Digestive microflora management to improve layer performance

In the context of reducing in-feed antibiotics, there is a need for natural, profitable and proven solutions for poultry production. Probiotic bacteria, which exert a positive effect on the digestive microflora balance and gut development, can help improve laying performance.

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The lactic acid bacteria strain Pediococcus acidilactici MA 18/5M, producing a high level of lactic acid, is one of the most studied probiotic bacteria with more than 40 scientific publications in monogastric feeding. Its modes of action are well documented.

This is confirmed by results obtained in farms and trials in commercial settings, which consistently show benefits on laying performance, in particular through an improved laying rate and persistence.

In addition, probiotic benefits lead to improved poultry survival and egg quality, representing significant benefits for producers.

The results of multiple trials conducted in laying hens with probiotic Pediococcus acidilactici MA 18/5M (Bactocell, Lallemand Animal Nutrition) have been compiled in order to evaluate the probiotic's potential benefits for farm performance. The data and results were analysed from six different published trials conducted in research institutes and in commercial farms with different housing systems, genetics and various supplementation duration.

Consistent benefits for performance

Depending on the trial, the laying rate is increased by 2.0-3.4%, while egg weight is always increased (up to 2.8%), resulting in consistent increase of exported egg mass (from 0.6% for the shortest trial duration up to 5%) (Fig. 1). Statistical analysis were performed on the results of four trials on a 24-week duration (from week 22-46).

On average, P. acidilactici MA 18/5M significantly increased the laying rate by 2.8% ($p<0.05$) and exported egg mass by 3.5% ($p<0.01$), equivalent to an extra 13.1g of egg/hen/week, or 131kg/week for 10,000 hens.

This effect is linked to improved feed utilisation with the probiotic, as shown by an improved feed conversion rate (Fig. 2).

Similar statistical analysis indicate a reduced feed conversion rate equivalent to -0.07kg/kg.

In addition, trials typically show a positive effect on the laying curve. It is sustained and made smooth over the whole cycle.

P. acidilactici MA 18/5M, supplemented during the whole cycle, improves laying persistence (Fig. 3). Taking into account laying performance enhancements, the minimum return on investment for the producer is 3-to-1.

Reducing mortality

Several trials have shown that under challenged conditions and high pathogen pressure, the lactic acid bacteria, thanks to its positive effect on the digestive

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Fig. 1. Effect of Bactocell supplementation on laying performance in various trials as compared to negative control diet.

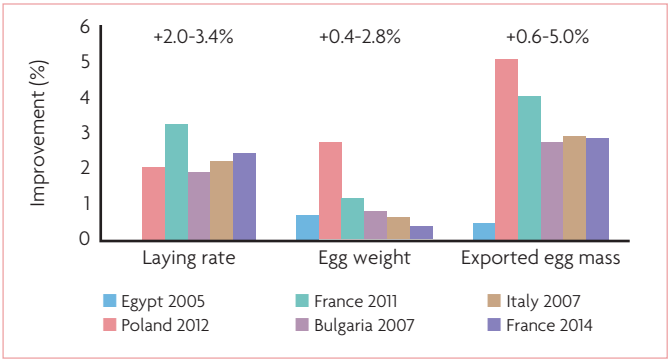
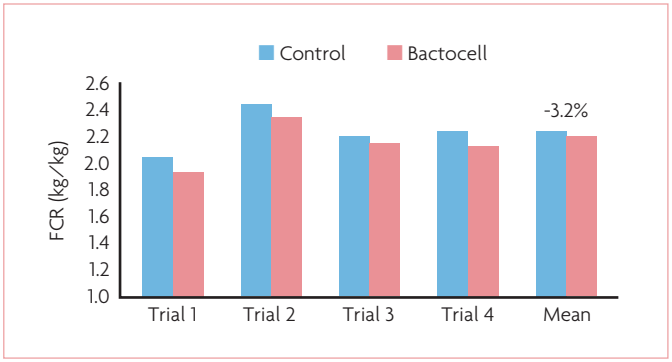


Fig. 2. Bactocell effect on feed conversion rate: statistical analysis from week 22-46, results of four trials ($p<0.05$).



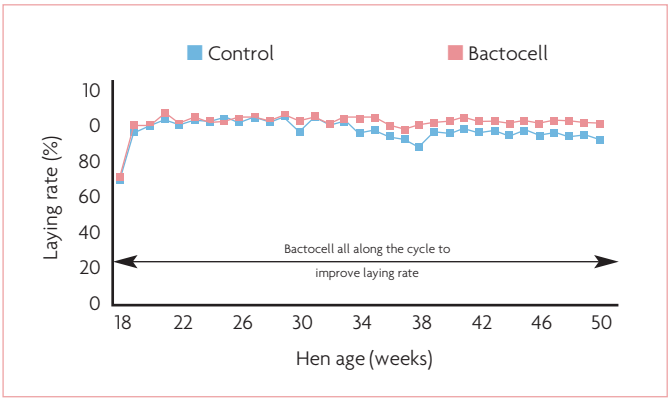


Fig. 3. Typical laying curve in Bactocell trial (free range hens, Alleman et al., 2011, France).

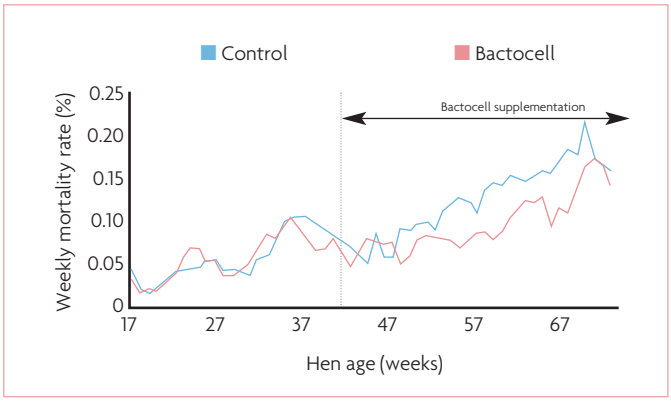


Fig. 4. Effect of Bactocell supplementation on hens' weekly mortality rates (%) (Morocco, 2012).

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microflora, helps control pathogen development and reduces mortality risks due to bacterial challenge. This has been observed in many farm conditions. A production trial conducted in Morocco in 2012 confirms this effect in commercial farming conditions (Fig. 4).

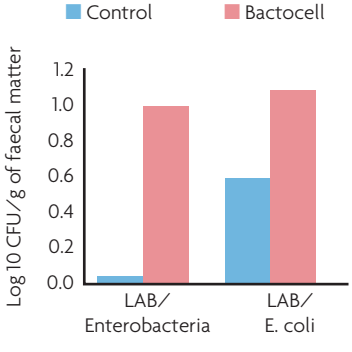
In this trial, at the end of the laying period (71 weeks), the cumulative mortality was 4.08% in the treated building vs. 4.92% in the control building; equivalent to 481 hens spared during the trial period.

In 2015, a French commercial trial gathering about 200,000 ISA Brown laying hens also showed a concomitant mortality reduction in two buildings independently receiving P. acidilactici MA 18/5M. In the first building (72,000 laying hens), the hens were supplemented from 17-60 weeks of age, with a four week involuntary discontinuation (week 34-38).

Following this disruption of the supplement, the mortality increased 2.5-fold (weekly mortality: 22 hens before vs. 56 after the probiotic disruption).

In the same manner, after the end of the supplementation period (week 60), the mortality increased 2.9-fold (weekly mortality: 161 after the supplementation).

Fig. 5. Effect of Bactocell supplementation on laying hens' average faecal microflora balance (Lallemand internal research). Meta-analysis encompassing 39 commercial farms.



In a second building (119,000 laying hens), P. acidilactici MA 18/5M implementation followed a spur of mortality linked to colibacillosis outbreak at week 36 of age.

The supplementation (from week 37-54) helped control the mortality; while, from week 54, when the supplementation stopped, weekly mortality rose again (weekly mortality 116).

Moreover, benefits have been observed in Asian commercial farms carrying out forced moulting. Reductions by half of the mean daily mortality have been reported.

This benefit is linked to the effect that P. acidilactici MA 18/5M has on the control of pathogen development in the gut and consequently on the barn environment.

Studies have shown that P. acidilactici MA 18/5M shifts gut microflora toward a more balanced profile under challenging conditions, resulting in reduced Clostridium perfringens, Salmonella sp. and Escherichia coli loads.

Effect on faecal microflora

In a laying farm, faeces represent a major pathogen reservoir, source of cross-contamination, and a potential vector of foodborne pathogen transmission through the litter or dust in the environment.

It has been shown that the microbiological analysis of faecal microflora can thus be a good indicator of a farm's sanitary risk status. The ratio between beneficial microflora (lactobacilli, or lactic acid bacteria (LAB)), and potential pathogenic microflora can be used as an indicator of both the animal's digestive microflora balance and the farm's sanitary status.

Such faecal microflora analysis has been established by Lallemand Animal Nutrition as a tool to evaluate the potential sanitary risk in farm settings and the influence of P. acidilactici MA 18/5M on the digestive ecosystems.

A field trial in an organic layer farm (2011), indicated a reduced count of potential pathogens (total coliforms, enterobacteria and E. coli) in the faecal microflora of 50 week old hens, as compared to an untreated control group, leading to a well-balanced microflora.

These results were confirmed within various commercial farm settings and conditions through a large-scale field survey encompassing 39 commercial layer farms in France. Twenty two of these farms supplemented their laying hens with P. acidilactici MA 18/5M, while the 17 remaining ones did not include a probiotic in their feed. Hens receiving P. acidilactici MA 18/5M showed improved microflora ratio (Fig. 5).

By helping control the digestive microflora, P. acidilactici MA 18/5M has positive consequences on the faecal microflora balance, which, in turn, helps control environmental contamination by reducing pathogens in the barn, air and dust. As shown in the field surveys, this creates a 'virtuous cycle'. A lower pathogen load in the faeces in the barn is an interesting outcome in itself since it reduces the risks of cross contamination and sanitary risks for the consumer (egg contamination for example).

Conclusion

In the context of increasing market pressure for antibiotic reduction in poultry farming and high feed costs, scientifically-proven solutions to enhance layer performance are necessary.

A lactic acid bacteria probiotic appears as an effective solution to attain production goals and maintain poultry health and sanitary status all along the production cycle. It has a beneficial influence on gut flora balance and maturity, enhancing basal digestive and gut barrier functions.

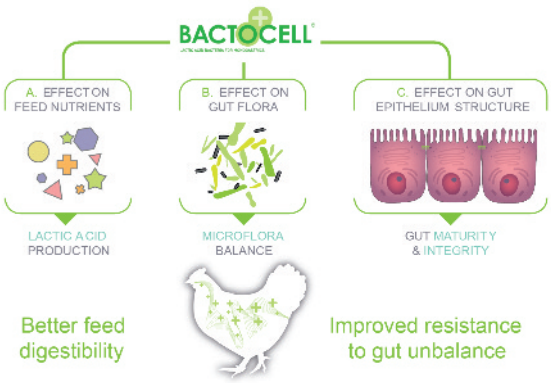
Such an impact at the gut level came to act as an effective animal performance booster offering better efficiency to the egg producer.

In addition, extra benefits such as better resistance to pathogens and reduced mortality, improved egg quality (less broken and dirty eggs, reduced meat spots, thicker eggshell, etc) or improved feathering have been documented, which can bring additional revenue to the farmer and better animal valorisation at the end of the production cycle.

These benefits have been officially recognised by the European Commission, which registered the probiotic bacteria as a zootechnical feed additive for laying hens in March 2011 (Regulation (EC) No 1831/2003), based on some of the trials data presented in this article. ■

How does this probiotic work?

Probiotics are specific beneficial bacteria selected for their benefits in the host diet. The lactic acid producing bacteria P. acidilactici MA 18/5M is a well described probiotic strain. It has the ability to produce important amounts of lactic acid in the gut of monogastric animals, and L+ lactic acid only (homofermentative bacteria).



Its ability to survive in the poultry digestive tract and remain alive for a few days in faeces has also been demonstrated. Its effects are translated into the following three major consequences for the animal:

- **Enhanced feed digestibility**
  P. acidilactici MA 18/5M produces important amounts of lactic acid from complex sugars present in the feed. This contributes to improve feed digestibility and increase feed efficiency because more sugar is transformed into lactic acid, a highly digestible source of energy.

- **Improved gut microflora balance**
  Because P. acidilactici MA 18/5M produces lactic acid in the gut, it causes a local decrease of pH close to the gut surface (villi) creating a favourable environment for the development of beneficial bacteria and unfavourable for potential pathogenic bacteria such as coliforms, salmonella, etc. The lactic bacteria compete with pathogens for nutrients, helping to keep them under control.

- **Enhanced gut maturity**
  P. acidilactici MA 18/5M supplementation increases the height of gut villi, thus increasing the gut absorption surface area. As a result, nutrients are better absorbed and feed digestibility is increased.

Altogether, these modes of action contribute to explain the unique effects of P. acidilactici MA 18/5M supplementation on layers' digestive function and performance.