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of production

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The integrity of the eggshell is a vital natural defense mechanism that protects the egg from physical damage and microbial invasion. Eggshell strength impairs the late phase of egg production, and there is an increase in incidences of cracked egg percentage. Aged layers are less responsive to calcium than younger ones. The gut microflora has a protective function to keep the intestinal integrity constant and adding beneficial bacteria to the diet helps to recover the intestinal integrity. *Bacillus subtilis* PB6 was used extensively in this regard. The primary objective of those applications is investigating the use of probiotics to improve the performance, eggshell quality, cecal microflora composition, and tibia traits of laying hens in the late phase of production.

To investigate the use of probiotics, ninety-six white laying hens were split into three treatment groups and fed with three different diets as below.

- Basal diet
- Basal diet plus 2.3×10^{11} cfu / MT of *Bacillus subtilis* PB6
- Basal diet plus 4.6×10^{11} cfu / MT of *Bacillus subtilis* PB6

The hens were fed with the diet for ten weeks, and the assessment metrics were egg production, egg weight, egg mass, eggshell weight, and eggshell thickness.

The results showed that across all those metrics, CLOSTAT™ exhibited the maximum statistically significant increase than any treatment group and has the lowest number of average unmarketable eggs percentage wise with the largest increase in tibia weight, density, and ash content.

To conclude, it is possible to improve egg performance and eggshell quality by dietary inclusion of *Bacillus subtilis* PB6.

Summary

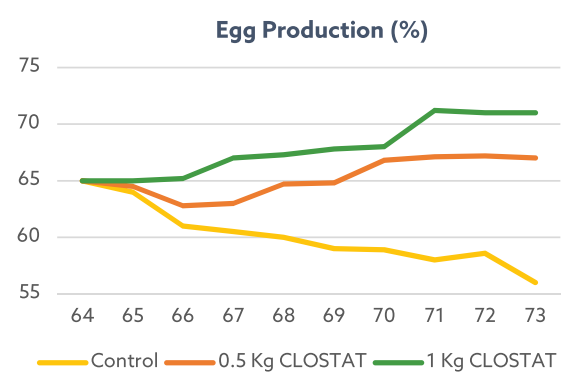
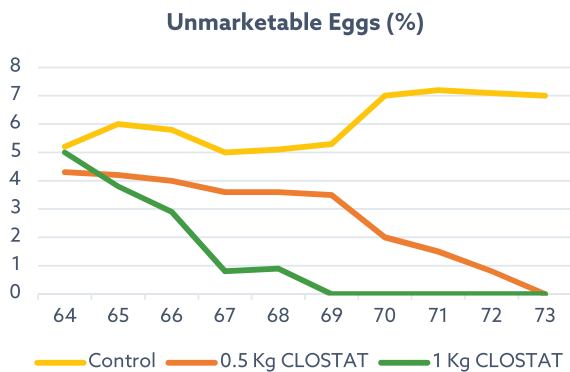
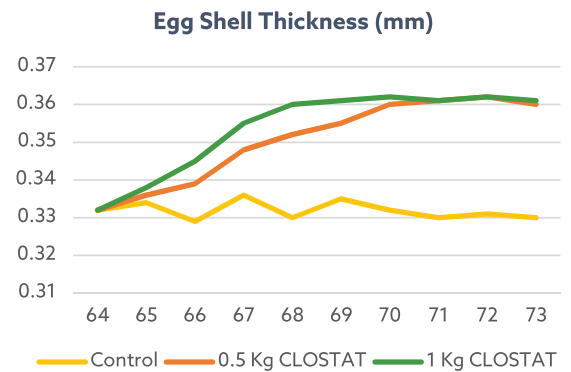
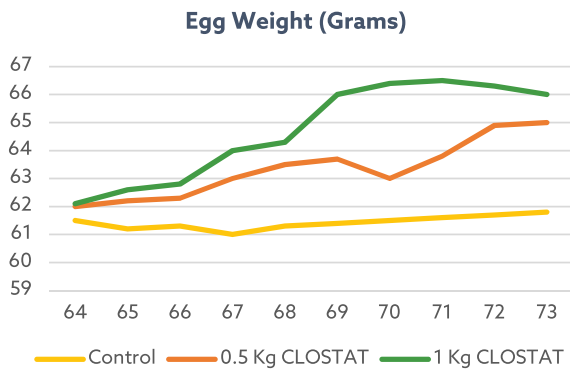
At the late phase of production, the laying hens limit nutrient absorption efficiency due to poor gut health. CLOSTAT™ has been involved directly in the stabilization of the intestinal microflora ecosystem and recovery of gut health and mucosal integrity, thus enhances the absorption.

The positive effects of CLOSTAT™ on eggshell quality attributes to the enhancement of Calcium absorption and availability due to microbial stability. CLOSTAT™ improved gut health, which directly improved birds' health and performance.

CLOSTAT™ increased fermentation rate and short-chain fatty acids (SCFA). This SCFA stimulates intestinal epithelial cell proliferation and villus height, which increases the absorption efficiency.

The late phase of production with *Bacillus subtilis* PB6 significantly improved egg production, egg weight, egg mass, eggshell thickness, eggshell weight, and eggshell density and reduced the percentage of unmarketable eggs.

Results for illustration



Graphs illustrating different improved egg quality parameters

