality of from 40 to 100 percent. It is particularly a threat when quail of different ages are maintained on the same premises. Quail bronchitis is caused by a virus. It can be spread by direct contact, on airborne particles and by mechanical carriers.

Quail bronchitis most often occurs in birds under 7 weeks old, and in some cases, as early as 7 days old. Older birds are generally affected less severely. The characteristic findings are the sudden onset and rapid spread of tracheal rattling, wheezing, coughing, and sneezing. A nasal discharge, watery eyes, depression, huddling, ruffled feathers and a sticky diarrhea are common, with some birds showing neurological signs, especially twisting or bending of the neck.

Young birds that recover from quail bronchitis are usually immune to later exposure. They may, however, have lower egg production, fertility, and hatchability; some birds may never lay eggs.

There is no specific treatment for quail bronchitis. However, treatment with Tylan or Gallimycin may be helpful. Good management and sanitation practices should be followed to prevent the occurrence of the disease.

### Avian Pox

Avian pox is a relatively slow-spreading viral infection that is transmitted primarily by mosquitoes or other biting insects. Some bird-to-bird transmission may occur through direct contact or in water and feed. Insects such as gnats or flies may spread the virus, especially when the birds' eyes are affected.

General symptoms are loss of appetite, dullness and decreased fertility. In dry pox, there are wart-like scabs and nodules on unfeathered skin and on the head. The eyes may be watery. In wet pox, there are cankers in the lining of the mouth, throat and trachea that may cause the bird to suffocate or to starve.

Mortality from pox is usually not severe, especially in the dry form. Vaccination with a quail pox (*not fowl pox*) vaccine at 6 to 10 weeks of age can prevent the cutaneous form (dry pox) and the oral and nasal forms (wet pox) of quail pox. There is no treatment for affected birds; however, an antibiotic-vitamin mix added to the water may be of some help.

### Other Diseases

A variety of other diseases may occasionally be a problem. Some of these are: infectious coryza, cryptosporidiosis, aspergillosis, fowl cholera, staphylococcosis, blackhead, chronic respiratory disease (CRD), pullorum, colibacillosis, and trichomoniasis.

### Worms

Quail can be infected with several types of internal parasites, including large roundworms, cecal worms, capillarid worms and tapeworms. The general symptoms of worms are unthriftiness, weakness, droopiness, poor growth and, in severe cases, emaciation. The large roundworms are found in the small intestines and may measure as much as 3



inches in length. Consult an avian veterinarian for recommended treatments.

Cecal worms are found almost entirely in the ceca. They usually affect the bird less than most other worms but are very important in the transmission of the blackhead organism (*Histomonas*). Phenothiazine or Hygromix compounds are effective in controlling cecal worms.

Capillarid worms generally occur in the tissue layers in the upper part of the intestinal tract (esophagus, proventriculus, and crop) and occasionally in the ceca. Most of these worms are very small, not easily seen by the unaided eye, and can build up on the premises rapidly. The worm eggs are picked up off the ground and out of droppings. They cause a thickening of the crop wall, resulting in high mortality. The birds give the appearance of starvation and, in the final stages, gasp as if having difficulty breathing. Some control may be achieved with Thibendazole or Tramisol compounds. Experimental drugs have shown promise against some forms of capillary worms, but no effective treatment is available at this time. Prevention is possible by use of good management and sanitation practices.

Tapeworms are flat, segmented worms that may be several inches long. There are several species, the most common of which are found in the small intestine. Intermediate hosts such as earthworms, snails, flies, etc. are necessary for tapeworms to be infective to birds. Treatment with dibutyltin dilaurate and preventing contact with intermediate hosts will help control tapeworms.

Worm populations can be effectively reduced by fumigating the soil with methyl bromide.

### External Parasites

The birds should be checked regularly for signs of external parasites. Some of the more common external parasites are fleas, lice, mites and ticks. Mosquitoes may also be a nuisance in some areas. Most external parasites reduce growth, efficiency and reproduction, as well as adding another stress, perhaps increasing the susceptibility of the bird to disease.

Several insecticides are effective in controlling external parasites; however, some are no longer permitted for use on birds. Care should be taken in the selection and use of the proper materials. Check with your county agent or state diagnostic lab for a list of approved, effective products.

### Toxins

Botulism - This is a type of food poisoning caused by eating materials containing the toxin produced by a bacterium, *Clostridium botulinum*. The clinical findings of poisoned birds are weakness, followed by paralysis of the neck, legs and wings, and finally, prostration and death. The feathers can be easily plucked. No lesions are apparent in the affected quail. Botulism can be prevented by keeping possible sources of contamination (such as spoiled foods, wet feed and dead animals) away from the birds.

Molds - The major toxins of concern are those generally found in the feed or litter that are produced by molds. The most common toxins affecting poultry seem to be aflatoxin and an estrogen-like compound produced by *Fusarium* molds. The symptoms of aflatoxicosis include an unsteady gait, leg weakness or paralysis, liver damage, small hemorrhages and, in many cases, a condition similar to rickets. The presence of aflatoxin in the feed and litter can be determined by laboratory tests.

Although some degree of prevention may be obtained from antibiotic-vitamin mixtures, using fresh, clean, dry feed manufactured from uncontaminated ingredients will usually prevent mold toxin poisoning.

Other Toxic Substances - Quail are susceptible to certain types of seeds, such as those of the croton plant, which may contaminate grain used in producing feeds. Other toxic materials such as insecticides, herbicides, certain minerals and pollutants may also cause an occasional problem.

## Disease Treatment

### Drug Use

Early disease diagnosis and treatment is essential to good management. Contact your state diagnostic laboratory for information about what drugs are approved for use with bobwhite quail. There are situations where periodic use of a specific medication for a specific problem is necessary, but this should occur only under the direction of a competent diagnostician.

### Treatment Administration

Once the problem and the proper treatment have been identified, a decision must be made on how to administer the treatment. Many medications are available as water-soluble powders or liquids and/or as feed additives. Some comments on these methods of treatment follow:

**Water** - Medicating birds through their drinking water is the most practical method of giving drugs, and a response is usually seen in 3 to 4 days. It is *very important* to follow the directions. Never give a heavier dosage than called for--it may do more harm than good. When giving water treatments, always consider the environmental conditions. If the temperature around the birds is warm, they will drink more water and, as a result, receive more medication. Cool temperatures will have the opposite effect on consumption. Many drugs will be inactivated by hard water. Before mixing in antibiotics, it is usually best to acidify water by adding 2.5 ounces of apple cider vinegar per 5 gallons of water. "City" water also has added chemicals that sometimes interact with drugs. Follow the manufacturer's recommendations and/or consult an avian veterinarian.

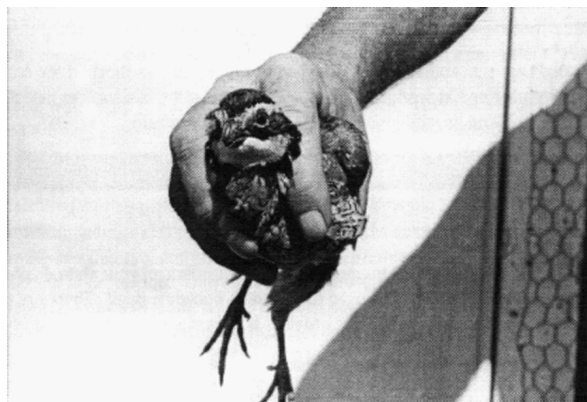
**Feed** - This type of treatment usually takes at least 5-8 days to cause a response. When a long-term medication treatment is prescribed, this is the usual way to administer it.

If a medication program in both feed and water is used, be sure the two treatments are compatible and are not additive or antagonistic.

## Handling Quail

Each time quail are handled, they are stressed and subject to injury. This can cause a loss of production, nonsalable birds and cannibalism. Try not to move the birds under unfavorable weather conditions. When birds must be moved, use transfer boxes that are only 6-7 inches deep. This will limit injuries from jumping and piling. Quail can be driven into transfer boxes or caught with a minnow net. Do not expose boxed birds to extended periods of direct sun in warm weather or to direct drafts in cold weather. Provide an adequate air supply into the transport boxes through ventilation holes.

When handling the individual bird, grasp it with its neck between your first and second fingers and with your thumb and remaining fingers enclosing the body as much as possible (Figure 15). This method prevents the wings from fluttering and allows the legs to hang free. Never handle quail unless absolutely necessary, and never hold a quail by a leg, wing or head.



**Figure 15.** Proper handling will prevent injuries and stress. Enclosing the body with your fingers will prevent the wings from fluttering.

## Releasing Quail

Quail should be released with the intent of recovering them by hunting shortly after release. It is difficult to establish a quail population in the wild by releasing pen-raised quail.

Locating a suitable area for release is important. The main considerations are availability of cover, food and water. Good results are generally obtained by releasing flight-conditioned birds as soon as they

attain adult size and weight, but not earlier than October 1. The highest recovery rate is experienced when releases are made periodically during the hunting season.

Plan to release the birds late in the afternoon so that they will feed and go to roost. A cardboard box 6-7 inches deep and 24 inches square will handle approximately 20 birds. Whatever container is used, it should be shallow, have the top padded and have plenty of small air holes that keep out most of the light. Place the transporting container in the cover area where the birds are to be released. Open only one end, so the birds can walk out. Do not frighten the birds or cause them to scatter. Go back after the birds are out of the box and remove it. In situations where supplemental feed will be provided after release, feeding the same feed in the same feeders used before release is recommended. It may also be necessary to provide supplemental water in some conditions. The birds are usually released in coveys of 15-20 birds.

### Processing

When quail are grown to be processed for meat, they should be slaughtered before six months of age. Younger birds will be more tender and the feathers will be easier to pick.

Birds to be processed can be killed by an outside neck cut and allowed to bleed for one minute. They should then be scalded for 30 seconds at a water temperature of 135°F. Feathers can be picked with small, commercially available, rotary drum pickers. Birds are picked in batches of 15 to 20 birds each, for 15 seconds per batch. After picking, the shanks, heads, and necks are removed and the carcasses are eviscerated, including crop and esophagus, by splitting the back.

Following processing, the carcasses should be chilled overnight in ice water to allow rigor to be completed. This will cause the meat to be more tender. If older birds are processed, it is usually beneficial to chill them overnight in 5 percent salt water (iced) to partially tenderize the meat. The birds can then be prepared fresh or can be frozen for several weeks before cooking.

### Eggs

Quail eggs may be prepared in essentially any form that chicken eggs are used. The flavor is very similar to that of the chicken egg but perhaps slightly more delicate. There is also about 6 to 10 percent more yolk in the quail egg in relation to the remainder of the egg. It has a thin shell but a very thick, strong membrane that must be cut when opening a fresh egg.

Since quail eggs are small, they are used most often in hors d'oeuvres and as snacks. A common form of preparation is pickling. Tested pickling recipes are shown in Table 4. Mix the ingredients in hot water, bring to a boil, then simmer until used.

Before cooking, freshly laid eggs that are to be used for pickling should be held for 24 to 48 hours at room temperature, or for 5 to 7 days in an egg cooler. This will enhance peeling quality. To hard cook the eggs, place them in a pan, cover with cold water, bring the water to boiling, remove from heat, cover and allow to stand at room temperature for 20 minutes. Remove cover and cool the eggs with cold running water. Allow eggs to remain in cold water until removed for peeling. Place peeled eggs in quart jars and pour hot pickling solution over the eggs. Seal jars and cool at room temperature. Store in a refrigerator.

### Acknowledgement

Appreciation is extended to Mr. Walter Walker, the author of the original Clemson University Extension bulletin "Raising Bobwhite Quail for Commercial Use."

**Table 1.** Agencies and Organizations\*.

Agency or Organization	Type of Assistance
State Diagnostic Lab	Game bird health problems, management problems
State Cooperative Extension Service sources	General information, quail literature, management advice
State Fisheries and Wildlife Department	Permits and licensing for rearing and marketing quail; laws and regulations
Local Natural Resource Conservation Service	Assistance with land and natural resource management
Local Agricultural Stabilization Conservation Service (ASCS)	Information regarding payments for wildlife conservation or release
North American Game Bird Assoc., Inc. Dr. Gary Davis North Carolina State University	Information and assistance from national level, promoting the game bird industry to the public
Southeastern Game Bird Breeders and Hunting Preserve Association (Contact North American Game Bird Association for address of current president.)	Marketing, contact with breeders and producers, advertisement, informative meetings
*The agencies and organizations listed here may provide additional assistance. Contact your county office of the Cooperative Extension Service for the addresses of the agencies in your area.	

**Table 2.** Suggested Minimum Space Requirements\*.

	1-10 days	11 days-6 weeks	6-14 weeks
Floor space	4 birds/sq ft	3 birds/sq ft	2 birds/sq ft
Feeder space	0.6 inch/bird	0.6 inch/bird	1.0 inch/bird
Waterer space	0.15 inch/bird	0.25 inch/bird	0.3 inch/bird
*Facilities, equipment, and management will affect space requirements.			

**Table 3.** Diets for Bobwhite Quail.

Ingredients	Composition (%)		
	Starter (0-5 weeks)	Grower (5-8 weeks)	Breeder
Yellow Corn Meal	43.42	64.45	56.77
Soybean Meal (48.5%)	48.64	31.34	31.84
Dyna Fos (18.5% P; 22% Ca)	1.36	1.67	2.86
Ground Limestone	0.66	0.56	5.92
Animal Fat	4.92	1.00	1.71
Iodized Salt	0.40	0.40	0.40
Micro-ingredient Mix <sup>1</sup>	0.50	0.50	0.50
Methionine	0.08	0.08	_____
Bacitracin MD <sup>2</sup>	0.02	_____	_____
Protein <sup>3</sup> (%)	27.40	20.80	20.30
Met. Energy <sup>3</sup> (kcal/kg)	3047	3051	2854
(kcal/lb)	1385	1387	1297
Calcium <sup>3</sup> (%)	0.68	0.67	2.96
Phosphorus <sup>3</sup> (% total)	0.68	0.67	0.88

<sup>1</sup>Supplies per kg of diet: vitamin A, 6600 IU; vitamin D<sub>3</sub>, 2200 ICU; vitamin E, 11 IU; menadione dimethylpyrimidinol bisulfite (MPB), 2.2 mg; riboflavin, 4.4 mg; pantothenic acid, 13.2 mg; niacin, 59.6 mg; choline chloride, 998.8 mg; vitamin B<sub>12</sub>, 22 mcg; biotin, 0.11 mg; ethoxyquin, 0.0125%; manganese, 60 mg; iron, 50 mg; copper, 6 mg; cobalt, 0.198 mg; iodine, 1.1 mg; zinc, 60 mg.

<sup>2</sup> Bacitracin MD may be added to the finished diet at 50 to 200 grams per ton activity (preventative or treatment) as necessary.

<sup>3</sup> Calculations based on 1983 International Mineral Co. table.

**Table 4.** Recipes for Pickled Quail Eggs (1 Quart)<sup>a</sup>.**Kansas Spicy Eggs**

- 1 1/2 cups apple cider
- 1 cup white vinegar
- 2 teaspoons salt
- 1 teaspoon mixed pickling spice
- 1 clove peeled garlic
- 1/2 sliced onion
- 1/2 teaspoon mustard seed

**Dilled Eggs**

- 1 1/2 cups white vinegar
- 1 cup water
- 3/4 teaspoon dill seed
- 1/4 teaspoon white pepper
- 3 teaspoons salt
- 1/4 teaspoon mustard seed
- 1/2 teaspoon onion juice
- 1/2 teaspoon minced garlic

**Sweet and Sour Eggs**

- 1 1/2 cups apple cider
- 1/2 cup cider vinegar
- 1 package (12 oz.) red cinnamon candy
- 1 tablespoon mixed pickling spice
- 2 teaspoons salt
- 1 teaspoon garlic salt

**Red Beet Eggs**

- 1 cup red beet juice
- 1 cup cider vinegar
- 1 teaspoon brown sugar
- a few small canned red beets

<sup>a</sup>Maurer, A.J., 1972. Pickled eggs - A novel snack. Cooperative Ext. Prog., Univ. Wisconsin, Ext. Fact Sheet A 2455.