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Case Study

Effect of alpha-galactosidase and beta-glucanase on the carbon footprint from poultry feed mills



Overview

In an assessment on the effect of alpha-galactosidase and beta-glucanase (AGBL) on the greenhouse gas (GHG) emissions from poultry feed mills, two variants of a typical broiler diet based on corn, wheat and SBM were considered, with the main variable being the presence or absence of AGBL.

These enzymes increase the nutritional value of feed, particularly soybean meal (SBM) and cereal grains, reducing the need for expensive fat sources in poultry diets. This may be of relevance in geographies where soy is grown due to the direct impact on land use.

Consequential life cycle assessment (LCA) was applied according to international standards (ISO 14040/44), including sensitivity analysis. This study defined appropriate GHG emission factors (EFs) from publicly available sources, considering the most applicable farming practices, crop geographical region and age of the data.¹

AGBL supplementation reduced feed conversion ratio by 0.04, translating into approximately 40 g less feed required per kilogram of chicken produced, thereby directly lowering total feed demand and associated resource use per unit of broiler output.¹

Impact

- **Carbon Emission Savings Using AGBL:** Findings showed that approximately 46 kg CO₂e/MT feed could be spared by supplementing a typical European broiler dietary feed formulation with AGBL.¹
- **Alleviate Regional Land Use Pressures:** A significant parameter affecting the sensitivity analysis was the impact of land use (LU) change. If a change of LU was avoided, savings increased to ~85 kg CO₂e/MT feed. This is important for regions where there is pressure to increase agricultural land use areas.¹
- **Regional Raw Material Variability:** The selection of regional emission factors are critical, selecting soybean oil emission factors (EF) from Brazil could increase savings to ~83 kgCO₂e/MT feed, while selecting factors from USA would reduce savings to ~10 kgCO₂e/MT feed.¹
- **Cost savings:** Per annum, up to 604,000MT of typical European feed could be saved by using AGBL in the formulation, with potential cost savings of approximately €135m. Additionally, results dictate that AGBL could allow for a 1% reduction in the use of soya oil Per MT of feed, saving €3.70 per MT of feed.²
- **Carbon footprint reduction:** By producing feed formulations that have a lower carbon footprint (46 kg CO₂e/MT feed) and increased nutrient digestibility lowering feed consumption by ~100g/bird, the resulting carbon footprint reduction of 1kg chicken meat can be reduced by ~2.2% (equating to a reduction of ~32,000 CO₂e per year).¹

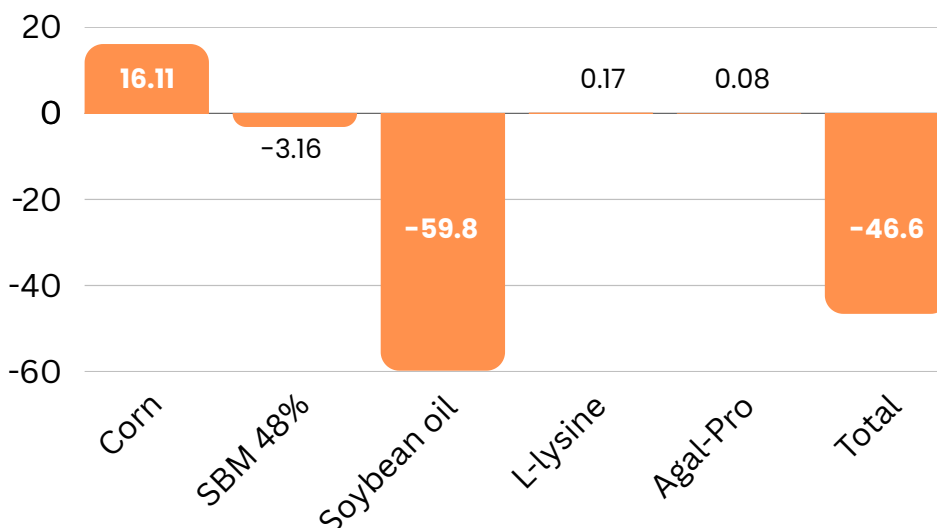


Figure 1: Changes in GHG emissions (kg CO₂/MT) associated with the utilization of an alpha-galactosidase and beta-glucanase (AGBL) enzyme combination in broiler feed. 1

Supporting Materials:

1. Llamas-Moya, S., Higgins, N. F., Adhikari, R., Lawlor, P. G., & Lacey, S. (2021). Effect of multicarbohydase enzymes containing α -galactosidase on the growth and apparent metabolizable energy digestibility of broiler chickens: A meta-analysis. *Animal Feed Science and Technology*, <https://doi.org/10.1016/j.anifeedsci.2021.114949>
2. Llamas Moya, S., Ryan, W. J., Sizer, D., & Griffiths, P. (2017). Effect of alpha-galactosidase and beta-glucanase on the carbon footprint from poultry feed mills. In *Proceedings of the 21st European Symposium on Poultry Nutrition (ESPN 2017)*, May 8–11, Salou/Vila-seca, Spain. Wageningen Academic Publishers.

(Note, calculations estimated based on 2024 market prices – fluctuations will impact values)

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*This sustainability-related case study was provided by **Kerry**.*

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