EDUCATION AND PRODUCTION

Air Velocity and High Temperature Effects on Broiler Performance

B. D. LOTT, J. D. SIMMONS, and J. D. MAY

USDA, Agricultural Research Service, South Central Poultry Research Laboratory, Mississippi State, Mississippi 39762

ABSTRACT Three trials, using a total of 1,320 male broilers, were conducted to study the effect of air velocity at 125 m/min on body weight gain and feed:gain. The broilers were placed on litter in pens in a wind tunnel or on litter in floor pens with conventional cross ventilation when 4 wk old. Except for air velocity, the conditions in the floor pens and the tunnel were the same. In Trials 1 and 2, only nipple waterers were used. In Trial 3, one-half of the pens on the floor and one-half of the pens in the tunnel were equipped with trough waterers; the remaining pens were equipped with nipple waterers. When compared with conventional ventilation, tunnel rearing improved body weight gain and feed:gain in all three trials. In Trial 3, waterer type did not significantly affect body weight gain or feed:gain in the tunnel. However, body weight gain and feed:gain were reduced in floor-reared birds using nipple waterers as compared with birds using trough waterers. The increased panting of the conventionally ventilated birds, as compared with the tunnel-ventilated birds, may have contributed to their decreased body weight gain and improved feed:gain. The lower body weights may occur because of the difficulty the birds experience when drinking from nipples while panting.

(Key words: tunnel, ventilation, broiler, weight, gain)

INTRODUCTION

Tunnel-ventilated poultry houses are replacing conventional, trough, curtain-sided houses in the southern U.S. Tunnel ventilation is an arrangement in which ventilating air is drawn into one end of the house and exhausted at the other end. The air velocity in a tunnel-ventilated house is greater than that in a conventional cross-ventilated arrangement with similar rates of air exchange. Lacy and Czarick (1992) noted improved weight gains of broilers in tunnel- vs cross-ventilated houses.

The use of tunnel ventilation probably originated from research done 30 yr ago. Drury (1966) noted increased weight gains as air velocity was increased over 7-wk-old birds. Similar results were obtained for birds 3 to 6 wk of age. Drury and Siegel (1966) observed that body temperatures did not stay elevated after a thermal stress for as long at high air velocities when compared with lower velocities. More recently, Mitchell (1985) showed that at 30 C, increasing wind speed increased sensible heat loss. Likewise, Timmons and Hillman (1993) observed that higher wind speeds increased sensible heat loss and reduced latent heat loss.

Research by Simmons et al. (1997) demonstrated that air velocity did not affect total heat loss, but increasing the air velocity caused a shift from latent to sensible heat loss for temperatures between 29.5 and 35 C.

Recent data show that at high cyclic temperatures, water consumption and weight gains are lower for a nipple watering system than for an open watering system (May et al., 1997). An open watering system consists of bell, trough, or cup; but nipple watering systems are being installed in most new poultry houses. McMasters et al. (1971) observed no differences in body weight, feed efficiency, or mortality with nipple systems as compared with trough systems. Most of the earlier air velocity work with poultry was done with a trough watering system. Vest (1986) reported that producers using nipple waterers had improved feed conversion and similar body weights compared with those using a trough watering system. Carpenter et al. (1992) suggested that during hot weather, nipple drinkers with increased flow rate improved broiler performance when compared to nipple drinkers with lower flow rates. The objectives of this research were to determine the effects of air velocity and waterer type on growth and feed conversion of broilers at warm temperatures.

MATERIAL AND METHODS

Trials 1 and 2

Each trial was conducted with 440 male broiler chickens. The chicks were obtained from a commercial hatchery and reared in an environmentally controlled
TABLE 1. Temperatures and starting dates for each trial

<table>
<thead>
<tr>
<th>Trial</th>
<th>Starting date</th>
<th>Minimum</th>
<th>Average</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2-22-96</td>
<td>25.7</td>
<td>28.2</td>
<td>31.8</td>
</tr>
<tr>
<td>2</td>
<td>4-30-96</td>
<td>26.1</td>
<td>28.5</td>
<td>32.8</td>
</tr>
<tr>
<td>3</td>
<td>6-18-96</td>
<td>26.1</td>
<td>30.3</td>
<td>35.6</td>
</tr>
</tbody>
</table>

TABLE 2. The effect of air velocity on weight gain (WG) and feed conversion (FC) of 4- to 6-wk-old male broilers, Trial 1 and 2

<table>
<thead>
<tr>
<th>Air velocity (m/min)</th>
<th>Trial 1</th>
<th></th>
<th>Trial 2</th>
<th></th>
<th>Trials combined</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WG</td>
<td>FC</td>
<td>WG</td>
<td>FC</td>
<td>WG</td>
<td>FC</td>
</tr>
<tr>
<td>15</td>
<td>978a</td>
<td>2.08a</td>
<td>1,078a</td>
<td>2.14a</td>
<td>1,028a</td>
<td>2.11a</td>
</tr>
<tr>
<td>125</td>
<td>1,258b</td>
<td>1.96b</td>
<td>1,298b</td>
<td>1.97b</td>
<td>1,258b</td>
<td>1.97b</td>
</tr>
</tbody>
</table>

a,bValues within columns with no common superscript differ significantly (P ≤ 0.05).
TABLE 3. The effect of air velocity on weight gain (WG) and feed conversion (FC) of 4- to 6-wk-old male broilers, Trial 3

<table>
<thead>
<tr>
<th>Air velocity (m/min)</th>
<th>Trough</th>
<th>Nipple</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WG</td>
<td>FC</td>
<td>WG</td>
</tr>
<tr>
<td>15</td>
<td>745\textsuperscript{a}</td>
<td>2.57\textsuperscript{a}</td>
<td>533\textsuperscript{a}</td>
</tr>
<tr>
<td>125</td>
<td>1,119\textsuperscript{b}</td>
<td>2.05\textsuperscript{b}</td>
<td>1,151\textsuperscript{b}</td>
</tr>
</tbody>
</table>

\textsuperscript{a,b}Values within columns with no common superscript differ significantly \((P \leq 0.05)\).

In Trial 3, both trough and nipple watering systems were used in the tunnel and floor pens. The body weight and feed data are presented in Table 3. We noted no significant difference in body weight due to waterer type in the tunnel with an air velocity of 125 m/min. The chickens reared in the floor pens had significantly reduced body weight gains when compared with the chickens reared in the tunnel. With the reduced body weight gain, there was a corresponding increase in the feed:gain. We observed a decrease in body weight gain with the nipple watering system vs the trough waterer system. This reduction was attributed to the reduction in water consumption due to the chickens panting at the higher temperature, as suggested by May \textit{et al.} (1997). The reduction in water consumption caused a decrease in feed consumption and a corresponding reduction in body weight gain.

The reduced panting in tunnel-reared chickens suggests a shift in the methods of heat dissipation by the bird. Simmons \textit{et al.} (1997) noted a shift from latent to sensible heat at higher environmental temperatures. The most efficient method of removing heat from the bird is by sensible heat at higher environmental temperatures. Therefore, the air velocity of 125 m/min used with the tunnel-reared chickens causes the shift from latent to sensible heat dissipation and may be the reason that the tunnel-reared chickens had improved weight gain and feed:gain when compared with the birds reared on the floor pens.

ACKNOWLEDGMENTS

The authors wish to thank Mike Lacy and James Donald for their critical review in the preparation of this manuscript.

REFERENCES


