Acknowledgments
The authors thank the animal care takers, B. Ampe for data analysis, and N. Peiren and T. Van De Gucht for technical assistance with ammonia measurements.

Funding
This study was financially supported by Flanders Innovation and Entrepreneurship (VLAIO) (project number 160778) and ILVO.

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doi: 10.1016/j.anscip.2022.07.107

O98 Supplementation of a novel consensus bacterial 6-phytase variant to all-plant-based diets without added inorganic phosphorus maintained tibia ash and performance in broilers fed EU type diets with increasing levels of phytate phosphorus

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Keywords: Phytase; Inorganic phosphate free; Broilers; Phytate; Tibia ash; Sustainability

Introduction
Inorganic phosphate is a finite resource which needs to be preserved as much as possible. To enable more sustainable broiler production, it was previously shown that it is possible to feed broilers inorganic P free from day one (Marchal et al, 2021; Dersjant-Li et al, 2022). In these studies, the control diets were formulated without phytase and in the studies, phytate levels were reduced in each sequential feeding phase. In this study the phytate levels were maintained throughout the different feeding phases to allow for the use of a higher levels of local European by-products (i.e. sunflower and rapeseed meal) in the broiler diets. The objective of this study is to test if the phytase can totally replace inorganic P and maintain performance and bone quality, in diets with increasing phytate P levels in comparison to a commercial diet, positive control (PC), supplemented with 1000 FTU/kg phytase and 750 U/kg xylanase. The hypothesis of this study is that the PhyG will maintain performance and bone quality regardless of phytate P level in the diets.

Material and Methods
Each treatment consisted of 12 replicates of 25 male Ross 308 birds at the start of the experiment. All diets were formulated nutrient adequate but not over specified. A four-phase feeding (0–10, 11–21, 22–35, 36–42 days) was performed. The PC was formulated with decreasing g/kg of inorganic monocalcium phosphate for 4 diet phases (5.36; 3.26; 1.44; 0.56) and with 1000 FTU/kg of a novel consensus bacterial 6-phytase variant (Phy G). The digestible P content in PC was 2.62, 2.12, 1.72, 1.52 g/kg respectively for starter, grower and finisher 1 and 2 phases, with considering the contribution of digestible P matrix of 1000 FTU/kg PhyG. All diets contained 750 U/kg of Danisco xylanase. The test treatments were formulated to contain low (LPP), medium (MPP) and high phytate P (HPP) without any inorganic phosphate from day 1. The PC and LPP diets consisted of varying amounts of corn, wheat, soybean meal; the MPP and HPP diets were formulated with inclusion of sunflower (up-to 5.5%) and rapeseed meals (up-to 5.7%). The phytate P level of all ingredients was analyzed before feed production to ensure accurate feed formulation. The average through feeding phases of formulated (and analyzed) phytate P (PP) concentration was 3.15g/kg (3.3 g/kg) in PC; 3.14g/kg (3.2 g/kg) in LPP; 3.29 g/kg (3.4 g/kg) in MPP and 3.44 g/kg (3.5 g/kg) in HPP treatment. All test treatments used a stepwise decrease in Phy G in 4 phases (3000, 2000,1000,1000 FTU/kg respectively). All diets were formulated with Ca, dig AA downspec based on the contribution of 1000 FTU/kg phytase and 70 kcal/kg ME downspec based on the contribution of 750 U/kg xylanase compared to breeder recommendation. At day 21 and 42, four birds per pen were euthanized and tibia ash determined. Data was analysed by one-way ANOVA.

Results and Discussion
The different treatments were all able to maintain performance as compared to the PC (Table 1) with respect to body weight and feed conversion ratio. There was no statistical difference in mortality between the different treatments. Also, the tibia ash percentage of all treatments were statistical identical (Table 2) indicating that bone development was maintained in the inorganic P free diets.

Conclusion and Implications
This trial confirmed that it is possible to formulate broiler diets inorganic P free (using normal available feed ingredients and a novel consensus bacterial 6-phytase variant) while maintaining performance compared to a commercial control diet with the phytase at 1000 FTU/

Table 1
Body weights and mortality corrected FCR (12 replicates per treatment).[1]

Treatment	Body weight [g]				FCR			
	day 10	day 21	day 35	day 42	day 1–10	day 1–21	day 1–35	day 1–42
PC	306	1030	2334	2978	1.12	1.24	1.40	1.58
1-LPP	306	1037	2312	3050	1.08	1.21	1.40	1.56
2-MPP	304	1032	2313	2983	1.10	1.20	1.38	1.57
3-HPP	302	1031	2301	2979	1.12	1.24	1.41	1.59
P-values	0.92	0.99	0.89	0.63	0.12	0.14	0.56	0.62
SEM	4.98	16.95	30.02	46.12	0.014	0.015	0.016	0.019

[1] PC Positive Control commercial diet, low phytate P (LPP), medium phytate P (MPP), high phytate P (HPP).

Table 2
Tibia ash% DM (pooled 4 birds per pen, 12 replicates per treatment).

Treatment	21d ash %	42d ash%
PC	41.9	31.7
1-LPP	39.6	32.9
2-MPP	39.5	32.7
3-HPP	40.2	31.0
P-values	0.19	0.41
SEM	0.94	0.90

kg. The use of evaluated phytate levels throughout all feeding phases was shown possible without performance effects, allowing for higher use of phytate rich by-products in broiler production.

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doi: 10.1016/j.anscip.2022.07.108

O99 Effect on carbon footprint when substituting grass-clover silage with maize silage for dairy cows

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Keywords: Methane mitigation; Climate; Carbon footprint; Feed production; Maize

Introduction

Maize silage and grass-clover silage are two important forage sources for dairy cows. Maize silage contains starch which can reduce enteric methane, whereas growing grass-clover increase the carbon-sequestration in the fields. The aim of this experiment was to determine the optimal ratio between maize silage and grass-clover silage for lactating dairy cow diets in order to reduce the total carbon footprint (CF) from dairy production, with enteric methane and feed production being the major hotspots.

Material and Methods

Four diets varying in proportions of grass-clover silage and maize silage (100:0, 67:33, 33:67, and 0:100 on forage dry matter (DM) basis, respectively) were fed ad libitum to 4 lactating Holstein cows in a 4 $\times$ 4 Latin square design. Forage made up 70% of diet DM. Rolled wheat was decreased from 18 to 0% of DM and rapeseed meal was increased from 4 to 22% of DM in the 100:0 diet vs. the 0:100 diet, respectively. The residual 8% was soybean meal, lipid supplement, and mineral and vitamins. Net energy was 7.0 MJ per kg DM in all diets, whereas starch in DM increased from 9.4 to 23.4% in the 100:0 vs. the 0:100 diet, respectively. Methane (CH_4) was measured in open-circuit respiration chambers on 5 consecutive days for each cow. The conversion factor 1 kg CH_4 = 25 kg CO_2-eq. was used.

Data were analyzed with treatment and period as fixed effects and cow as random effect using the Mixed-procedure of SAS 9.4 version. Carbon footprint from feed production was based on the Life Cycle Assessment (LCA) and average net crop yields in Denmark, 8,100 kg DM for grass-clover and 9,990 kg DM for whole crop maize, respectively. Total CF per kg dry matter intake (kg CO_2-eq/kg DMI) was calculated by adding CF contributions from enteric methane measured in the experiment and CF from feed production, manure management, energy used in stable and CF from changes in soil carbon during crop production using standard emissions factors. Furthermore, total CF was calculated for conditions where the yield of grass-clover was increased by 20%, and yield of maize decreased by 20%. Finally, total CF was calculated under conditions where yield was altered 20% in the opposite direction for the two crops.