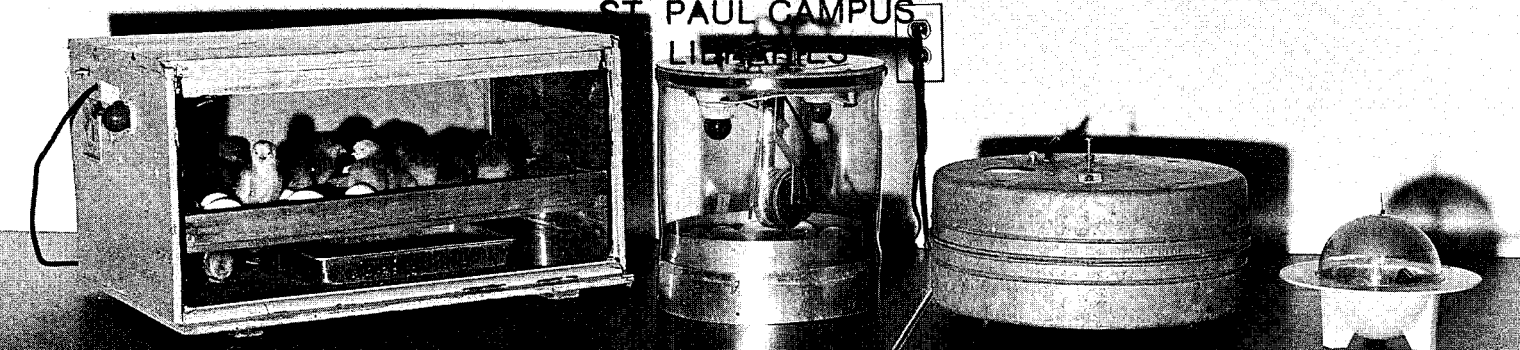


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## Hatching And Brooding Small Numbers Of Chicks

—By Melvin L. Hamre, extension poultry specialist

This publication is designed to help farmers, science teachers, and students incubate and brood small numbers of chicks. The information applies, in general, to most other commonly incubated poultry and game bird species.

Your county extension agent and extension poultry specialists can provide additional information.

### Hatching and brooding small numbers of chicks

An incubator is an enclosure having controlled temperature, humidity, and ventilation.

The information in this extension folder is a guide for the general operation of a small, still-air incubator.

Small incubators can be purchased, or you can make your own. If you have a commercial model, follow the instructions supplied with the unit. If the instructions have been lost, write to the manufacturer for a new set giving the model number and a complete description of the incubator.

### Obtaining hatching eggs

Most eggs sold in stores are not fertile and cannot be hatched. Fertile eggs must be ordered from hatcheries or from poultry farmers having roosters in their flocks. Check with potential suppliers well in advance. Your county extension agent or extension poultry specialist may be able to suggest a source.

Hatching eggs should be incubated within 1 week to 10 days after they are laid. Hatchability declines rapidly when incubation is postponed for more than 10 days. Until they are incubated, hatching eggs should be stored in cartons or cases—large end up—at 40 to 70° F. (50-60° F. is best) with a relative humidity of about 75 percent. If the eggs are to be stored for more than 2 to 3 days before they are incubated, their positions should be changed each day to reduce the tendency for the yolks to stick to the shells. Begin by propping up one end of the case or carton; each day, change the

position of the block, or turn the container end for end. If you can have your eggs supplied within 1 or 2 days before you incubate, you eliminate these procedures.

### Location of incubator

To help your incubator maintain a constant temperature, place it where it will receive as little temperature fluctuation as possible. Do not place it near a window where it will be exposed to direct sunlight. The sun's heat can raise the temperature high enough to kill the developing embryos. Connect the unit to a dependable electrical source, and make sure the plug cannot be accidentally detached from the outlet.

### Preparing the incubator

Before you incubate, be sure the incubator is working properly and that you know how to operate it. Place warm water into the humidity pan, and adjust the heat source until the incubator temperature stays between 99° and 102° F. Check the thermometer frequently for at least 24 hours before you incubate to be sure it will stay at the correct temperature.

Heat sources having a thermostat are most reliable. Light bulb units without a thermostat can be difficult to control unless the room temperature is relatively constant.

Occasionally, people attempt to incubate eggs in ovens or other unconventional facilities. They are nearly always disappointed because temperature and humidity requirements are within a quite narrow range.

Even with good equipment, incubation is not always successful, so make every attempt to provide the proper environment—using a reliable incubator.

When eggs are placed into an incubator operating at the proper temperature, the temperature will drop. Do not adjust the thermostat upward during this warmup period. The time that the temperature in the unit will remain below normal depends upon the temperature of the eggs and the capacity of the heating unit. This temperature lag period can be reduced by warming the eggs to room temperature before they are placed into the incubator.

## Incubator operation

**Temperature**—Maintain the temperature in the 99-102° F. temperature range (100-101° F., if possible). Place the thermometer to measure the temperature at a level at or slightly above where the center of the egg will be. Overheating the embryo is much more damaging than is underheating it; overheating speeds up embryo development, lowers the percentage of hatchability, and causes abnormal embryos. Although a short cooling period may not be harmful, longer periods of low temperatures will reduce the rate of embryo development. Excessively low temperatures will kill the embryos. Avoid temperatures outside the 97-103° F. range. If the temperature remains beyond either extreme for several days, hatchability may be severely reduced.

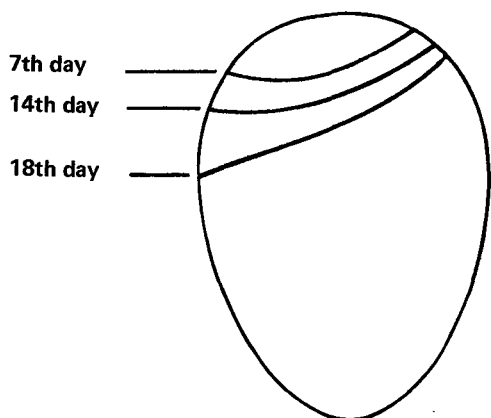
**Humidity**—The moisture level in the incubator should be about 50 to 55 percent relative humidity, with an increase to about 65 percent for the last 3 days of incubation. Moisture is provided by a pan of water under the egg tray. The water surface should be at least half as large as the surface of the egg tray. Add warm water to the pan as necessary. If more humidity is needed, increase the size of the pan or add a wet sponge. Humidity adjustment can also be made by increasing or decreasing ventilation.

Using a wet bulb thermometer, you can determine relative humidity from this chart:

Temp. ° F.	Wet bulb reading in still-air incubator					
100	81.3	83.3	85.3	87.3	89.0	90.7
101	82.2	84.2	86.2	88.2	90.0	91.7
102	83.0	85.0	87.0	89.0	91.0	92.7
Relative Humidity, %	45	50	55	60	65	70

If a wet bulb thermometer or hygrometer is not available, the size of the air cell in each egg can be used to estimate whether the humidity should be increased or decreased (see candling instructions). The air cell increases in size during incubation at a rate that depends on temperature and humidity as moisture evaporates from the egg. The drawing shows the normal size of an egg's air cell at 7, 14, and 18 days of incubation.

Size of the air cell in the egg on the 7th, 14th, and 18th day of incubation



**Ventilation**—Ventilation is adjusted by increasing or decreasing openings in the sides or top of the incubator. Normal air exchange is needed during embryo development and should be increased as the chicks begin to hatch. The embryo needs oxygen and produces carbon dioxide. However, the correct relative humidity must be maintained until most of the chicks are out of their shells. Do not open the incubator unless necessary during the last 3 days of incubation.

**Turning**—The eggs should be placed into the incubator on their sides. Turn them at least 3 times a day, except for the last 3 days when they don't need turning. Turn the eggs an odd number of times so the position that is up the longest (at night) will be changed from day to day. Mark the date or an "X" on each egg so you can tell if the eggs have been turned. When you turn the eggs, move them to a different part of the tray to minimize the effects of temperature variation in the incubator. If the eggs are not placed on their sides, they should be placed at an angle so the small ends are in the downward position. Weekends often pose a problem for teachers incubating eggs at school. They sometimes take the incubators home (placing the eggs into egg cartons and wrapping them to keep them warm when traveling back and forth), especially the 1st weekend. Some teachers have found leaving incubators unattended during 2-day weekends has had little effect. Often the effect of not turning the eggs may be much less than that of the jostling, jarring, and possible temperature changes involved in taking the eggs home.

## Getting ready for the hatch

When the eggs are last turned, 3 days before hatch, place a layer of crinoline or cheesecloth on the screen under the eggs. It will make cleaning the incubator easier after hatching.

Most chicks should hatch within a 24-hour period. Late-hatching chicks may lack vigor or be abnormal. After the chicks have dried and fluffed up completely, they can be removed from the incubator. When most of the chicks have hatched, you can lower the incubator temperature to about 95° F. if the chicks are to be kept in the incubator for 1 or 2 days. Plan ahead for what you will be doing with the chicks. (Students will be concerned about what you do with the chicks.)

Clean the incubator after the hatch, so it will be ready for the next time. Sanitation is an important part of incubating. Remove and dispose of the crinoline or cheesecloth, together with the shells and other remains. Clean the inside of the incubator with soap and water, and let it dry completely before putting it away.

## Length of incubation

Approximate incubation periods for commonly hatched poultry and game bird species in small incubators are:

Species	Days
Chicken	21
Most ducks	28
Muscovy ducks	33-35
Turkey	28
Most geese	29-31
Ringneck pheasant	23-24
Japanese quail	17-18
Bobwhite quail	23
Chuckar partridge	22-23
Guinea	26-28
Peafowl	28

These times may vary slightly, depending upon incubation temperature, genetic differences, and other factors.

The success rate in hatching eggs is quite variable. Chickens and some upland game bird species are much easier to hatch than are many waterfowl species. Even commercial hatcheries having specialized equipment may not have more than an 80 percent success ratio. Goose eggs can be particularly difficult to hatch. So don't be disappointed if your hatch is not highly successful. Get as high-quality supply of hatching eggs as possible, provide an incubator that can provide a good environment, and then pay close attention to the operating procedures.

Recommendations for chicken eggs generally apply to hatching eggs of other species. However, waterfowl require greater humidity. Increase the incubator humidity by using a larger water pan. Some hatcheries sprinkle waterfowl eggs with lukewarm water every other day after the 1st week. "Candle" the eggs to remove those not showing proper embryo development, since such eggs will rot quickly and may explode in the incubator.

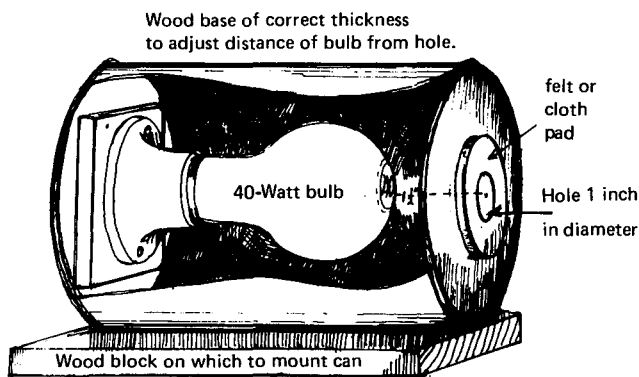
### Candling the eggs

"Candling" is the examination of the contents of the eggs using a shielded light in a darkened area. Eggs should be checked for development; then, if fertility is poor, you do not have to wait the entire incubation period to learn you are going to have a poor hatch. Candling to check air cell size can determine incubator humidity. You can also observe the development of the embryo.

You can make an egg candler from a wood or metal box or from a container in which you mount a 40-watt light bulb. Make a 1-inch hole in the end near the bulb. For better viewing, place a felt or cloth cushion around the opening so an egg fits the opening better and so light does not leak around the egg.

Hold the large end of the egg up to the candling light. You won't see much development until the 4th or 5th day of incubation. White or light-colored eggshells permit better view-

**This egg candle can be made from a tin can that's about 5 inches in diameter and 7 to 9 inches long (A shortening can with an easily removable lid works well)**



ing of embryo development. The contents of the egg have a pinkish color or cast when the embryo is developing properly. As the embryo grows, it occupies most of the space within the shell. Toward the end of incubation, the contents will appear dark except for the air cell. Eggs that appear clear at 4 to 5 days in incubation or that show little development at 10 days should be removed from the incubator. They are infertile or contain early dead embryos.

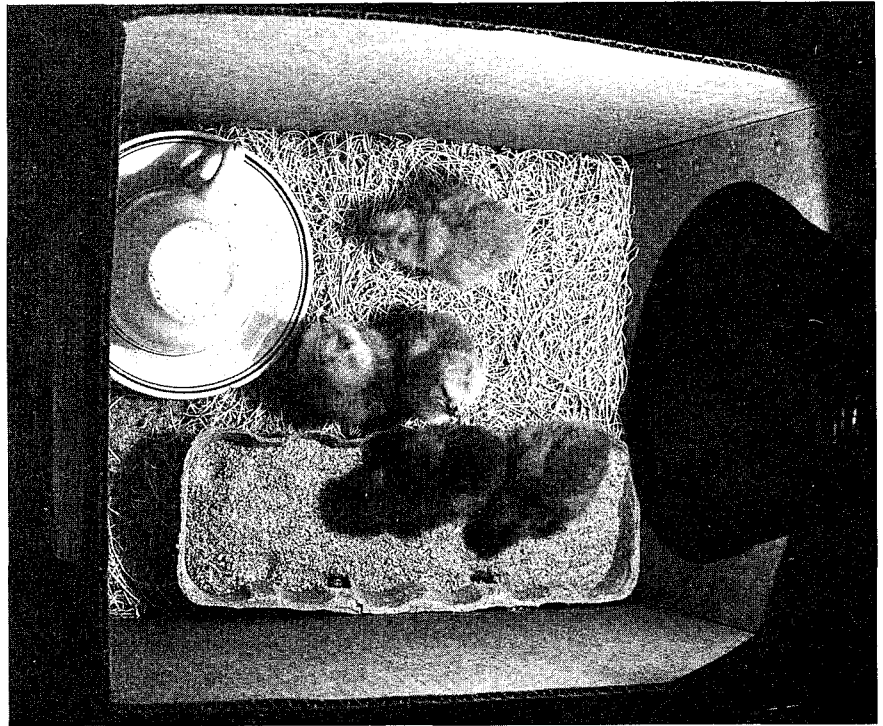
Candling will not influence embryo development if you handle the eggs gently. When eggs are removed from the incubator only a few times and are not allowed to cool to any extent, candling makes little difference in hatchability or the time required for hatching.

### Problem-solving

There are many reasons for poor hatches. Breeding, feeding, and management of the egg production flock; care of the eggs before incubation; and the incubation environment: these all can influence the hatch. Possible causes for some of the more common problem symptoms are listed here.

Symptoms	Possible cause
<b>Eggs candling clear</b> No blood rings or embryo growth.	<ol style="list-style-type: none"> <li>1. Eggs from a flock having no roosters.</li> <li>2. Poor flock management.</li> <li>3. Eggs stored below 40° F. or which were too old before setting.</li> </ol>
<b>Eggs candling clear</b> But showing blood or very small embryos on breaking.	<ol style="list-style-type: none"> <li>1. Incubator temperature too high.</li> <li>2. Eggs stored below 40 or above 80° F. before setting.</li> </ol>
<b>Dead Embryos</b> Before hatching time.	<ol style="list-style-type: none"> <li>1. Eggs haven't been turned at least 3 times a day.</li> <li>2. Lack of ventilation.</li> <li>3. Incubator temperature set too high or too low.</li> <li>4. Breeder flock having poor hatchability or fed inadequate ration.</li> </ol>
<b>Eggs pipped but not hatched</b> (Chick pecks hole through shell) Chicks dead in shells.	<ol style="list-style-type: none"> <li>1. Low average humidity.</li> <li>2. Low average temperature.</li> <li>3. Low humidity at hatching time.</li> <li>4. Excessive high temperature for short period.</li> </ol>
<b>Sticky chicks</b> Shells sticking to chicks.	<ol style="list-style-type: none"> <li>1. Low average humidity.</li> <li>2. Low average temperature.</li> <li>3. Low humidity at hatching time.</li> <li>4. Excessive high temperature for short period.</li> </ol>
<b>Hatching too early</b> With bloody navels.	<ol style="list-style-type: none"> <li>1. Temperature too high.</li> </ol>
<b>Delayed hatch</b> Eggs not pipping until 21st day or later.	<ol style="list-style-type: none"> <li>1. Temperature too low.</li> </ol>
<b>Draggy hatch</b> Some chicks hatch early, but hatch is slow in finishing.	<ol style="list-style-type: none"> <li>1. Temperature too high.</li> </ol>
<b>Crippled chicks</b>	<ol style="list-style-type: none"> <li>1. Abnormalities in development.</li> <li>2. Poor nutrition of hens.</li> <li>3. Incubator temperature too high.</li> </ol>

Here's a simple home for chicks for a few days.



#### Care of chicks

Newly hatched chicks must be kept warm and free from drafts, be properly fed and watered, and be protected from predators. If you plan to keep the chicks for a long time, consult references for care and management information. See AG - FS - 1188, "The Small Flock for Poultry Meat" or AG - FS - 1191, "Rearing Chicks and Pullets for the Small Laying Flock." These are available from your county extension agent or from 3 Coffey Hall, University of Minnesota, St. Paul, MN 55108. If you want to raise a small number of chicks for only a few days, you can care for them in a simple enclosure and with a minimum of equipment.

A cardboard box can be a satisfactory home for up to 12 chicks. The size and shape of the box is not too important as long as it provides enough space for the chicks and the equipment to feed and water them. A 2 x 2½ foot box 12-15 inches high is adequate. A screen or wire mesh should cover the box to restrict handling and to protect the chicks from cats and other predators.

The sides of the box provide adequate protection from drafts. The 1st week, keep the temperature at the level of the chicks at 90-95° F. Reduce the temperature about 5 degrees per week until room temperature is reached. It is best to use a thermometer to measure the temperature, but the actions of the chicks can also be a guide. When the chicks are cold, they bunch up and give a distressed "cheep." When they are too warm, they stand apart with their beaks open, and their throats may have a pulsating or panting motion. In most rooms, a light bulb placed over the box will provide enough heat. A gooseneck study lamp with a 60- or 75-watt bulb works well. The neck of the lamp can be adjusted to provide more or less heat. If necessary, cut a slit in the side of the box so the base

of the lamp can remain outside the box, with the gooseneck of the lamp fitting in the slit and the lampshade placed inside the box.

About 2 inches of litter material give the chicks better footing and help keep the box clean. Wood shavings, chopped straw or paper, peat moss, or sand are suitable. Replace the litter when necessary to keep the box clean and dry.

Waterers to be used with pint canning jars are often available at farm supply stores. They should be placed onto a wooden block to help keep them free from litter. A small dish—with marbles or pebbles added to keep the chicks out of the water—can be used for a waterer. You can also use a saucer having an inverted cup placed over it. Replace the water twice a day, or more frequently if necessary to keep the water clean and fresh. Clean the waterer each time you make the change, and refill it with lukewarm water.

Although chicks don't need feed or water the first 48 hours after hatching, both are usually provided as soon as the chicks are transferred to the rearing box. Use a small box or tray for a feeder. Let the chicks scratch around in the feed for the first few days so they get off to a good start on the feed and don't eat too much litter.

Chicks are best started on a chick starter mash. For other poultry, use the appropriate starter feed for that species of bird, if available. Mashed, hardcooked egg also makes an excellent starter feed. You can use breakfast cereal for a few days if it is in a form the chicks can readily eat. Rapidly growing chicks must have a well-balanced starter diet for proper growth and development.