INCUBATING EGGS IN A DRY CLIMATE

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To Increase the Efficiency of the Hatch in the Arid Southwest Would be to Place the Dry Climate Under a Degree of Control of Which Moisture, Ventilation, and Cooling are Limiting Factors.

ARTIFICIAL incubation of hen eggs has been practised since time immemorial. Ruins of mammoth incubators having ninety thousand egg capacity stand up in Egypt today as a symbol of the development of artificial incubation reached by the Ancient Egyptians. The French and English incubated eggs artificially as early as in the eighteenth century. American experimentors paved the way for our modern incubators back in the "70's". The strides taken in the development of modern commercial incubators have been tremendous for the past twenty years, during which time artificial incubation has been raised to a practical science.

Unfortunately the modern commercial incubators are manufactured in the more humid districts without regard to the vital problems that confront the people of the dryer sections. There is no such thing as a dry climate incubator. However, some makes of incubators come more nearly meeting the requirements of our climate than others. While the purpose of this article is not to recommend any particular make of machine, it can be wisely said that we should purchase those tried machines which are giving results in our district and beware of those with which we are unfamiliar.

In a dry climate as found in Arizona, where the mean relative humidity hangs well around 42% compared to a mean relative humidity of 70% to 80% in the humid sections of the United States, the evaporation of the moisture content of incubating eggs becomes a serious problem.

To those who do not have a clear understanding of the meaning of relative humidity, I may say simply, that relative humidity is the actual amount of water in the air, at a given temperature, compared with the largest amount it could possibly hold, which would be 100 per cent. When air contains all the water possible, it is said to be saturated, and at this point evaporation ceases. The further the air is from saturation the more rapidly evaporation occurs. Consequently, we should attempt to keep up the relative humidity of the egg chamber, thus controlling the evaporation of the eggs as much as possible. Professor Harry R. Lewis found that under Massachusetts conditions in a cellar having a relative humidity of 60 per cent, the hatch was increased when moisture was added to the egg chamber by means of sand trays. Professor Lewis states, "It is doubtful whether the humidity can be kept too high." Professor W. A. Lippincott makes the general statement, "At the same time that the eggs are put in, moisture should be supplied". There is very little danger of ever getting too much humidity if ventilation is properly regulated.

Ventilation is closely related to evaporation. The more we open the vents the more we increase evaporation, and as we close the vents we retard evaporation. The only reason for ventilating an egg chamber during the period of incubation, is to provide oxygen for the developing chick and to provide means of discarding refuse gases liberated by the chick. Thus, we have two opposing factors, particularly in our dry climate; one of too much ventilation, and one of too little ventilation.

The question now arises, "How much ventilation is the proper amount?" Because of the fact that all incubators have different arrangement for ventilation there could be no set rule for providing the proper amount of ventilation for all makes of machines. An approximate rule would be to provide just enough air to supply sufficient oxygen to secure normal development of the chick and to adequately displace refuse gases. Any more than this in our dry climate means a sacrifice of moisture. To learn to control ventilation would mean to closely study and observe some of the peculiar effects of ventilation and evaporation.

With the use of a hygrometer we are able to ascertain the relative humidity of the air. The hygrometer actually determines the amount of moisture held by air of incubator cellar or by air in egg chambers. This is an index to amount of ventilation to provide as well as the amount of moisture to supply. Next we have the increase in size of air cell of egg which acts quite efficiently as a gauge of ventilation and evaporation. The air cell of an egg is about one eighth of an inch in depth when first placed in the incubator. It should be about three eighths of an inch in depth on the seventh day, about five eighths on the fifteenth day, and about six eighths on the nineteenth day. Too much evaporation at end of hatch is detected by chicks drying in shell, hence giving a high rate of mortality in shell. Not enough evaporation at end of hatch is ascertained by chicks coming out soupy with an offensive odor.

Cooling eggs during incubation period is closely related to ventilation and evaporation. Cooling has been an attempt of man to substitute cooling periods in nature when hens leave nest. Hens leave nest to seek food and not to cool eggs. The practical reason for cooling eggs is to supply oxygen and to displace refuse gases. When cooling, the contents of the egg contracts, thus taking in fresh air and discarding the old through the pores of the shell.

The modern incubators of larger sizes require no cooling of eggs during the period of incubation. Oxygen is supplied and refuse gases are displaced by adequate means of ventilation. A great number of the smaller machines are inadequately ventilated. When this is found to be true, cooling must be substituted for ventilation.

While conducting experimental work on cooling at the University of Arizona incubator cellar, using a machine inadequately ventilated, the writer secured best results from eggs cooled thirty minutes daily at a temperature ranging from 65 to 70 Fahrenheit. The amount of cooling required varies from one make of machine to another. Hence, the operator should study his particular machine with due regard to ventilation and evaporation.

The statement was made in a preceding paragraph that the further the

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air is from moisture saturation the more rapidly evaporation occurs and the more saturated the air the less rapidly evaporation occurs. Hence, the main reason for applying moisture to egg chamber in the incubator cellar is to retard evaporation of the moisture content of the eggs by keeping the surrounding air somewhat saturated with moisture. Besides controlling evaporation, applied moisture aids the hatch considerably by dissolving much of the carbon dioxide which is continuously eliberated by the eggs. This weakens the shell materially, thus allowing chick to break out of the shell much easier.

The first point of attack in applying moisture should be the room in which the incubator is operated. The best type of room is a cellar having sand on the floor which can be kept thoroughly moist. Water evaporates more rapidly from a sand surface than from a free water surface. Sand increases the surface of the floor which in turn increases evaporation. The floor should be sprinkled frequently during each day of the period.

The ventilation of the room should be kept down to a reasonable degree. The best gauge of ventilation is the degree of sweetness of the air, that is, ventilation should not be reduced to such a degree that the air would become impure. If too much ventilation is provided the moisture of the room will be lost to the outside air. The proper amount of ventilation for the incubator room as well as for the egg chamber, should be just enough to discard refuse gases and to supply a sufficient amount of oxygen to the developing embryo. Any more ventilation means an increase in evaporation of the moisture content of the eggs.

The best method of keeping up moisture supply in the egg chamber of the incubator is by means of placing a moist sand tray beneath the egg tray, as evaporation is greater from a sand surface than from a water surface. While conducting experimental work at the University of Arizona incubator cellar the writer found that the loss of weight due to evaporation averaged 12.2 per cent per egg during incubation in an incubator provided with a moist sand tray, whereas the loss was 15.4 per cent per egg in a machine provided with a pan having free water surface.

If a sand tray is not accessible, the eggs should be sprinkled as often as necessary during the period of incubation to maintain the proper rate of evaporation of the contents of the egg. The air cell should be watched with due regard to evaporation. Be careful not to open the doors of the machine while chicks are breaking out of the shell as this would mean a loss of moisture. At this period the remaining moisture must be conserved, because of the danger of the chick drying and sticking to the shell, thus increasing mortality of chicks in the shell. If the air cell is large at the end of the hatch, sprinkle vigorously when closing the machine for the hatch. If chicks are dry and sticking to the shell try steaming with a warm towel.

Controlling moisture in our dry climate should be reduced by the operator to problems of moisture, ventilation, and cooling, using the degree of evaporation as his gauge.