

Improving the performance of layers with probiotic bacteria

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Probiotics represent one of the best documented natural solutions to improve poultry health and performance. The probiotic bacteria *Pedococcus acidilactici* MA 18/5M (Bactocell; Lallemand Animal Nutrition) is one of the most studied probiotic strains.

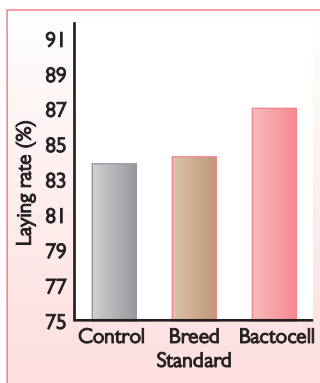
Both scientific studies and production trials in different poultry species have been performed, showing the probiotic ability to improve feed efficiency and safety (pathogens prevention), thanks to its action at several levels of the digestive tract.

A statistical analysis (meta-analysis) of the data from four trials performed in laying hens in several countries, under different rearing conditions, demonstrates the beneficial effects of Bactocell supplementation on zootechnical performance: increased laying rate (+2.8%); improved feed conversion (-3.2%), and increased eggs mass.

In addition, the probiotic bacteria improved egg quality parameters such as eggshell resistance (reduction by 50% of downgraded/broken eggs), as well as yolk colour and meat spots occurrence.

These benefits on layer production have been officially recognised by the European Commission who registered the probiotic bacteria as a

Fig. 1. Effect of the probiotic treatment on the mean laying rate (Italy, 2012).



zootechnical feed additive for laying hens in March 2011 (Regulation (EC) No 1831/2003).

Today, 18 months after this authorisation, feedback received from users in different markets confirm the benefits of this specific probiotic on layers performance and its profitability for the producers, both under challenging and optimal production conditions.

This article reports on some of the latest results obtained under 'real-life' conditions in various geographical areas and laying environments.

Proven benefits in the field

- In a large scale field trial performed in Italy with a poultry unit housing a total of around 150,000 Hy-Line Brown layers, the effects of Bactocell were evaluated in particularly challenging conditions since the barns are not all empty at the same time. When a new cycle starts, there is always at least one remaining barn on the farm still housing producing hens, hence an increased hygiene risk for the new flocks. For this reason, the use of an adapted probiotic supplement, recognised to support pathogen control, was suggested.

The trial was performed during 76 weeks, from May 2011 (18 weeks of age) to July 2012. Some 41,900 layers received *Pedococcus acidilactici* MA 18/5M at 2×10^9 CFU/kg of feed during the first three weeks (double the recommended dose), and then at 1×10^9 CFU/kg of feed for the rest of the cycle (standard technical dosage).

Production data were compared to the previous cycle in the same barn (December 2009 to March 2011), and to the standard laying rate for this breed (Fig. 1).

Statistical analyses were performed using the paired T-test.

Laying rate was statistically improved when compared to the previous cycle ($P < 0.01$), as well as to the standard laying rate for the breed ($P = 0.023$); while there was no statistical difference between the control cycle and standard (Fig. 1).

However, since 2010, Hy-Line has



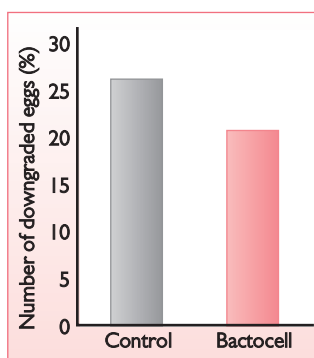
notified an improvement in laying rate of this breed of around 4-5 eggs per housed layer. In the trial, the improvement (12 eggs per hen), remains much higher than the genetic improvement. Moreover, the probiotic supplementation led to a smoother laying curve when compared to the control cycle.

Egg quality was statistically improved following Bactocell supplementation: the proportion of downgraded eggs (Grade 2) was reduced by 21% ($P < 0.01$) (Fig. 2).

- Mortality was statistically reduced by 12% for the group receiving probiotic bacteria ($P = 0.018$) (Fig. 3).

- Another recent production trial was conducted in Morocco in 2010/2011 and involved two of the four buildings of a standard commercial farm:

Fig. 2. Effect of the probiotic treatment on egg downgrading (Grade 2) (Italy, 2012).



- Control: 57,240 hens – Hisex breed; control diet.

- Bactocell: 63,414 hens (Hisex breed). The probiotic bacteria was added to the standard diet at 1×10^9 CFU/kg complete feed (standard technical dosage) from 45-60 weeks of age; and at 5×10^8 CFU/kg complete feed from 60 weeks to the end of the laying cycle.

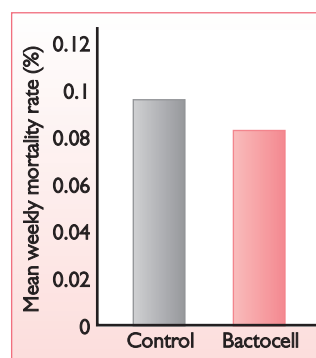
Both houses were equivalent in terms of animals and environmental characteristics (age, orientation of the building, microbial environment).

The results of the trial showed increased performance and lower mortality rate with Bactocell:

Fig. 4 shows that the laying rate is improved with the probiotic treatment as compared to the control diet and notably that laying rate

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Fig. 3. Effect of the probiotic treatment on mortality rate (Italy, 2012).



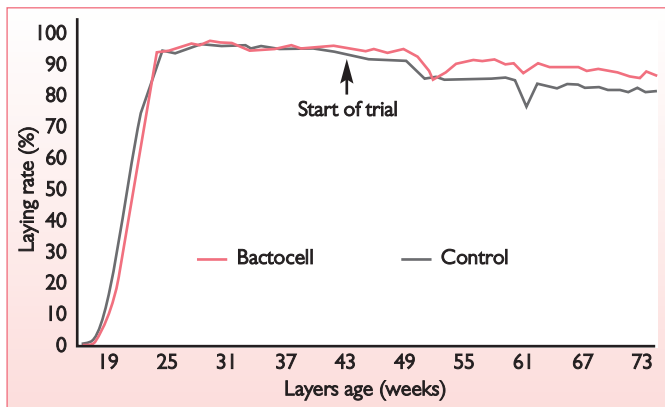


Fig. 4. Effect of the probiotic supplementation on laying rate (Morocco, 2011).

Continued from page 11 remains steady towards the end of the laying period, which is in line with observations made on several other trials.

As a result, we could get an extra 7.31 egg/hen on average at the end of the Bactocell supplementation, which represents 463,490 extra eggs in total for the 63,414 hens on trial. Based on current local price references, this represented a 3:1 Return on Investment for the producer (at least €3 earned for each €1 invested); without taking into account the additional health benefits, in particular Bactocell effect on pathogen control.

Moreover, the number of downgraded eggs was also lower with the probiotic treatment.

● Mortality rates are shown in Fig. 5. Altogether, 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, which is equivalent to a 17% reduction of mortality with the probiotic bacteria supplementation.

This commercial trial demonstrated positive effects of the probiotic bacteria on survival and production rates.

However, it is important to notice that the probiotic bacteria supplementation started only from week 45 and that the recommended dosage was only provided for the

first 15 weeks of the trial phase. In order to obtain optimal benefits, Bactocell should be implemented as early as possible and using the recommended technical dosage (10^9 CFU/kg feed) during the whole production cycle.

Finally, other field results, reported from Denmark, confirm the zootechnical benefits of *P. acidilactici* MA 18/5M, even when productivity and breeding conditions are optimal.

● A trial was performed during the whole laying cycle on Lohmans LSS breed, housed in cages (62,000 hens in the same barn).

P. acidilactici MA 18/5M was supplemented at 10^9 CFU/kg of feed during the whole laying cycle.

Fig. 6 compares the laying curve obtained to the previous production cycle (control): the probiotic allowed a better persistence of the laying rate, in particular at the end of the cycle.

Additional effects

While these latest field results confirm that *P. acidilactici* MA 18/5M is a profitable solution to optimise laying hens performance in production conditions, the benefits of this particular probiotic bacteria go beyond that.

Indeed, it has been shown previously that *P. acidilactici* MA 18/5M supplementation has a positive

Fig. 5. Effect of Bactocell supplementation on hens weekly mortality rates (Morocco, 2011).

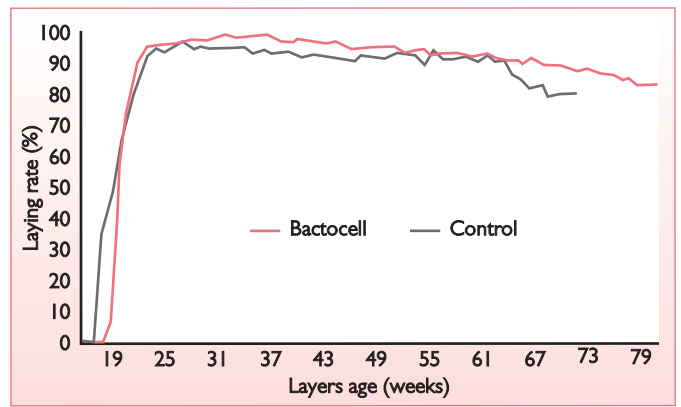
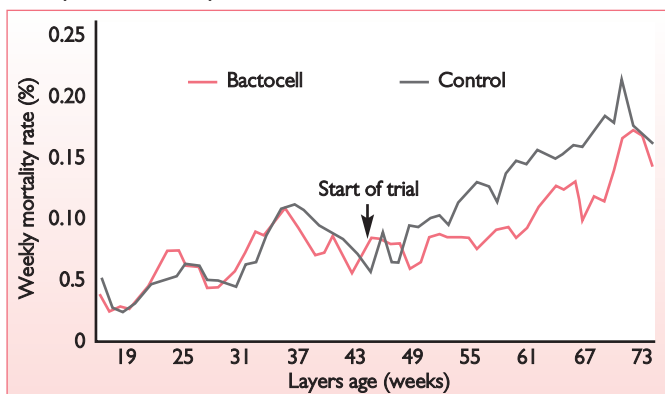


Fig. 6. Effect of the probiotic supplementation on laying rate (Denmark, 2011).

impact on egg quality and shell resistance, other aspects of economical significance.

During a 12 week trial, the probiotic supplement improved egg yolk pigmentation, decreased the number of meat spots and blood spots in egg white or yolk, and increased the egg white/yolk ratio.

Eggshell thickness and shell weight ratio were also improved, increasing the egg resistance. Interestingly, this trial also showed a positive effect on lowering the egg yolk cholesterol level, as well as lowering the hen serum cholesterol level.

These effects on egg cholesterol content can be seen as additional benefits in terms of consumers' health. The probiotic *P. acidilactici* MA 18/5M is also well known for its protective effects against pathogens, and this is exerted at several levels:

● In the feed: trials have shown that *P. acidilactici* MA 18/5M prevents

feed colonisation by pathogens such as *E. coli*.

● In the gut: this has been shown for several major pathogenic agents in poultry production: *E. coli*, *Salmonella typhimurium* and *Clostridium perfringens*.

● On the eggs: *P. acidilactici* MA 18/5M is effective to prevent egg contamination with foodborne pathogen salmonella.

In a pathogen challenge study, three days following pathogen challenge in the form of oral inoculation of *S. enteritidis* at 4.10^8 CFU/hen, 50% of the egg shells from the control group were positive for salmonella contamination, while none of the eggs were contaminated in the group that had received Bactocell for 12 weeks. This shows that, not only *P. acidilactici* MA 18/5M is beneficial for poultry performance, but also as a natural tool to prevent bacteria pathogens for both animals and consumers.

Modes of action: Bactocell effects at the gut level

The probiotic bacteria *P. acidilactici* MA 18/5M is one of the best described probiotic strains. Three main modes of action have been described to explain its benefits on poultry performance and health:

● Effect on gut maturity.

It has been shown that *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. This phenomenon explains part of *P. acidilactici* MA 18/5M effect on feed efficiency.

● Effect on feed digestibility.

P. acidilactici MA 18/5M has the ability to produce important amounts of lactic acid from complex sugars present in the feed (homofermentative bacteria). This contributes to improve feed digestibility and increase feed efficiency because lactic acid is highly digestible (source of energy) and because production of lactic acid decreases the viscosity of the feed, facilitating enzyme access to break down feed particles.

● Effect on gut microflora balance.

Because *P. acidilactici* MA 18/5M produces lactic acid both in the feed and the gut, it causes a local decrease of pH in the mucus surrounding the villi, creating a favourable environment for the development of positive bacteria and unfavourable for pathogenic bacteria, which thrive under high pH. Moreover, *P. acidilactici* MA 18/5M produces some metabolites which are used for the development of positive bacteria. This positive microflora competes with pathogens for nutrients, helping to keep them under control.

Altogether, these modes of action contribute to explain the positive effects of *P. acidilactici* MA 18/5M supplementation on layers performance and resistance to pathogens.