

Maximising genetic potential in broilers

by Ken Laughlin, Aviagen, Newbridge, Midlothian EH28 8SZ, Scotland, UK.

This article examines the relationships between the genetic potential of broiler stocks and the actual field performance which is achieved. There are numerous reports and references to the continuous genetic improvement in growth rate of broiler chickens.

Average daily gain (ADG) is an indicator of one of the many selection traits which is most easily measured and compared. Therefore, consideration of achieving genetic potential can usefully use this character as an example.

Good data is available on this trait for all breeds for one country over more than 30 years from the NFU Quarterly Broiler Bulletins produced in the UK from 1971 to 2003. This shows a very close linear relationship over time (Fig. 1).

This means that improvements in daily gain have shown a very consistent improvement (of around 1g per day each year) with little variation in the rate over many years.

This is not really surprising since weight and hence ADG to slaughter age is measurable by all farmers and historically was probably the first determinant of breed choice.

Therefore, it can be argued that in a particular country or environment such an easily measurable parameter will become the standard for entry of any breed into the market. All other production parameters or broiler traits will probably be regarded secondary to this unless the production system identifies and rewards the farmer for them.

Fig. 1. Data on average daily gain to slaughter weight extracted from UK NFU Quarterly Broiler Bulletins (1971-2003).

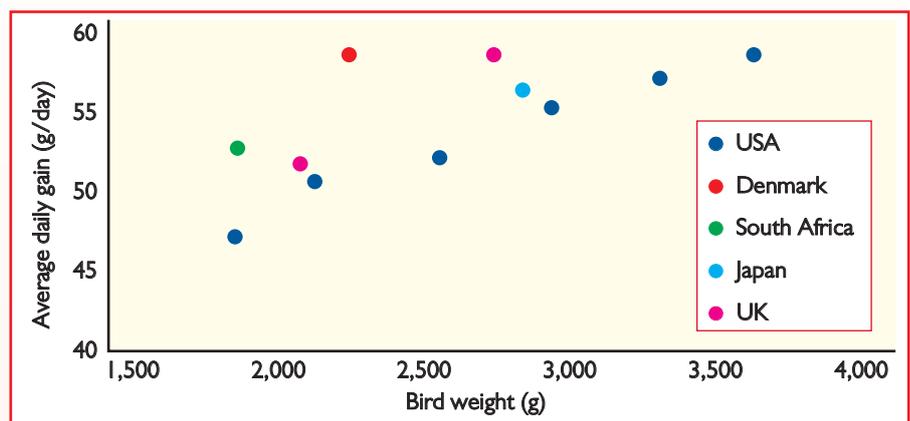
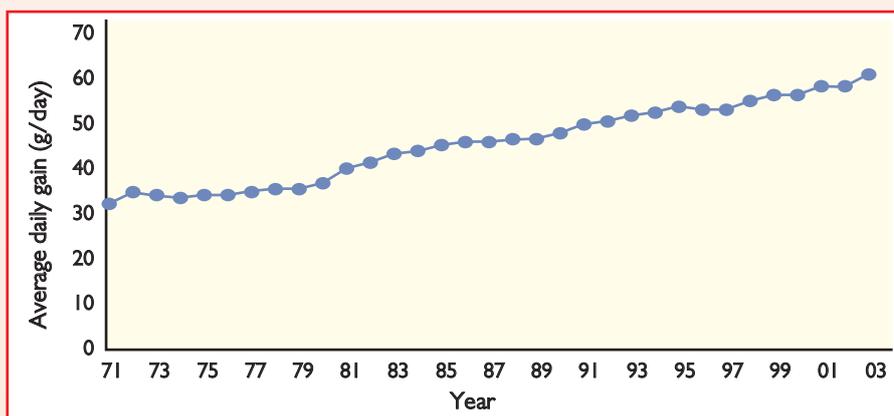


Fig. 2. Average daily gain to slaughter weight for a range of weights and countries.

These data for the average performance are an indication of the improvement in the genetic potential of broilers. However the real situation around the world is not as simple as shown in Fig. 1.

Worldwide differences

Firstly the same genetic stocks achieve very different ADG in different countries due to variations in nutrition, climate and health at a point in time (Fig. 2).

Secondly, the variation around the mean performance in any country or even in a company is wide. Data on farm average and crop average performance for one large

broiler integration are shown in Figs. 3 and 4. Average daily gain for the whole operation is 52.3g for a 2kg bird but we can see in Fig. 3 that the range of average farm performances is from plus or minus 4% about the mean.

This may seem to be a quite tight distribution but with the precision required in many operations for processing weight this may be critical and, therefore, this type of information could be useful in planning and other decision making situations. For example, it should be noted that 4% is almost two days difference in slaughter age.

Further examination of the range of individual crop averages across farms and seasons shows an even wider range – plus or minus 12% (Fig. 4).

On this basis a poor crop from a poor farm can have a very serious effect on production targets on a particular day.

As a final variable for bird weight we should remember that under normal conditions within a house the coefficient of variation (CV) for as hatched or straight run birds is around 12% and for a single sex crop would be expected to be around 9%.

What this means is that for an average weight in the house of 2.5kg the weight range which includes 95% of the birds will be between 1,900g and 3,100g in mixed sex flocks and 2,050g and 2,950g in single sex flocks. This CV is a measure of the inherent variability of the birds and there is little that can be done genetically that can reduce this.

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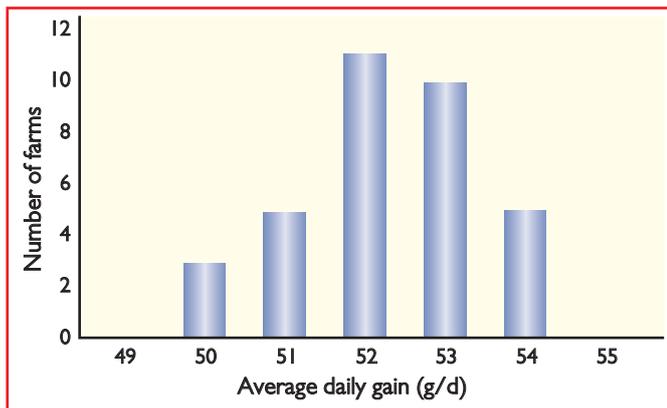


Fig. 3. Range of farm average ADG to 2kg slaughter weights across farms for one company (same feed source).

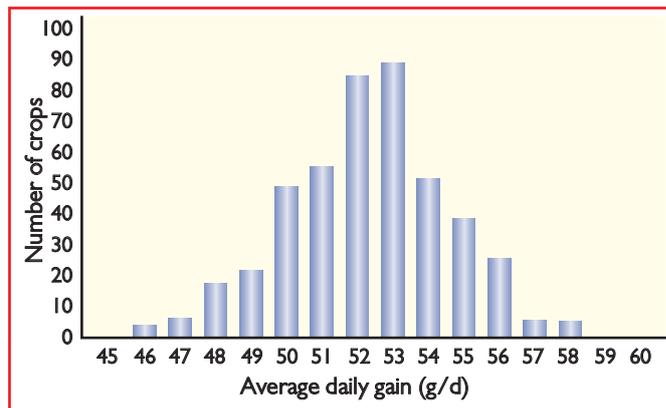


Fig. 4. Range of crop average ADG to 2kg slaughter weights across farms and seasons for one company (same feed source).

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A variety of management factors can, however, significantly increase it!

The data presented show an important feature of broiler growing – not all individuals have the average genetic potential and the effects of environment in terms of feed inputs, house conditions and other aspects of general management have a significant affect on the final performance achievement.

However, extreme precision is expected in broiler weight performance to satisfy relatively narrow product weight ranges and this puts considerable pressure on the broiler grower to ensure continual attention to detail and fine tuning of all the inputs under his control. Further, this highlights the need for regular reviews of all aspects of management to ensure that current best practices are being followed.

House environment

Managing the house environment is a critical responsibility of the broiler grower and this extends throughout the crop – providing the best brooding conditions to ensure a good start and seven day weight, whilst controlling the late stage environment to ensure continued optimal growth and feed conversion.

Data are available covering hundreds of millions of broilers grown in 'controlled environment' housing in the United States. These show that the ADG varies between summer and winter conditions (Fig. 5).

At lower slaughter weights the data suggest that conditions can be maintained to achieve similar daily gain but as target weights increase the environment is clearly limiting growth rate.

This routine average difference is equivalent to 1.5-3.0 days extra growing time to achieve the same processing weight.

It is important to note that although there is a clear effect on growth rate the data also show that liveabilities are not significantly different in the two seasons suggesting that the houses are managed to achieve this at the expense of growth rate. Avoiding the loss of heavy birds with their considerable

investment clearly takes precedence over ADG.

The purpose of presenting these data has been to demonstrate that whilst there may be a clear 'genetic potential' for broiler traits – in this case growth – the field achievement of this shows extremely wide variation due to the 'environmental' influences which include such factors as feed and day to day management inputs.

Growth has been used to demonstrate this since it is the most easily measurable and comparable broiler trait for which there is a large amount of data from many countries. However, other production traits, FCR, yield and health and welfare traits are equally subject to management influences which affect the achievement of genetic potential. Wherever measurement and feedback is applied we are likely to see appropriate adjustment of management practices and in different production regions there are several examples of this.

Examination of these data sets also shows the value of data collection and its analysis in determining performance and the factors which influence it.

In fact the precision of prediction and delivery of product to the correct specification which is required by the processing divisions of a broiler operation demands that considerable detail is available in the data which is routinely collected.

Further, these data need to be routinely analysed in order to ensure that trends in actual performance can be identified and potential problems recognised before they have a serious impact on the business.

Statistical analysis processes are currently being developed by Aviagen which can be used in companies with adequate existing data sets to assist in optimisation of the overall broiler production process.

Examination of comparative data from different geographical regions also allows a better understanding of the differing production strategies for broiler meat which have been adopted. This, in turn, can assist with further optimisation of these strategies which may be influenced by varying economic, climatic or raw material constraints and will not necessarily be consistent world-wide.

Conclusions

In summary, each broiler product has a clear genetic potential. These products are then used as part of a broiler production strategy, within which there will be variations in the production processes which affect final performance, including season, nutrition, farm and house effects.

Finally, the individual broilers all display a variation around the average performance. The task of management at all levels of a broiler integration is to understand the strategy and to minimise variations in the production processes to ensure consistency of product performance. ■

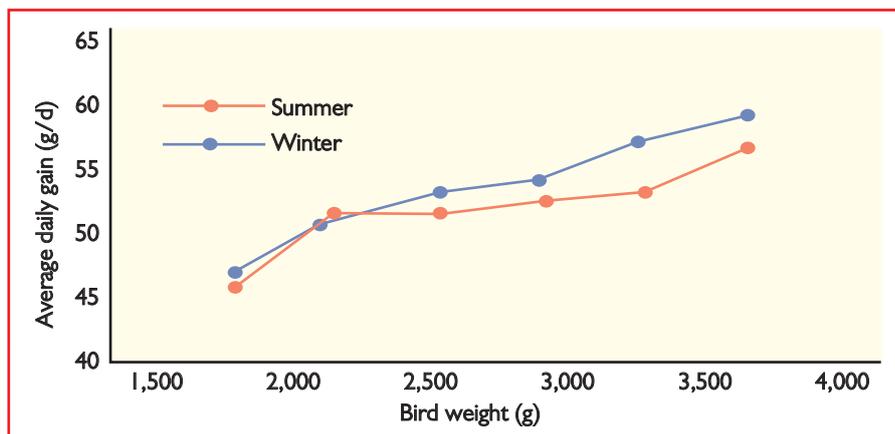


Fig. 5. Variation in ADG by season and bird weight.