Chickens in Hot Weather

effects of high air temperatures and methods of cooling poultry houses under study

Wilbor O. Wilson

The chicken is a nonsweating animal. It maintains a high body temperature of 106° F to 107° F.

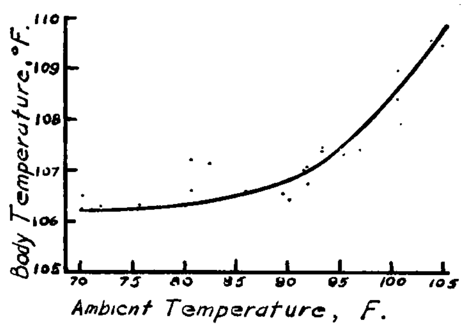
It is possible to lower the hens body temperature 30° below normal before death occurs, yet body temperature only six to eight degrees above normal results in death. This indicates that the hen is living near the top of her temperature range. At air temperatures of 80° F the body temperature of the hen starts to rise and by the time air temperature reaches 100° F to 105° F the hens begin to die of heat prostration. This rise may be observed in the accompanying graph. The data for the graph were obtained from hens kept in a climatic chamber at Davis.

Certain sub-lethal air temperatures have harmful effects. Even at as low a temperature as 70° F there is a slight reduction in egg size and the shells become thinner. It is not until a higher temperature is reached—80° F—that this difference becomes noticeable. An increase in water consumption occurs when the air temperature reaches 75° F and above this the droppings become watery.

The hens begin to pant at about 80° F in an effort to keep down their body temperature. In spite of these efforts the body temperature starts to rise. Feed consumption is reduced at this point. Hens begin to lose weight when exposed for a period of time to temperature in excess of 80° F. One of the major factors involved in the summer decline of egg production appears to be temperature.

In sweating animals the heart has an increased load in hot weather because the blood is sent to the capillaries near the surface for cooling. In chickens there is no such mechanism for cooling. In fact, the heart rate is decreased by temperatures of 85° F and over. The heart rate is used in studies because it is a sensitive indicator of physiology-on-the-whole.

Egg production is decreased by continuous exposure to 90° F air temperatures. There is a breed difference in this susceptibility. The heavy breeds such as New Hampshires and R. I. Reds are more susceptible than White Leghorns. A difference of about 10 degrees in susceptibility to heat has been observed in experiments when Leghorns did not show a decline in egg production until the temperature reached 100° F.



Body temperature of hens at various environmental or ambient temperatures.

When the air temperature reaches and remains for eight hours or more at 100° F some hens will die from heat prostration. The overly fat birds seem to be the hardest hit. If air temperature is increased to 105° F the time required for death to occur is much less. High humidity aggravates the effect of high temperature. The observations reported here were obtained at relative humidities below 50%.

The physical reaction of the hen to 70° F and 100° F are shown in the illustration. At 100° F the hens are visibly distressed; they pant and have increased respiration. Their water consumption is increased by 35%. The wings are held loosely from the body and the hens lie on the floor with their wing on the underside raised in an attempt to cool themselves.

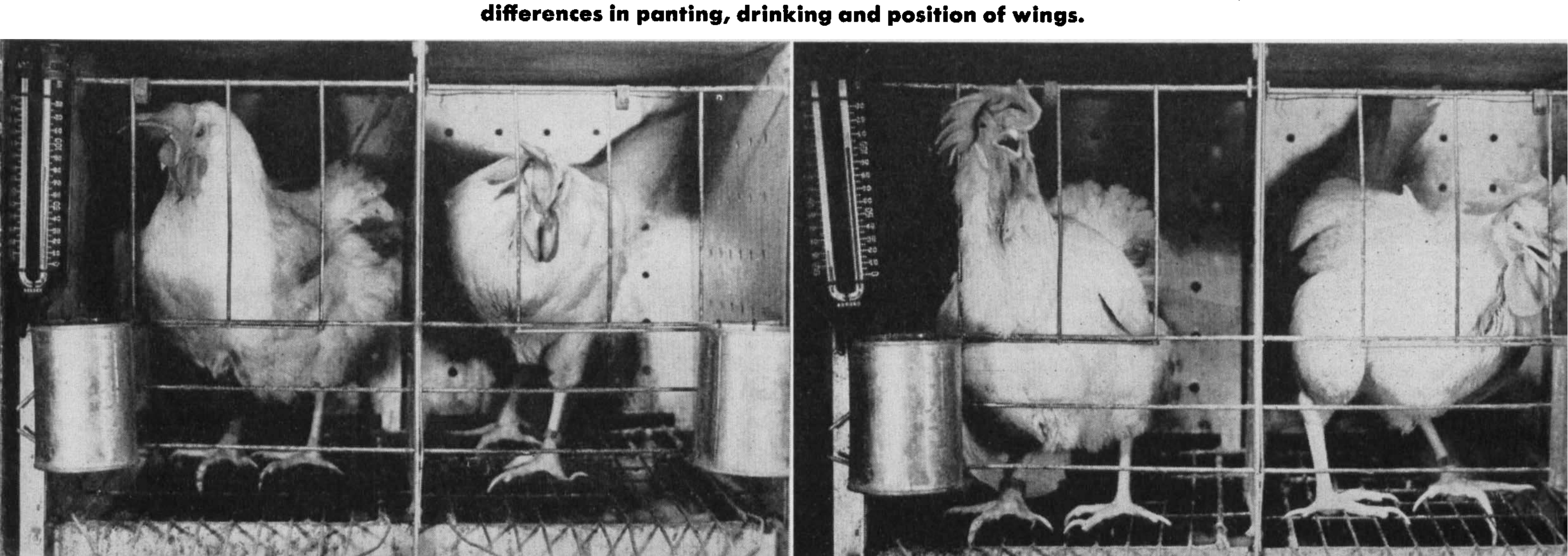
Air movement may or may not help to reduce the effect of high temperature on hens. Generally, if the air temperature is below 100° F increasing air movement appears to be beneficial. Above this temperature the deleterious effects are accentuated by increasing air movement. More work needs to be done on this phase.

The problem that faces the poultryman is to keep feed consumption up and temperature down. Experiments were conducted on the feeding of iodized casein as a means of preventing a decline in egg production due to high temperatures. It has been reported by research workers in other states that iodized casein was beneficial but that was not confirmed in experiments at Davis.

The effect of dubbing—the removal of combs and wattles—was investigated to see if it would influence the birds' ability to withstand high temperature. No differences were observed. It is all right to dub birds if dubbing is needed for other reasons.

Continued on page 15

Hens exposed to different environmental temperatures in the climatic chamber. *Left* 70° F and *right* 100° F. Note differences in panting, drinking and position of wings.



CHICKENS

Continued from page 11

The houses need to be cooled when the air temperature reaches 90° F if egg production is to be maintained and to prevent losses. Birds kept on wire are more susceptible to high air temperature than birds kept on the floor. Commercial poultry raisers cool their houses by using roof sprinklers. A mist spray is also used by some growers inside the house. This is for the purpose of cooling by evaporation. The efficiency of the cooling is increased by air movement.

Trials were conducted at Davis and in the Imperial Valley with evaporative coolers. It was found that the house could be effectively cooled by this method. The hens were more comfortable; laid a few more eggs than did hens in the uncooled houses. The expense of buying and operation should be paid for by increase in the number of eggs and/or the number of birds kept alive. In some years at Davis the expense seemed to be justified while in other years it did not.

The spray method of cooling poultry houses is to be recommended instead of the use of evaporative coolers. Further investigation is needed before unqualified recommendations can be made.

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The experiments with evaporative coolers were conducted by Professor V. S. Asmundson of Poultry Husbandry, Davis, and J. R. Tavernetti, Associate Agricultural Engineer in the Experiment Station, Davis.

GRAPES

Continued from page 10

which fail to set is complete. A delay in thinning of only a week to 10 days will reduce the increase in berry size a third or more.

Berry thinning must usually accompany the girdling of Thompson Seedless to avoid overcompactness of cluster. With the great increase in size of berry on girdled Thompson Seedless vines, clusters of 200 to 250 berries are large enough.

Cluster thinning consists in the removal of cluster after bloom—after the berries have set. It does not influence the number of berries on the retained clusters but does improve quality through greater uniformity of size and better coloring. Therefore it is useful on varieties that set well-filled clusters, such as Emperor, Malaga on light soils, and Rish Baba.

Irregular, oversized, and undersized clusters should be removed in order to produce uniform, nicely shaped, properly matured clusters.

The thinning should be carried out as soon as the berries have set—seven to 10 days after full bloom. The time of thinning is especially important in order to obtain the largest possible increase in the size of berry.

Under certain conditions Ribier may require only cluster thinning. Where Emperor produces clusters with long, straggly tips these should be cut off, which would be berry thinning. On some soils Emperor may set clusters that are too loose, and flower-cluster thinning would be appropriate.

Careful observation from year to year, however, should enable any grower to select the proper method of thinning. When the proper method of thinning is carried out skillfully, it not only improves quality, but actually increases the marketable crop.

Girdling

Girdling consists in removing a complete ring of bark about three-sixteenth inch wide from the trunk, arm or cane below the fruit it is intended to affect. As a result, the carbohydrates elaborated in the leaves will accumulate in the parts above the girdle, including the fruit, and will influence its development.

The effects to be achieved by girdling determine the time of girdling. Thus, if the girdling is to increase size of berry of Thompson Seedless, it must be done when the berries are beginning to grow most rapidly—one-eighth to three-sixteenth inches in diameter. If it is to hasten coloring and maturing it must be done at the beginning of ripening.

Properly timed and executed girdling accompanied by proper thinning has regularly increased the size of Thompson Seedless berries from 50% to 100%.

The berry size of seeded varieties such as Ribier and Malaga is influenced very little by girdling. The coloring of Red Malaga and Ribier can usually be hastened by girdling when the color first appears. The rate of ripening of most seeded varieties may be accelerated.

In the early producing sections the advance in coloring and maturity of Ribier and Red Malaga may be of great value. The girdling of these varieties is of questionable value elsewhere, since the color and maturity are normally advanced only a few days.

To obtain the best results, the vines must be carrying relatively light crops—not as heavy as girdled Thompson Seedless in the same area. A girdled Thompson Seedless vineyard should not carry more than two-thirds as much fruit as would be brought to normal maturity without girdling.

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SOILS

Continued from page 8

bon dioxide—and complete ionization of the carbonic acid—distilled water would have a pH of approximately 6.7. As it requires only .13 of a pound of sulfuric acid to change an acre foot of distilled water from pH of seven to six, the concentration of carbonic acid in distilled water under atmospheric conditions is extremely small.

If the atmosphere or the gas surrounding the water is made up entirely of carbon dioxide, then solubility of the gas will be much greater. At 68° F, 1,000 grams—2.2 pounds—of water will contain 1.688 grams—.17%—of carbon dioxide and with complete ionization of the carbonic acid it would reduce the pH to approximately 4.3. As ionization is not complete, it is questionable whether pH would be reduced below five.

The principal buffers in most of the California irrigation waters pumped from wells are the carbonate salts of calcium, magnesium and sodium. An equilibrium or balance is established between the carbonate, the bicarbonate of these salts, carbonic acid, and the carbon dioxide of the air. As these bases—calcium, magnesium and sodium—are strong and the carbonates are weak acids, the irrigation waters are usually alkaline with an equilibrium pH value between 7.5 and 8.5.

The addition of carbon dioxide by saturating the air in or around the water will increase the carbonic acid content and lower the pH of the water but it is necessary to maintain the carbon dioxide atmosphere over the water or the pH will gradually rise to its original value and in equilibrium with the carbon dioxide of the air.

A water in equilibrium with an atmosphere of 12% carbon dioxide will form sufficient carbonic acid to reduce the pH from one to 1½ units provided the water is near neutral and nearly complete ionization occurs. This represents less than one pound of free carbonic acid per acre foot of water.

High concentrations of acid in the irrigation water will be deleterious to concrete pipe and corrosive to irrigation equipment. Even though the water has sufficient buffering capacity to neutralize the acid, the temporary acidity will be sufficient to ruin irrigation equipment. It is good judgment not to add any acids or acid forming materials to water that will be run through irrigation equipment.

The above discussion indicates that with the high buffering capacity in many California irrigation waters, large additions of acid will be required before the water is acid enough to add an appreciable amount to the soil.

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