Reducing the environmental footprint of monogastric animal production through the combination of selected feed additives

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Introduction

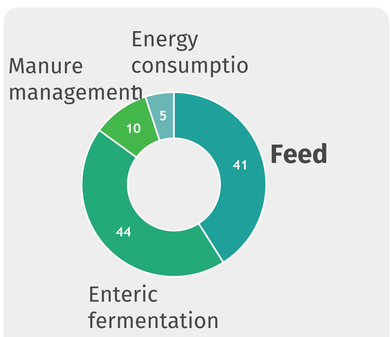
If animal production continues without change...

...it will consume an increasing proportion of the worlds' GHG budget

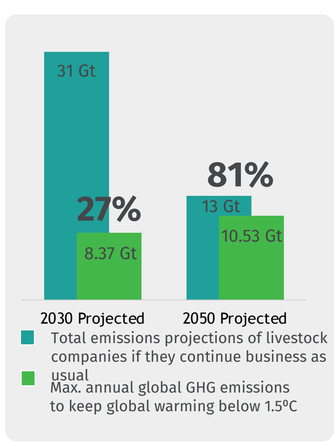
Animal farming accounts for

14.5%

of all human derived GHG emissions



Source: FAO GLEAM 2.0 Assessment of GHG emissions and mitigation potential. 2018; adapted from GRAIN and IATP report: Emissions impossible, July 2018



Hence the pressing need for emissions mitigation strategies

Feed additives have been identified as one lever of actions

Swine & Broiler

Enzymes, Vitamins and Eubiotics

Using **LCA** (Life Cycle Assessment)

Environmental impacts

Materials & Methods

Life Cycle Assessment

System boundaries

Cradle to farm gate: from crop cultivation, feed processing to animal farming

Functional unit

In line with the PEFCR Red Meat and the LEAP guidelines: **1 kg of liveweight as delivered to the slaughterhouse**

Methodological tools

LCA calculations were done using the **APS/Sustell™ tool**, co-developed by Blonk Sustainability and DSM in line with ISO 14040/44

Methodology

European Joint Research Center (JRC) Environmental Footprint impact assessment method (**EF 2.0**), and guidelines from **PEFCR Red Meat, LEAP and PEFCR for feed**

Sustell™ Sustainability Intelligently Applied · PEF guidelines · Blonk

Animal Systems

Poultry

Description

- Modern Benelux broiler production system of Ross 308
- **Production cycle:** 42 days rearing & 10 days cleaning
- **Final Bodyweight:** 2.5kg
- **FCR:** 1.6
- **Mortality:** 4.4%
- **Diet:** 4 phases diet, wheat/corn/soybean diet with average Crude Protein 19%

Feed additives

- **25(OH)D3**: 69 µg/kg feed replacing 3000 IU Vit D3/kg feed
- **Eubiotics**: 300 mg/kg feed
- **Phytase**: 100 mg/kg feed
- **Protease**: 200 mg/kg feed
- **Xylanase**: 75 mg/kg feed

Fattening pigs

Description

- Modern Benelux intensive grower-fattener pig production system
- **Production cycle:** 114 days
- **Final Bodyweight:** 117kg (starting at 25kg)
- **FCR:** 2.0
- **Mortality:** 3.2%
- **Diet:** wheat/barley/corn diet with average Crude Protein 17%

Feed additives

- **Vitamin E**: 200 mg/kg finisher feed
- **Benzoic acid**: 5,000 mg/kg DM feed; 10,000 mg/kg DM feed
- **Phytase**: 30 mg/kg feed
- **Xylanase**: 100 mg/kg feed

Results & Discussion

Poultry

Table 1: Zootechnical effects of feed additives and LCI parameters for poultry

Feed additives	Zootechnical effect (qualitative)	Zootechnical effect (quantitative)	Quantitative LCI flows
25(OH)D3	Muscle and bone development support	·Mortality reduction: -0.5% pts ·Breast meat yield increase +4%	·Feed consumption +0.20% (mortality) ·Increased production +0.47%
Eubiotics	Gut functionality support	FCR -3%	·Faster growth, BWG +1.6% ·Lower feed intake -1.6%
Phytase	Improvement of phytates digestion	Lower mineral phosphate requirement	Change in diet
Protease	Improvement of proteins digestion	Lower CP requirement	Change in diet
Xylanase	Increased hydrolysis of arabinoxylan	Lower gross energy requirement	Change in diet

Fattening pigs

Table 2: Zootechnical effects of feed additives and LCI parameters for fattening pigs

Feed additives	Zootechnical effect (qualitative)	Zootechnical effect (quantitative)	Quantitative LCI flows
Vitamin E	Enhanced meat quality, lower meat losses	-5% meat loss at consumer	Out of boundary
Benzoic acid	Gut functionality support and urine acidification	FCR -3%, NH3 emissions: -10%/-20% depending on dosage*	·Faster growth, BWG +1.34% ·Lower feed intake, -1.34% ·NH3 emissions -10%/-20%
Phytase	Improvement of phytates digestion	Lower mineral phosphate requirement	Change in diet
Xylanase	Increased hydrolysis of arabinoxylan	Lower gross energy requirement	Change in diet

* Benzoic acid dosages: 5,000 mg/kg DM feed or 10,000mg/kg DM feed

Figure 1: Impact assessment per kg of LW for the combination of all feed additives

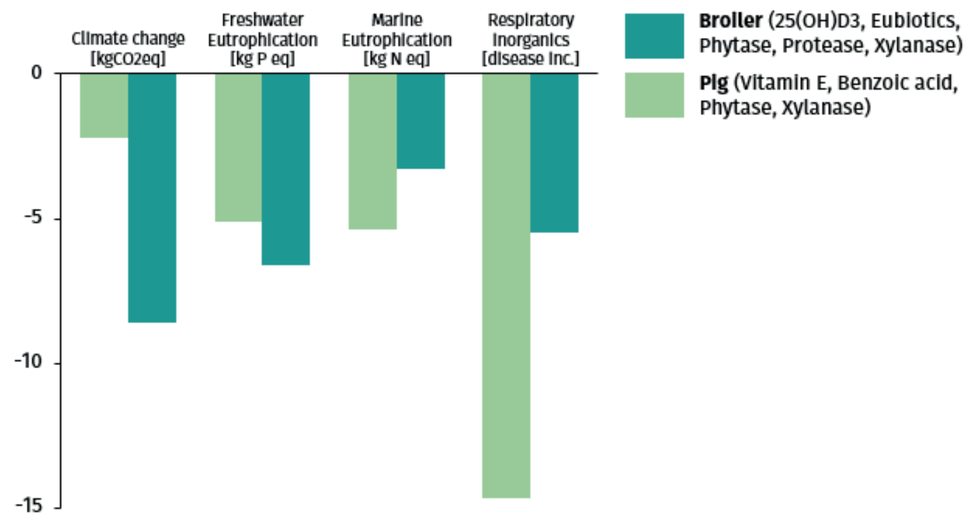


Table 3: Impact assessment per kg of LW

Impact Category	Unit	Poultry Baseline	Poultry All feed additives	%	Fattening pigs Baseline	Fattening pigs All feed additives	%
Climate change	kgCO2eq	4.00	3.65	-8.6%	4.16	4.07	-2.2%
Freshwater Eutrophication	kg P eq	$5.83 \cdot 10^{-4}$	$5.45 \cdot 10^{-4}$	-6.6%	$4.09 \cdot 10^{-4}$	$3.89 \cdot 10^{-4}$	-5.1%
Marine Eutrophication	kg N eq	$1.91 \cdot 10^{-2}$	$1.85 \cdot 10^{-2}$	-3.3%	$2.72 \cdot 10^{-2}$	$2.58 \cdot 10^{-2}$	-5.4%
Respiratory Inorganics	Disease incidence	$3.82 \cdot 10^{-7}$	$3.61 \cdot 10^{-7}$	-5.5%	$5.08 \cdot 10^{-7}$	$4.43 \cdot 10^{-7}$	-14.7%

Conclusion

The study confirms the important role that feed additives can play at farm level in conducting sustainability improvement plans through the improvement of animal productivity and animal health, and the reduction of on-farm emissions for monogastric animals. The combination of carefully selected feed additives can play a significant role in emissions mitigation strategies.