ENVIRONMENT AND HEALTH

Improvements in the Performance of Commercial Broilers in the USA: Analysis for the Years 1997 to 2001

H. D. Chapman,*1 Z. B. Johnson,† and J. L. McFarland*

*Department of Poultry Science, and †Department of Animal Science, University of Arkansas, Fayetteville, Arkansas 72701

ABSTRACT The performance of commercial broilers reported by broiler production units in the USA from 1997 to 2001 has been evaluated. There was a linear decrease in calorie conversion (CC) and number of days to produce a 2.27 kg bird (DAYS) but no change in percentage mortality. By contrast, there was a linear increase in final bird weight (FBW) during this period. There was a linear increase in the percentage of production units rearing birds to more than 2.5 kg and a decrease in those rearing birds to less than 2.0 kg or 2.0 to 2.5 kg. There were no differences in CC or DAYS during the first half of the year (January to June), but these traits showed a significant increase in July followed by a steep decline during August, September, and October. FBW was similar from January to June but showed a significant decrease in July. No consistent variation in monthly mortality was noted. It is concluded that improvements in the productivity of broilers have been achieved from 1997 to 2001 but that more attention should be given to the problem of broiler management during the summer months.

(Key words: broiler, broiler production unit, performance, season, climate)

INTRODUCTION

Significant improvements in the performance of commercially reared broilers have been made during the last half of the twentieth century. These improvements have included increases in liveweight; reductions in feed conversion, mortality, and the age to which birds are reared; and decreases in the cost of production (Aho, 2002). The changes are believed to have resulted from genetic selection for faster growth, improved nutrition and flock health, and better management practices (Havenstein et al., 1994; Sainsbury, 1992). According to industry interviews (Aho, 2002), these changes have been sustained in recent years; it was projected that liveweight would increase from 2.05 to 2.27 kg from 1990 to 2000 and that feed conversion would decrease from 2.0 to 1.9 over the same period. Although it is widely accepted that there have been major improvements in productivity and performance of commercial broilers, available information is often anecdotal, and actual data documenting these changes is not widely available. In the USA, a database has been developed that provides accurate, frequent information from individual poultry units on many aspects of poultry production.2 The database has been used to analyze the use of anticoccidial drugs and other feed additives by the poultry industry (Chapman, 2001; Chapman and Johnson, 2002). In this study, performance criteria for the 5 yr from January 1997 to December 2001 have been analyzed to establish whether there have been significant changes during this relatively short period.

MATERIALS AND METHODS

The Agri Stats Inc. database provides information on a monthly basis from poultry plants throughout the USA. A poultry plant is defined as a production unit (PU) that in most cases represents a broiler complex comprising a group of farms, in a common geographical area, that is served by a single feed mill. During the period studied, the number of PU providing data varied from 134 to 165. Data analyzed included a measure of the efficiency of feed utilization, calorie conversion (CC),3 the number of days taken to grow a flock to 2.27 kg (DAYS), final bird weight (FBW), and percentage mortality for different regions of the USA. Regions included Delaware, Maryland, North Carolina, Virginia, Pennsylvania, and West Virginia (region 20); Georgia, South Carolina, Tennessee, and Florida (region 30); Alabama and Mississippi (region 40); and Arkansas, Texas, and Missouri (region 50). For each month, observations in the database are ranked from the...
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FIGURE 1. The mean calorie conversion reported by broiler production units from different regions (REG.) of the USA from 1997 to 2001.

PU with the lowest CC to the PU with the highest. In order to limit the amount of data to be analyzed to manageable proportions, data for every sixth PU were utilized, thus providing from 22 to 28 observations for each month throughout the 5 yr. PU were categorized according to whether birds were reared to a final weight less than 2.0 kg, from 2.0 to 2.5 kg, or greater than 2.5 kg. The percentage in each weight class was then determined for each year. Performance characteristics were analyzed using the general linear models procedure of SAS software (1988). Means were separated using probabilities generated by the least squares means option of this procedure. Trends over time were examined using the regression (REG) procedure of SAS (1988). For year, linear and quadratic equation were examined. Year was coded from 1 to 5 in these equations with 1 corresponding to 1997, 2 to 1996, etc. To examine trends over month, polynomial equations up to the fifth degree were examined.

RESULTS

There was a linear decrease in CC (Figure 1) and DAYS (Figure 2), but no pattern was evident in percentage mortality (data not presented) from 1997 to 2001. The decrease was apparent for all regions but was most evident for region 40. By contrast, there was a linear increase in FBW that was most evident for region 20 (Figure 3). The decreases in CC and DAYS were 1.4 and 1.5% per year, respectively, whereas FBW increased by 1.7% per year (Table 1). There was a linear increase in the percentage of PU rearing birds to more than 2.5 kg (4.53% each year) and a linear decrease in the percentage PU rearing birds to a final weight less than 2.0 kg (1.78% each year) or 2.0 to 2.5 kg (2.75% each year) (Figure 4).

Monthly variations in performance variables followed the same general pattern for all years; therefore, data from all years and regions were combined for analyses of trends. All terms for fourth and fifth degree polynomials were significant for CC and DAYS, respectively; however,

FIGURE 2. The mean number of days to produce a 2.27 kg bird reported by broiler production units from different regions (REG.) of the USA from 1997 to 2001.

FIGURE 3. The mean final weight of birds reported by broiler production units from different regions (REG.) of the USA from 1997 to 2001.

FIGURE 4. The mean percentage of broiler production units rearing birds to less than 2.0 kg, from 2.0 to 2.5 kg or more than 2.5 kg from 1997 to 2001.
TABLE 1. Equations for performance criteria reported by broiler production units from 1997 to 2001

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Equation</th>
<th>Percentage change per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC</td>
<td>2.9989913 – 41.3638 yr</td>
<td>−1.4</td>
</tr>
<tr>
<td>DAYS</td>
<td>50.2132 – 0.7633 yr</td>
<td>−1.5</td>
</tr>
<tr>
<td>FBW</td>
<td>4.8196 + 0.0815 yr</td>
<td>+1.7</td>
</tr>
<tr>
<td>&lt; 2.0 KG</td>
<td>3.595 – 1.78 yr</td>
<td>−1.78</td>
</tr>
<tr>
<td>2.0 – 2.5 KG</td>
<td>5.527.41 – 2.75 yr</td>
<td>−2.75</td>
</tr>
<tr>
<td>&gt; 2.5 KG</td>
<td>−9.002.97 + 4.53 yr</td>
<td>+4.53</td>
</tr>
</tbody>
</table>

1 CC = calorie conversion; DAYS = number of days to produce a 2.27 kg bird; FBW = final bird weight; < 2.0 KG = birds reared to less than 2.0 kg; 2.0 – 2.5 KG = birds reared to 2.0 – 2.5 kg weight; > 2.5 KG = birds reared to more than 2.5 kg.

2 Linear equations for performance criteria reported by broiler production units.

the fit of these regression equations was not very good (R² = 0.09 and 0.12, respectively). A quadratic equation was obtained for FBW (R² = 0.02). Therefore, monthly variations in performance variables are shown in Figures 5, 6, and 7. For the first 6 mo of the year (January to June), there were no differences in CC and DAYS (P < 0.05). In July, CC and DAYS were higher than for the first 6 mo. DAYS were also higher in August (P < 0.05) than for the first 6 mo, whereas CC in August did not differ from that of the first 6 mo. Subsequently, there was a steep decline from August to September for these two traits, with the lowest value occurring in October for CC and November for DAYS. By contrast, FBW showed a decline during July and August, although the July FBW only differed from FBW in January, June, and December (P < 0.05); August FBW did not differ from FBW in March, May, or July. No consistent variation in monthly mortality was noted (data not presented).

DISCUSSION

Continued improvements in performance, as measured by CC and time required to produce a bird of given size, are evident from the results of this study, even for the relatively short period (5 yr) considered. The data support the conclusion that limits for improvement of production efficiency have not yet been realized. The percentage of PU rearing birds to more than 2.5 kg increased during the 5-yr period, whereas the percentage rearing birds to less than 2.0 kg or 2.0 to 2.5 kg decreased. This finding suggests that, for commercial reasons, there may have been a requirement to rear birds to heavier weights over the 5-yr period. The increase in the final weight of birds has been observed during the same time period that the number of days to produce a bird of given weight has decreased, which suggests that the increase in final weight may also be explained by a faster rate of weight gain.

Attainment of the maximum genetic potential for growth of broilers is dependent upon many factors including the extent to which environmental variables can be controlled (Settar et al., 1999). The ever-increasing sophistication of modern poultry housing has been an important component in the improvements that have been achieved. Despite this, it is evident that one environmental factor, the climate at different times of the year, has a major impact upon poultry production. During the first 5 mo of the year, performance variables remained fairly constant, but during the summer months of July and August there was a marked deterioration. Climatic conditions for rearing birds may be difficult in July and August, but the environment for brooding chicks may be ideal.
FIGURE 7. The mean final weight of birds reported by broiler production units from all regions of the USA from January to December.

toward the end of the summer months. Better brooding conditions at the end of summer and reduced temperatures during the fall may explain the improved performance reported for October and November.

Climatic differences between the seasons are known to have a substantial effect on broiler growth and feed conversion (Daghir, 1995; Settar et al., 1999). Thus in Florida more feed was required to produce a unit of gain in broilers from June to August than from November to April (McDowell, 1972). High temperatures encountered during the summer months pose a management challenge (Kempster, 1938), and the finding of a seasonal effect in this study illustrates that this is still a major problem for poultry growers. The results suggest that more attention should be given to overcoming problems of poultry management during summer months.

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REFERENCES


