# The effect of a pre- and probiotic (separate and in combination) on the performance of broilers

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**As an alternative for the banned antimicrobial growth promoters in poultry, pre-, and probiotics are used in practical broiler feeding. A trial was done by Schothorst Feed Research to test Vetmostan, an exocellular mannan oligosaccharide (MOS) produced by an intentionally cultured micro-organism, and a probiotic based on Bacillus subtilis spores added to a wheat/soya-based broiler diets. MOS was added as 2, 1 and 1 g/kg and the probiotic as 0.5, 0.5 and 0 g/kg to the starter, grower and finisher, respectively. 408 Ross male and 408 female day-old broilers were randomly allocated to 48 pens (17 birds/pen). Per sexe, each dietary strategy was tested with 6 replicate pens.**
**MOS improved body weight gain (BWG) and feed conversion ratio (FCR) after 36 days significantly both with 1.9%, whereas Bacillus subtilis had no significant effect on BWG and FCR. The use of both products together improved BWG and FCR significantly with 3.0 and 2.1% respectively. Positive effects became significant after 14 days. No interaction between sexe and treatment was found. It was concluded that the addition of MOS to the diets was more effective stimulating broiler performance than the addition of Bacillus subtilis.**

**Keywords:** broilers; MOS; Bacillus subtilis; prebiotic; probiotic

## Introduction

As antimicrobial growth promoters in poultry and pig diets are banned, feed manufacturers and producers of feed additives are looking for alternatives to control the microbial activity in the gastro-intestinal tract and its potential negative effects on nutrient utilisation, intestinal integrity and production performance. Such potential alternatives are pre- and probiotics (Veldman et al, 1999). Prebiotics are defined as dietary supplements, which stimulate the growth of certain potentially beneficial bacteria in the intestines. Probiotics are dietary supplements containing such bacteria or yeasts. At Schothorst Feed Research a study was conducted to determine the effect of Vetmostan, an exocellular mannan oligosaccharide (MOS) produced by an intentionally cultured micro-organism, and a probiotic based on Bacillus subtilis as dietary supplements on production performances of broilers from 0 to 36 days of age. Dietary supplements were studied alone or in combination.

## Materials and methods

The experiment comprised eight treatments in total, based on four dietary treatments, tested in male and female broilers. Dietary treatments were based on the addition of either Vetmostan or Bacillus subtilis spores or a combination of both to an unsupplemented basal diet in the starter and the grower phase. In the finisher phase only Vetmostan was used. The test products were supplied by Huvepharma, Belgium. Dietary treatments and the levels of supplementation of the additives are given in Table 1.

**Table 1. Dietary treatments in the experiment**

| Dietary treatment | | Starter | | Grower | | Finisher | |
|---|---|---|---|---|---|---|---|
| No. | Description | 0-14 d | g/kg[1] | 14-28 d | g/kg[1] | 28-36 d | g/kg[1] |
| 1 | Control diet[2] | | - | | - | | - |
| 2 | As 1 + Vetmostan | | 2 | | 1 | | 1 |
| 3 | As 1 + Bacillus subtilis | | 0.5 | | 0.5 | | - |
| 4 | As 1 +Vetmostan + Bacillus subtilis | | 2+0.5 | | 1+0.5 | | 1+0 |

[1] Dosing of test product as top-dressed
[2] In tables the additive treatments will be abbreviated as V (Vetmostan) and BS (Bacillus subtilis spores)

408 Ross male and 408 female one-day-old broilers were purchased and randomly allocated to 48 pens (17 birds per 0.88 $m^2$ pen) with wood shavings as bedding material. A lighting schedule of 23 hours light and 1 hour darkness was used throughout the experimental period. The ambient temperature was gradually decreased from 32ºC at arrival according a standard temperature schedule.

At the hatchery the birds were vaccinated against IB. At 10 days of age the birds were vaccinated against NCD and at 20 days of age against Gumboro.

A starter, grower and finisher diet was formulated based on approximately 60% wheat and 25% soybean meal (AMEn 2925, 3000, 3000 kcal/kg; dig. lysine 10.7, 10.1, 10.0 g/kg). The nutrient, mineral and vitamin composition of all diets were nutritionally adequate according to the CVB (2005) requirements for broilers. The starter and grower diets were supplemented with chemical coccidiostats Robenidine and Halofuginone, respectively. The diets did not contain any antimicrobial feed additive and were presented as mash. The birds were given feed and water for ad libitum intake.

Per sexe, each dietary strategy was tested with 6 replicate pens. Body weight gain (BWG) and feed intake (FI) were measured from 0-14, 14-28 and 28-36 days of age. BWG, FI and feed conversion ratio (FCR) were statistically analysed using ANOVA (Genstat) with sexe and diet as treatment factors. The experiment was carried after approval of the experimental protocol by the Dutch Animal Experimental and Ethics Committee.

## Results and discussion

Healthy one-day-old broilers arrived at the institute with an average body weight of 40.5 and 40.3 grams for the males and females, respectively. Bird mortality after 36 days was low (2.6%) and not affected by experimental treatments.

Broiler performance per dietary treatment are presented in Table 2. Differences between males and females were significant as expected. As this study was focussed on the effect of Vetmostan and Bacillus subtilis spores on production performances and no interaction effects “sexe x additive” were observed, no further attention will be paid to the sexe effect.

It was shown during the first 14 day period that feed intake was improved in birds fed the Vetmostan containing diets (P=0.06). Although this effect disappeared in older birds, a positive response was shown on BWG and FCR from 0 to 28 days of age and from 0 to 36 days of age. Up to 28 days of age, dietary supplementation with Vetmostan resulted in a 2.1% and Bacillus subtilis spores in a 1.4% improvement of BWG. The combination of both products gave a 3.2% improvement and effects of both feed additives therefore seemed to be additive (see Figure 1). The positive effect of the feed additives after 36 days on BWG was slightly less than shown during the 28 day period, but improvement (in g) was larger (on average 40 and 63 g for Vetmostan and Vetmostan plus Bacillus subtilis respectively). Compared to the 28-day period, the positive effect on feed conversion ratio was similar for Vetmostan (-1.9%) and Vetmostan and Bacillus subtilis (-2.1%) supplementation, but was no longer significant for the Bacillus subtilis alone (-0.9%).

**Table 2. Mean results per dietary treatment for body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR) of the broilers**

| | FI | | BWG | | FCR | |
|---|---|---|---|---|---|---|
| | g | % | g | % | g/g | % |
| 0-14 d | | | | | | |
| Control | 493 | 100.0 | 374 | 100.0 | 1.327 | 100.0 |
| V | 502 | 101.9 | 377 | 101.0 | 1.329 | 100.1 |
| BS | 492 | 99.8 | 372 | 99.7 | 1.321 | 99.5 |
| V+BS | 500 | 101.5 | 380 | 101.6 | 1.317 | 99.2 |
| *P / Lsd (Additive)* | *0.06* | *8.8* | *0.22* | *8.0* | *0.62* | *0.0207* |
| *0-28 d* | | | | | | |
| Control | 1989 | 100.0 | 1328 [a] | 100.0 | 1.499 [b] | 100.0 |
| V | 1992 | 100.2 | 1355 [bc] | 102.1 | 1.471 [a] | 98.2 |
| BS | 1985 | 99.8 | 1347 [ab] | 101.4 | 1.475 [a] | 98.4 |
| V+BS | 2013 | 101.2 | 1371 [c] | 103.2 | 1.469 [a] | 98.0 |
| *P / Lsd (Additive)* | *0.21* | *27.9* | *0.008* | *23.8* | *<0.001* | *0.0134* |
| *0-36 d* | | | | | | |
| Control | 3290 | 100.0 | 2061 [a] | 100.0 | 1.598 [b] | 100.0 |
| V | 3290 | 100.0 | 2101 [bc] | 101.9 | 1.568 [a] | 98.1 |
| BS | 3280 | 99.7 | 2073 [ab] | 100.6 | 1.584 [b] | 99.1 |
| V+BS | 3321 | 101.0 | 2124 [c] | 103.0 | 1.565 [a] | 97.9 |
| *P / Lsd (Additive)* | *0.24* | *42.3* | *0.001* | *31.5* | *<0.001* | *0.0152* |

[a,b,c] *Mean values without a common superscript letter within a column differ significantly between diets per age period*

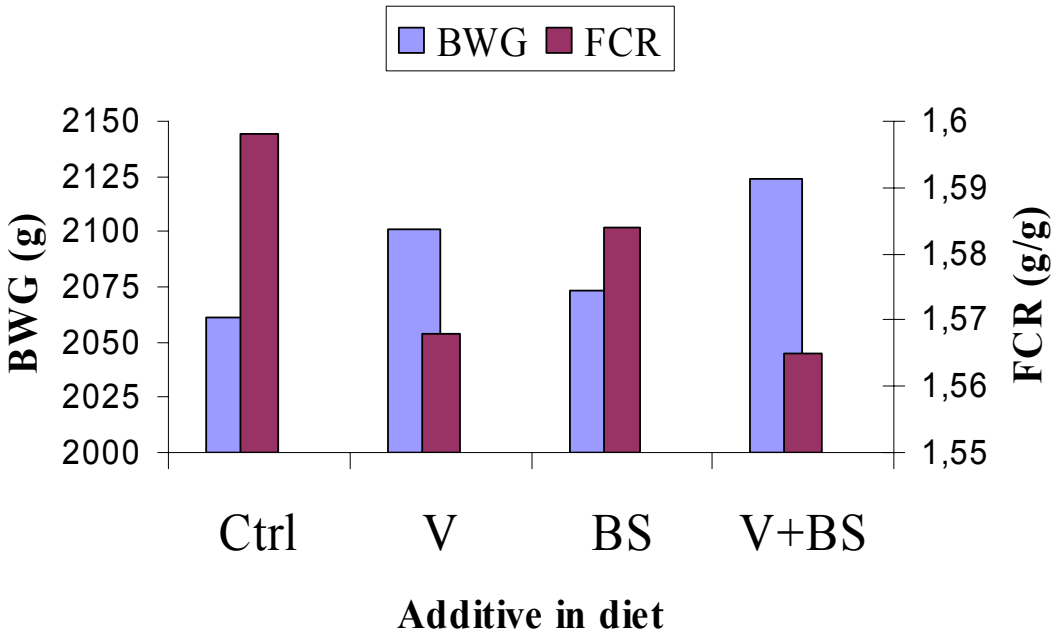


**Figure 1. Effect of the addition of Vetmostan (V), Bacillus subtilis (BS) alone or in combination (V+BS) to the control diet (Ctrl) on body weight gain (BWG) and feed conversion ratio (FCR) of broilers from 0 until 36 days of age.**

Average body weights of the male and female broilers from the control group were higher than the Ross standards: approx. +6% and 8%, respectively, whereas the FCR were similar to the Ross standards. After the first 14 day period, however, BWG of the males and females were approx. 6% and 1% lower compared to the standard values. These results of the control group show that broilers fed mash diets with a high inclusion level of wheat can result in good production performances, even without specific feed additives. As these feed additives are assumed to be the most effective under less optimal gastro-intestinal or management conditions, it is hypothesised that the magnitude of the effects shown in this study will most probably be larger under more practical circumstances. In the finisher phase (days 28-36) no effect of Bacillus subtilis was shown, which was most probably due to the absence of Bacillus subtilis in the finisher diets. The calculated European efficiency factor (EPEF) for the results form 0-36 days of age increased significantly from 350 for the control group to 362 and 367 for the groups with Vetmostan and Vetmostan + Bacillus subtilis added to the diets respectively.

From this experiment it was concluded in that dietary supplementation with 2.0, 1.0, 1.0 g Vetmostan as prebiotic feed additive alone or in combination with 0.5, 0.5, 0.0 g/kg Bacillus subtilis as a probiotic feed additive in starter, grower and finisher diets respectively improved BWG and FCR of broilers during a complete production period. Effects were not affected by sexe.

## References

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