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QTI™ ANIMAL HEALTH & NUTRITION

# What Numerous Broiler Trials Tell Us About *Bacillus Subtilis* C-3102 and Profitability

Since the 1980s, our scientific understanding and use of direct-fed microbials (probiotics) in feed has progressed significantly. In 1986, Calpis Co., Ltd, introduced CALSPORIN® a direct fed microbial containing a robust facultative anaerobe bacteria strain *Bacillus subtilis* C-3102. Since its introduction, the product has become more global and now is considered to be the most widely used bacillus probiotic for poultry. The following is a review of relevant commercial trials to help evaluate the potential use and profitability of this product in your company.

## Science-Based Product

CALSPORIN® *Bacillus subtilis* C-3102 was selected through extensive testing and evaluation of over 300 different beneficial bacteria. EU regulatory testing has confirmed that CALSPORIN® does not contain plasmids to develop antibiotic resistance. European Food Safety Authority (EFSA) approved CALSPORIN® for broilers in 2006. For over 30 years, research has confirmed its survivability during steam pelleting, reduction in clostridia counts, and improvements in gut health, live performance, carcass traits, and food safety.

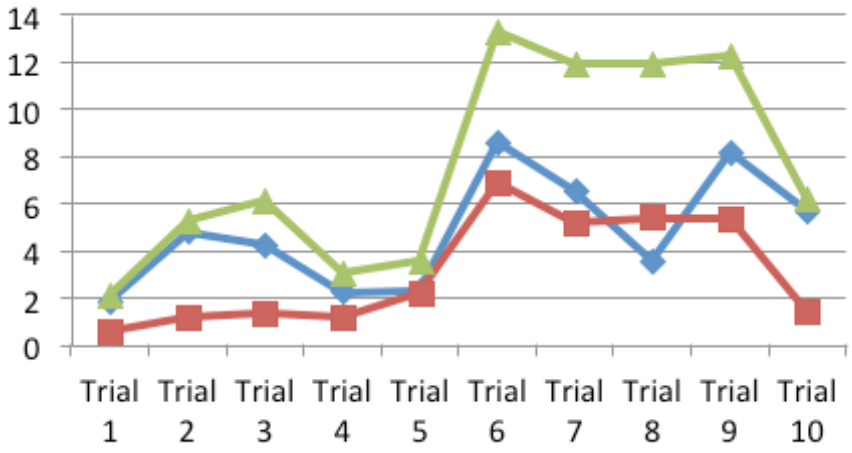
Academic research has revealed some of the modes of action of dietary *Bacillus subtilis* C-3102 spores. Known modes of action include: 1) vegetating within the digesta of the intestinal tract which consumes oxygen making the digesta more anaerobic and favoring the proliferation of native Lactobacillus species, 2) synthesizing and releasing a number of important enzymes, 3) improving calcium dynamics in bone (osteoblasts and osteoclasts), and 4) enhancing the immune response of the host for better disease resistance.

In practical terms, these modes of action often translate into improved nutrient digestion, more weight gain, better feed conversion ratio and livability (lower mortality), higher carcass and breast muscle yields, and better profitability. Besides pen trials, field trials under commercial conditions have confirmed these benefits.

## Trial Results: Broilers

Results of 10 U.S. controlled pen trials published and conducted on new or recycled litter indicate the productivity of broiler production can be improved by adding CALSPORIN® at an inclusion rate of 300,000 cfu/g to the feed (Figure 1).

**Figure 1** - Summary (10 trials) of % improvements in broiler live performance with *Bacillus subtilis* C-3102.




| | Average: |
|---|---|
| Final BW | 4.84% |
| FCR | 3.10% |
| EPEF | 7.58% |

European Poultry Efficiency Factor (EPEF) = (BW, kg x Livability, %)/(Age, days x FCR) x100

Across all 10 broiler pen trials (Figure 1), the average improvements from feeding diets with CALSPORIN® were 4.84% in body weight, 3.10% in feed conversion ratio, and 7.58% in European Poultry Efficiency Factor. The final ages in the 10 U.S. pen trials ranged from 39 to 49 days with an average of 42.20 days.

Economically, the return on investment varies according to feed cost/ton and live value or worth per broiler or per unit of weight. However, feed formulas, broiler genetics, levels of inclusion, and so on can cause variability in economics.

When using the overall Control vs. CALSPORIN® body weight, feed conversion ratio, and mortality % values from the meta-analysis and assumed feed cost and live broiler value, economic returns can be estimated as shown in Table 1. As the feed cost and live bird value increased, the cost-benefit ratio and return on investment increases partly because the cost of the feed additive remained the same. These are not guaranteed returns, just examples.

Broiler pen trials have been conducted with a combination product known as BacPack™ containing CALSPORIN® and IMW50®, a yeast cell wall extract that provides different but complementary modes of action to enhance performance and reduce pathogen loads. This gives a ready-to-use combination with a proven yeast cell wall product. In Table 2 are shown results comparing antibiotic free versus BacPack™ diets in February-April, 2013.

## References


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**Table 1.** Theoretical benefit: cost ratios and returns on investment in U.S. dollars using 10-trial meta-analysis results and assumed broiler feed cost per ton, broiler live production costs (value or worth), and CALSPORIN® cost.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Feed cost/U.S. ton, $ | 150.00 | 200.00 | 250.00 | 300.00 | 350.00 | 400.00 | 450.00 |
| Live broiler value, $/lb | 0.32 | 0.35 | 0.38 | 0.41 | 0.44 | 0.47 | 0.50 |
| Return on investment, $ | 9.1:1 | 9.6:1 | 10.2:1 | 10.7:1 | 11.3:1 | 11.9:1 | 11.2:1 |

Notes: The 10-trial means for Control and CALSPORIN® treatments, respectively, in body weight were 4.257 and 4.471 lb., in feed conversion ratio were 1.944 and 1.881, and in mortality were 3.098 and 3.390%. The return on investment ratio deducts the price of product (1x inclusion rate) giving an estimate of pure profit. The assumed CALSPORIN® cost for this exercise was $1.27 extra per treated ton at 300,000 cfu (viable spores)/g feed.

**Table 2.** Broiler performance at 49 or 56 days of age comparing antibiotic free (ABF) and BacPack™ diets

| Treatment | Body weight, lb | | Feed/gain ratio | | Mortality, % | | Feed expense, $/lb body weight gain | | (Index) EPEF |
|---|---|---|---|---|---|---|---|---|---|
| | 49 d | 56 d | 49 d | 56 d | 49 d | 56 d | 49 d | 56 d | 56 d |
| ABF diets | 6.640b | 7.959b | 1.916 | 2.043a | 4.444 | 5.185 | 0.369a | 0.390a | 299.3b |
| BacPack™ diets | 6.773a | 8.083a | 1.904 | 2.009b | 5.555 | 5.741 | 0.364b | 0.385b | 307.2a |
| Difference | +0.133 | +0.126 | -0.012 | -0.033 | +1.111 | +0.556 | -0.005 | -0.004 | +7.9 |
| *P* value | 0.051 | 0.001 | 0.325 | 0.007 | 0.275 | 0.555 | 0.018 | 0.100 | 0.046 |

a-b When comparing two treatments, P value refers to the probability of a conclusion being in error. For example, if treatment 2 is better on average than treatment 1 at P=0.05, this indicates 5% chance of being wrong (P=0.10 indicates 10% or P=0.001 indicates 0.10% chance of a wrong conclusion).




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