QUALITY TECHNOLOGY INTERNATIONAL

qtitechnology.com

Effect of single and multi-strain Q-Biotic® *Bacillus* on performance of broiler chickens

M. Ruano[1], T. Lohrmann[1], M. Araba[1], B. Lumpkins[2], G. Mathis[2]. [1]Quality Technology International, Inc. [2]Southern Poultry Research, Inc.

Introduction

- For over six decades, dietary antibiotics have been used to improve growth performance and feed efficiency, in addition to controlling infection diseases (1).
- The ban or reduction of the use of antibiotic growth promoters in animal production has increased the adoption of direct fed microbials (DFM) (2).
- Currently, a number of DFMs are available for improving poultry production efficiency, health and safety.
- The level of effectiveness of DFMs depends on a number of factors, including the bacterial species and strains used.
- Research and development efforts continue to result in new DFM alternatives for use in poultry.

Objectives

The objective of this study was to evaluate the effect of a *Bacillus*-based single strain DFM (Q-Biotic® 1DP) and a *Bacillus*-based multi-strain DFM (Q-Biotic® 3DP) on performance of broiler chickens.

Materials & Methods

EXPERIMENT 1

- 1,250 day old male Cobb 500 broilers, randomly assigned to 5 dietary treatments with 10 floor pens per treatment, 25 birds/pen and fed to 45 days of age.
- Stock density: 0.085 m^2 per bird.
- Treatments: Negative Control (NC), Positive Control (PC; BMD®50, 50g/ton), Q-Biotic 1DP (DFM1, 500K cfu/g feed), Q-Biotic 3DP (DFM2, 700K cfu/g feed), and commercial *Bacillus* probiotic (DFM3; 500K cfu/g feed).
- Diets: Corn-soy based, meet Cobb 500 minimum nutrient requirements, fed as crumbled starter, pelleted grower and finisher.
- Bedding: 4” recycled litter topped with fresh pine shavings.
- Vaccination: Coccivac® B52 at day 0.
- Body weight and feed intake measured at 2, 14, 28 and 45 days of age; mortality recorded daily.
- Five birds per pen were randomly selected for processing at 45 d of age.

EXPERIMENT 2

- 1,100 day old male Cobb 500 broilers, randomly assigned to 5 dietary treatments with 10 floor pens per treatment and 22 birds/pen and fed to 42 days of age.
- Stock density: 0.085 m^2 per bird.
- Treatments: Negative Control (NC), Positive Control (PC; BMD®50, 50g/ton), Q-Biotic 1DP (DFM1, 500K cfu/g feed), Q-Biotic 3DP (DFM2, 700K cfu/g feed), and commercial *Bacillus* probiotic (DFM3; 500K cfu/g feed).
- Diets: Corn-soy based, meet Cobb 500 minimum nutrient requirements, fed as crumbled starter, pelleted grower and finisher.
- Bedding: 4” recycled litter topped with fresh pine shavings.
- Vaccination: Coccivac® B52 at day 0.
- Body weight and feed intake measured at 2, 14, 28 and 42 days of age; mortality recorded daily.

References

- 1. Gadde, U. D., S. Oh, H. S. Lillehoj, and E. P. Lillehoj. 2018. Antibiotic growth promoters virginiamycin and bacitracin methylene disalicylate alter the chicken intestinal metabolome. Scientific Reports 8:3592.
- 2. Mingmongkolchai, S. and W. Panbangred. 2018. *Bacillus* probiotics: An alternative to antibiotics for livestock production. Journal of Applied Microbiology 124(6) DOI:10.1111/jam.13690.

Results

In experiment 1 (Figure 1-3 and Table 1), feeding PC or DFM2 improved (P<0.05) BWG by 255 and 243 grams, and reduced (P<0.05) mortality-corrected FCR by 12 and 17 points at 42 d of age, respectively, compared to NC. Birds fed DFM3 or DFM1 had lower BWG than PC and DFM2, but were not different from NC. DFM1 and DFM3 reduced (P<0.05) mortality-corrected FCR by 10 and 12 points, respectively, compared to NC, but did not significantly differ from PC and DFM2. Compared to NC (P<0.05), higher % breast, lower carcass weight, and lower % carcass were observed with DFM2, DFM3, and DFM1, respectively. Mortality rate did not differ significantly among the treatments; however, birds fed DFM2 or BMD50 had numerically lower mortality than the control or the single-strain DFM treatments.

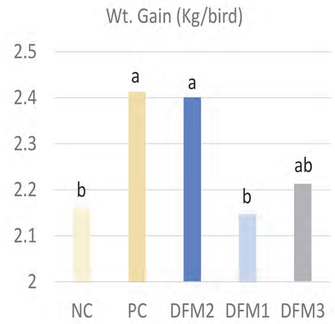

Figure 1: Body weight gain, 2-45 days of age (Experiment 1). Bars with different superscripts are significantly different (P<0.05).

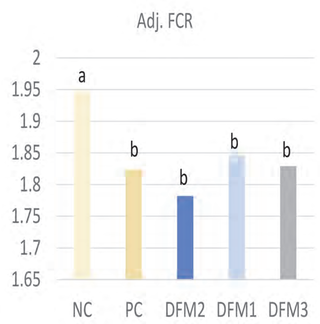

Figure 2: Mortality-adjusted feed conversion ratio, 2-45 days of age (Experiment 1). Bars with different superscripts are significantly different (P≤0.05).

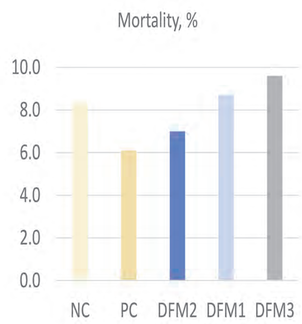

Figure 3: Mortality, 2-45 days of age (Experiment 1).

Effect of DFM on Carcass Quality

Treatment	Carcass Weight (Kg/Bird)	Breast Weight (Kg/Bird)	% Carcass	% Breast
NC	1.94^{ab}	0.50^{ab}	71.89^{ab}	25.71^{bc}
PC	2.00^{a}	0.53^{a}	72.02^{a}	26.33^{ab}
DFM2	1.98^{a}	0.52^{a}	71.56^{abc}	26.39^{a}
DFM1	1.83^{bc}	0.47^{bc}	70.37^{d}	25.38^{bc}
DFM3	1.81^{c}	0.46^{bc}	70.90^{bcd}	25.44^{bc}

Table 1: Carcass quality at 45 days of age (Experiment 1). Means within a column with different superscripts are significantly different (P≤0.05).

In experiment 2 (Figure 4-6), compared to NC at 42 d of age, PC increased (P<0.05) BWG by 124 grams, which was greater (P<0.05) than DFM3 but was not statistically different from DFM2 or DFM1. PC and DFM2 improved (P<0.05) mortality-corrected FCR by 12 and 11 points compared to NC, whereas DFM1 and DFM3 improved (P<0.05) FCR by 9 and 4 points, respectively. Mortality-corrected FCR of PC and DFM2 were lower (P<0.05) than that of DFM1, which was lower (P<0.05) than DFM3. Mortality was lowest in birds fed DFM2, which was significantly lower than DFM1 or DFM2 treatments.

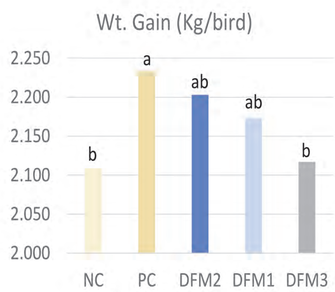

Figure 4: Body weight gain, 2-42 days of age (Experiment 2). Bars with different superscripts are significantly different (P≤0.05).

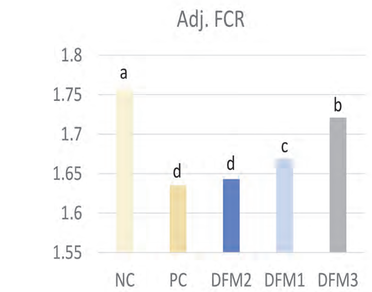

Figure 5: Mortality-adjusted feed conversion ratio, 2-42 days of age (Experiment 2). Bars with different superscripts are significantly different (P≤0.05).

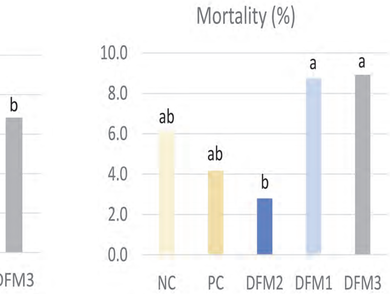

Figure 6: Mortality-adjusted feed conversion ratio, 2-42 days of age (Experiment 2). Bars with different superscripts are significantly different (P≤0.05).

DFM1 = Q-Biotic® 1DP
DFM2 = Q-Biotic® 3DP
DFM3 = Commercial *Bacillus* probiotic
PC = BMD®50
NC = No additive

Summary

All treatments improved broiler performance compared to NC, with best and equivalent performances observed with the 3-strain Q-Biotic® 3DP (DFM2) or BMD®50. The single-strain Q-Biotic® 1DP (DFM1) and the commercial single-strain DFM (DFM3) resulted in similar bird performance improvements.

Implications

- Q-Biotic® 1DP and Q-Biotic® 3DP are new and viable DFM options available for use in poultry.
- The multi-strain Q-Biotic® 3DP can result in better bird performance under more challenging rearing conditions, compared to the single-strain DFMs used in this study.