Practical testing of poultry feeds under commercial conditions

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Many studies are carried out under perfect husbandry conditions within experimental research farms – individual housing or small pens with good access to feeding and drinking equipment (less competition for feed and water), climate controlled ventilation (no temperature stress or accumulation of ammonia) and clean cages with wire floors or good litter condition (less infectious challenge pressure from disease).

However, field conditions are typified by a diversity of climatic conditions, production and housing systems, feed ingredients and disease challenges.

Additional variation occurs due to variable management expertise, production philosophies (low live cost, low meat cost, optimal performance), market conditions and welfare standards.

Therefore, there is genuine concern about the validity of extrapolating results from trials conducted under standard experimental conditions to commercial practice.

Optimising testing

The response to feed additives depends on a number of factors including farm management, exposure to pathogens, environmental stresses and diet.

Nevertheless, the use of growth promoters has been widely recognised as an important tool to prevent the development of some specific intestinal pathogens such as Clostridium perfringens and Escherichia coli and to improve broiler growth and body weight uniformity whilst increasing feed efficiency.

The prohibition of the use of feed antibiotic growth promoters (AGPs) in some countries has left the industry at an increased risk of excessive growth of pathogenic microflora in the chick's intestine associated with enteric disorders, wet litter, increased mortality and greater variation in performance.

For this reason, considerable research has been dedicated during the past few years to testing of promising natural alternatives, either alone or in combination and at different treatment doses.

There are many non-therapeutic alternatives to AGPs including enzymes, organic acids, probiotics, prebiotics, herbs and essential oils and immuno-stimulants.

What makes research a complicated task is not this diversity of products but finding an efficient way to screen them to avoid the choice of products based on false positive or false negative results.

It is commercially critical to avoid choosing a product which improves performance in an experimental farm but does not improve performance in the field. Likewise, but perhaps a more difficult challenge, is rejecting a product with poor performance in experimental farms that would have good performance in the field.

The ideal way to avoid false positive or false negative results would be to screen the products directly in the field. However, because of the diversity of both products and standard field facilities, it is logistically impossible in most cases to obtain objective field comparisons of products while using contemporary positive and negative controls.

As a consequence, an objective evaluation of products has to resort to using experimental trial farms but the critical challenge is to define the conditions under which to conduct the trials to ensure results have the maximum practical relevance.

Table 1. Overall performance of broilers in trials run under standard experimental farm conditions at Evialis' research centre (negative control = 100).

	No. of trials	Weight gain Average	Weight gain Range	FCR Average	FCR Range
Avilamycin 10ppm	8	100.9	97.6-105.6	99.85	96.9-101.6
B-Safe	10	100.94	98.6-105.8	100.39	97.9-102.4

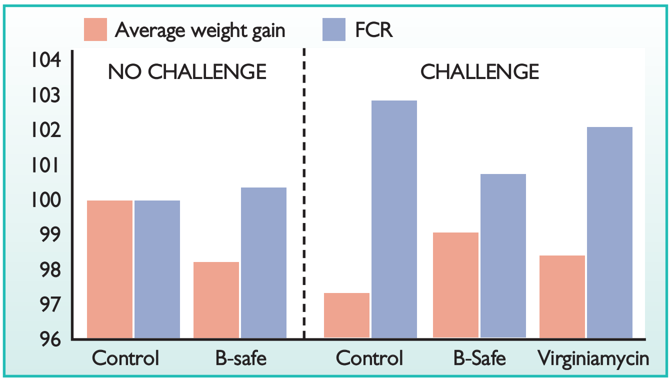

Fig. 1. Example of a feed additive experiment involving a challenge – Brazil (negative control = 100).

Research station trial

The following example is used to illustrate the importance of the choice of experimental conditions. For the Evialis Research Station trial programme, all the experiments undertaken before 2003 were run under optimal conditions typical of an experimental farm (well managed environment and low pathogenic pressure).

All trials included a negative control (basal diet) and a positive control (10ppm Avilamycin).

The results varied widely between experiments but in half of the experiments, the performance of the positive control with avilamycin was not significantly improved or different from the negative control.

If these trials had been used to evaluate Avilamycin it would have been rejected as a growth promoter product because the frequency of improvement was only 50%.

G. Rosen proposed that the minimum frequency of improvement across a series of trials must be 70% to choose a product for commercial use.

Under the optimal research farm conditions, improvements in performance due to AGPs fed alone or in combination were generally not economically important and the individual results were not consistent between flocks.

It could be proposed that the experimental conditions and diets were such that the genetic potential of the broilers was nearly fully exploited.

Therefore, the scope for improvements in performance due to the different additives tested in these trials was potentially very limited and at a scale that could not be detected by the statistical power of the trial via number of birds and replication per treatment. Moreover, the impact of the range of treatments on performance was very limited (see Table 1).

The average improvement in performance with Avilamycin was about 1% for both growth rate and FCR for the trials conducted under standard experimental farm conditions, whereas Avilamycin generally improves growth rate between 2-5% and FCR from 0-5% in field conditions.

One solution to overcome this problem is to develop so called 'challenge models' in experimental farms to attempt to ensure the performance of the birds will resemble performance under practical conditions.

Many challenge protocols have already been proposed that investigate the influence of one factor. In many trials, performance is reduced significantly due to the significant

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influence of one factor (for example, bacterial inoculation or high feed viscosity). These kind of challenge studies may induce a bias in the product selection process because they are inherently designed to demonstrate products are beneficial simply because they overcome the negative impact of the single challenge factor tested (for example, antimicrobial activity against high doses of inoculated bacteria or products reducing feed viscosity).

These results may not be truly representative or repeatable under field conditions. This is the reason why we adopted an innovative protocol to implement environmental challenges to attempt to reproduce field growing conditions.

Alternatives to AGPs

To illustrate the effect of working in challenging environmental conditions, the results of a broiler trial conducted in a Brazilian experimental farm are presented (Fig. 1). To replicate what is often observed under Brazilian field conditions, the built-up litter was kept wet to maintain bacteriological activity until the chicks arrived. This constituted the challenge. For the non-challenged groups, new litter was used. The temperature and ventilation were managed as in commercial farms.

A negative control diet without an AGP, a positive control diet with an AGP (Virginiamycin 20ppm) and Evialis' main alternative growth promoter (B-Safe, a mix of natural and synthetic activated clays, essential oils and plant extracts) were compared in the challenging conditions.

These treatments were also compared with a negative control diet and B-Safe in non-challenging conditions. The litter challenge had a significant negative effect on growth of the control group. There were no significant differences between the other treatments.

However, we observed that the product tested as an alternative to AGPs showed a numerically lower growth than the negative control in standard conditions, but numerically improved performance to the same extent as Virginiamycin under challenging conditions.

This trial illustrates the fact that testing the product proposed as an alternative to AGP in standard conditions would have lead to the conclusion to reject the product, whereas under simulated field conditions, it demonstrated similar improvements in performance as the AGP Virginiamycin.

Best feeding strategy

Consolidation within the poultry breeding sector has greatly reduced the number of locations devoted to the genetic improvement of poultry.

As a result, genetic selection is undertaken under a limited range of environmental conditions that can be quite divergent from commercial conditions. In addition, primary breeders are generally obliged to utilise facilities that are biosecure (low disease challenge) and offer a high degree of management control to maximise the genetic progress, optimise biological performance and eliminate environmental variation.

However, genetic lines are commercially expected to perform consistently under variable environmental conditions worldwide.

This apparent conflict is of particular concern to production in the developing markets. This creates a fundamental dilemma for poultry breeders. The market requires products that are disease and pathogen free but resistant to disease under field conditions.

Products must be robust and resistant to physiological challenges associated with rapid growth, such as ascites, sudden death syndrome and tibial dyschrondroplasia, but must also be rustic and able to withstand stress presented by low feed quality, poor environmental control, high environmental temperatures and local and varied disease challenges.

Using its own facilities, Hubbard has undertaken controlled research trials investigating such Genotype x Environment (G x E) interactions.

During the last 15 years, all pedigree chicks have been grown under challenging conditions using factors such as various temperature programs and commercial types of feed with high viscosity. These challenges have been imposed to improve the identification of the best individuals and families for livability and robustness traits. Broiler studies have been undertaken worldwide under various field conditions to assess whether this strategy gives positive results in the field.

One such trial was undertaken in France (Fig. 2) comparing Hubbard 915 (M99 x F15) and Breed X broilers. Before 21 days of age, higher stocking density, lower brooding temperature and lack of feeding and drinking equipment were imposed in the challenge groups' protocol.

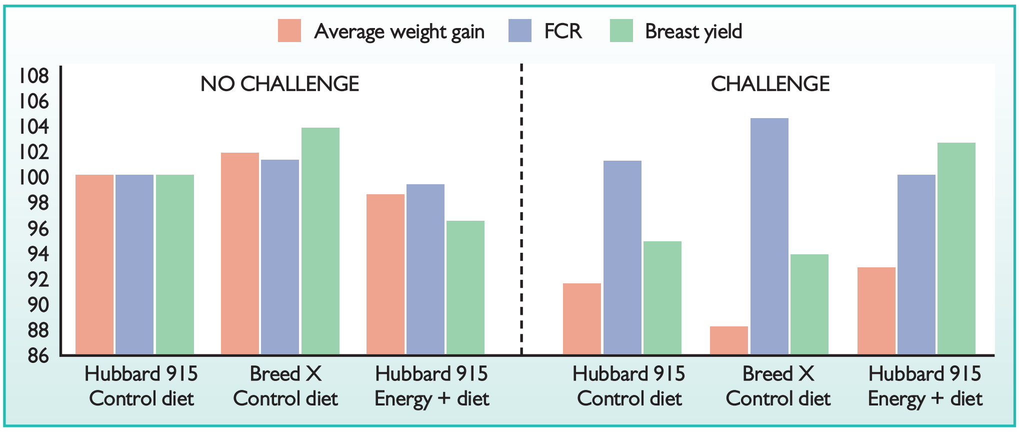

Fig. 2. Example of a genetic experiment involving a challenge – France (negative control = 100).

Non-challenged groups were with conventional optimal growth conditions of the test station.

Without a challenge under optimal conditions, growth rate performance was as high as 60g/d but with challenges, performance was significantly reduced for all major parameters (-8% to -13% weight, +1% to +3% FCR and -4% to -9% breast yield depending on breed) and closer to average French field performance with an average growth rate of 53g/d.

Under the optimal conditions, Breed X had significantly higher growth than the Hubbard 915 but a higher FCR. In contrast, when the conditions were challenging, the Hubbard 915 gave better results than Breed X for both final weight and FCR demonstrating a significant G x E interaction. An increase of 3% in the metabol-isable energy content of the diet did not significantly affect performance when housing conditions were optimal.. However, when housing conditions were challenging, the same nutritional modification increased final weight and reduced FCR.

Genetic lines tested under research conditions with different feeding programs may illustrate the potential of a product to begin with but such tests cannot take into account the wide range of environmental and managemental factors affecting responses in praxis.

Even worse, good conditions may lead to false negative conclusions about the impact of dietary effects such as energy level.

Conclusion

Choosing between the various growth promoting feed additives or choosing the right feed specifications for a given genetic line requires extensive testing.

In many cases, conclusions of experiments undertaken in test stations are not always applicable in field conditions. It is possible that the experimental conditions are such that the genetic potential of the broilers is almost fully exploited.

Consequently, the different supplements or additional nutrients tested in such trials have a limited scope to improve performance that cannot be detected within the power of the experiment.

More important, stressful infectious challenges observed in the field may affect metabolism and impact specific nutritional requirements. In 'the real world' birds probably need more but eat less!

Using the knowledge acquired with all the experiments we have undertaken, the 'challenge' concept has been developed with trials performed with birds kept both under normal experimental conditions and challenging conditions.

Imposition of various challenges made the conditions of an experimental station more like those of a commercial farm and gave the possibility to make conclusions about the benefit of a feed additive or about the best feeding strategy for a given breed for good conditions and management as well as for birds exposed to a wide variety of stress factors.

Our preference is not for specific challenges but to simulate poultry field conditions with high stocking density or poor brooding conditions. Tests undertaken under conditions closer to the field conditions may also allow the flow of more comprehensive information between poultry research and final users of feed which is also an important role for researchers.

Variations in husbandry, age of birds, disease patterns and management support the need for a series of well organised long term field studies which will be undertaken after the 'challenge' concept experiments performed in test stations.

Not only can field trials take into account the variations in commercial broiler growing, but they may help to establish even more significant commercial differences between treatments. ■

References are available from the author on request