



Introduction

Traditional plant-based feed ingredients used in animal production systems, such as soybean, have high irrigation requirements, often lead to soil degradation, and require fertilizers and pesticides and are therefore becoming increasingly unsustainable (Boerema et al, 2016). A promising alternative to traditional protein and energy sources for the poultry industry is insect meal, in particular black soldier fly larvae meal (BSFM), which can be produced with minimal environmental impacts, is rich in nutrients, can be reared at high stocking densities with low water requirements and utilize food waste as their energy source. Previous trials indicate that feeding BSFM can result in reduced performance such as feed conversion, feed intake and egg production. This could be attributed to impaired digestibility and availability of the protein caused by the presence of chitin in the exoskeleton of the BSFM (Simbaya et al, 1996). For this reason, the research team included proteases (Concentrase-P) in the diets to aid in the digestion of the protein.



Photo Credit: Janice MacIsaac

Objective

To determine the effects of including up to 13% BSFM (Enterra Feed Corporation) with or without a supplementary protease-based enzyme (Concentrase-P) in Lohmann Brown-Lite laying hen diets on performance and egg quality.

Industry Impact

The results from this project may provide an option for producers that are looking for new and improved methods for reducing feed costs and improving bird health and product safety with a non-antibiotic-based treatment. Necrotic enteritis is not a significant issue for the egg industry at present. However, it could be a greater concern as the industry transitions to modified housing systems. Feeding BSFM to improve the valeric

acid content of the gut may prove very beneficial to producers to manage this condition. As well, BSFM's effect on healthy gut microflora could prove very useful as the industry continues to move away from the use of preventative antibiotics.

Trial

A total of 180 Lohmann Brown-Lite hens (52 weeks of age) were housed in 36 conventional cages with five birds per cage. The cages were randomly allocated to one of six feed treatments: 1) the control diet was a commercial soybean mash with 0% BSFM and no Concentrase-P enzyme; 2) 6.5% BSFM and no enzyme; 3) 13% BSFM and no enzyme; diets 4, 5 & 6 contained 0, 6.5% and 13% BSFM, respectively, and 0.025% enzyme.

This was a 20-week trial, broken into five four-week production periods. Production performance and egg quality data were collected at the end of each four-week period. Feed consumption, body weight, egg production and egg quality were determined.

At the end of the trial, two birds per cage were euthanized and digesta samples were harvested. Cecal content samples were collected for short-chain fatty acid analysis and next generation sequencing to identify microbial populations.

Results

- ✓ For both white and brown hens, body weights, egg production, egg quality and feed conversion were similar for all treatments. However, for brown hens, feed consumption was lower when fed the 13% BSFM diet. There was no difference in feed consumption between treatments for white hens.
- ✓ For both strains of hens, feeding the highest level of BSFM at 13% had a negative impact on the omega-3 fatty acid content of the egg (this finding would have an impact for those marketing their eggs as a source of Omega-3).
- ✓ BSFM increased the lauric acid content of the eggs which has been shown to have antimicrobial properties and therefore may improve gut health.
- ✓ Egg yolks were more yellow from the white hens fed the 6.5 and 13.5% BSFM treatments than those of the hens fed no BSFM. The yolk color was not affected by BSFM for the eggs from the brown hens.
- ✓ For both strains of hens, the inclusion of BSFM did not affect the presence of the primary short-chain fatty acids, acetic, propionic, and butyric. However, the valeric acid content in the brown hens fed the control diet was significantly lower than those fed the 6.5% BSFM diet. It is thought that valeric acid may reduce the incidence of necrotic enteritis in broiler chickens.
- ✓ Analysis of the gut microbial populations indicated significantly different populations in brown and white hens. Microbial populations in the gut were significantly different between treatments. Feeding 6.5 and 13% BSFM significantly improved the cecal microbial community. This could be due to the increased Proteobacteria, Desulfobacterota, Verrucomicrobiota and decreased Actinobacteriota (Figure 1).

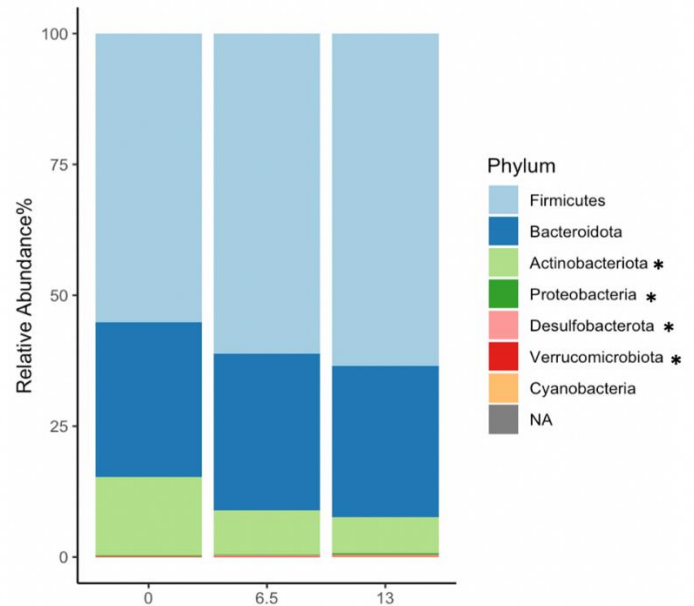


Figure 1. Effect of dietary inclusion of BSFM on the relative abundance of phyla in laying hens. On the phylum level, Firmicutes, Bacteroidetes and Actinobacteriota are the dominant phyla accounting for 99% of the relative abundance in the laying hen cecal microbiome.

Researchers and Cooperators

Hannah Facey, Janice MacIsaac, Jing Lu, Madelaine Empey, Sarah MacPherson, Krista Budgetell, Stephanie Collins

Funding Support

Advancing Agricultural Research and Innovation Initiative & Egg Farmers of Nova Scotia, Egg Farmers of New Brunswick, and Egg Farmers of PEI. Canadian Bio-Systems Inc. donated the Concentrase-P used in this study.

References

Boerema, A., Peeters, A., Swolfs, S., Vandevenne, F., Jacobs, S., Staes, J., Meire, P. 2016. Soybean trade: Balancing environmental and socio-economic impacts of an intercontinental market. *PLoSOne*. 11: e0155222.

Simbaya, J., B. Slominski, W. Guenter, A. Morgan, and L. Campbell. 1996. The effects of protease and carbohydrase supplementation on the nutritive value of canola meal for poultry: in vitro and in vivo studies. *Anim Feed Sci Technol* 61:219–234.