UNIVERSITY OF HOHENHEIM

HoLMiR
Hohenheim Center for Livestock Microbiome Research

GUT MICROBIOME VARIATIONS DURING THE PRODUCTIVE LIFESPAN OF TWO HIGH-YIELDING LAYING HEN STRAINS

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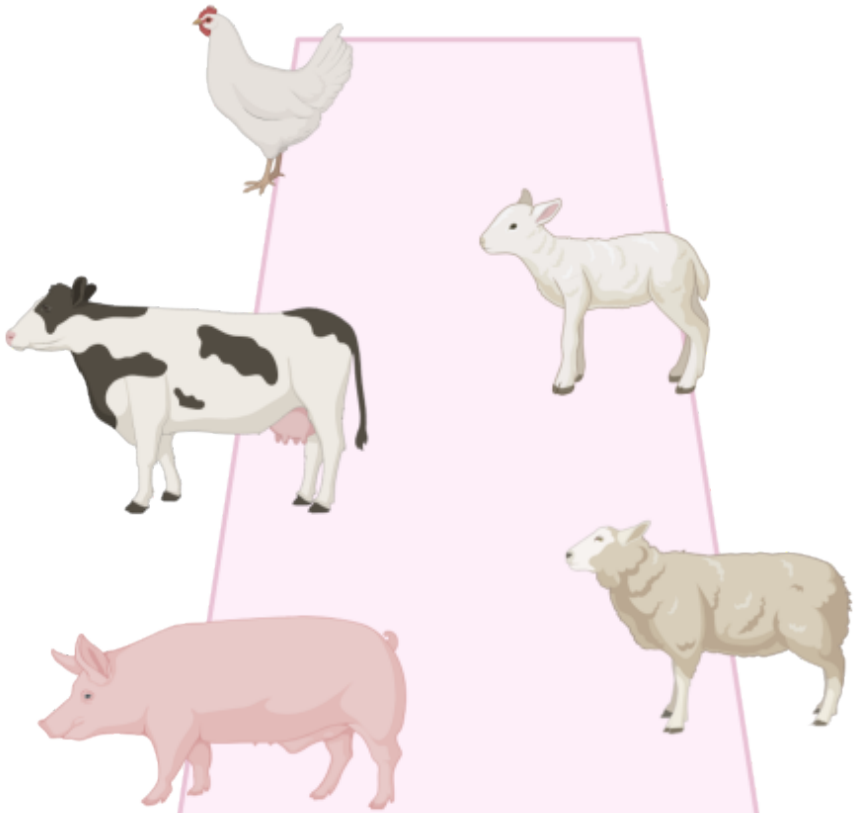
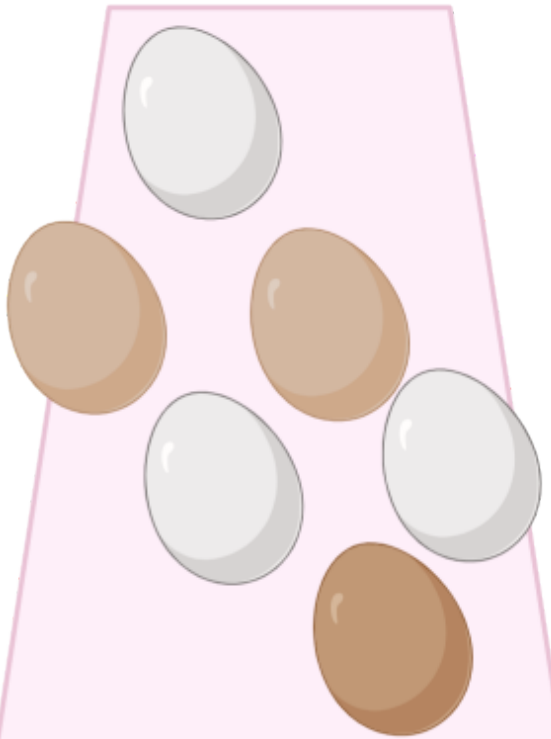
INTRODUCTION

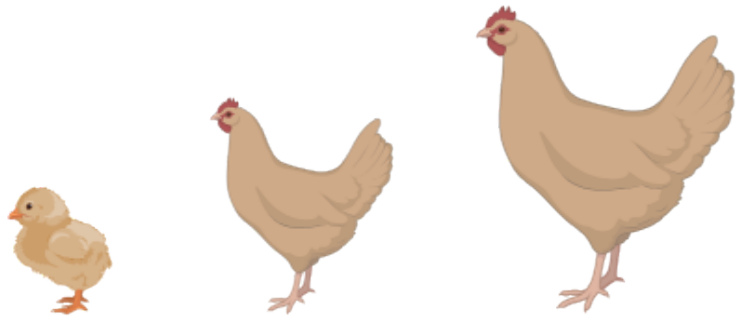


Global meat consumption rise by 73% in 2100



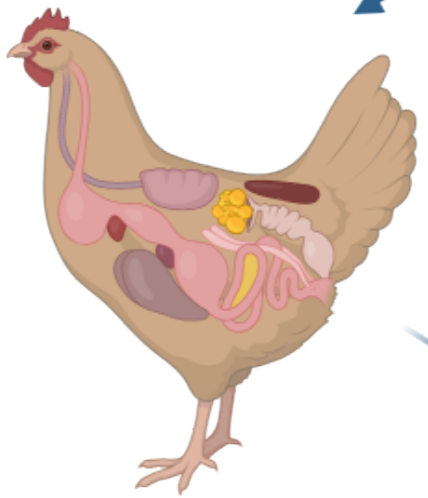
Egg production increased > 100% in the last 30 years

INTRODUCTION



LIFESPAN

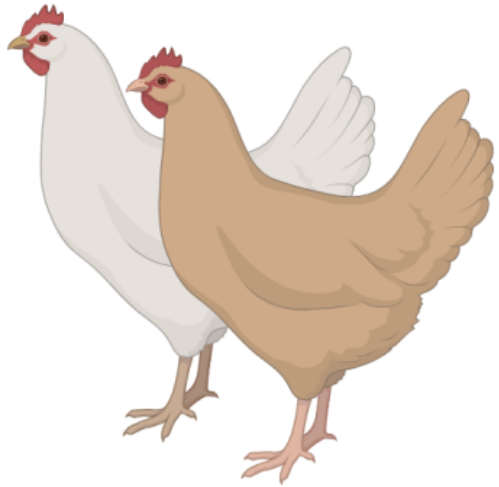
- Physiological changes
- Diet changes (energy and crude protein content, P, Ca)
- Onset of egg production (week 16 and 24)



Phosphorus - limited resource in environment

Animal health and performance

METHODOLOGY



LSL (n=50) **LB (n=50)**

Crop
Gizzard
Duodenum
Ileum
Caeca

Weeks 10, 16, 24, 30, 60

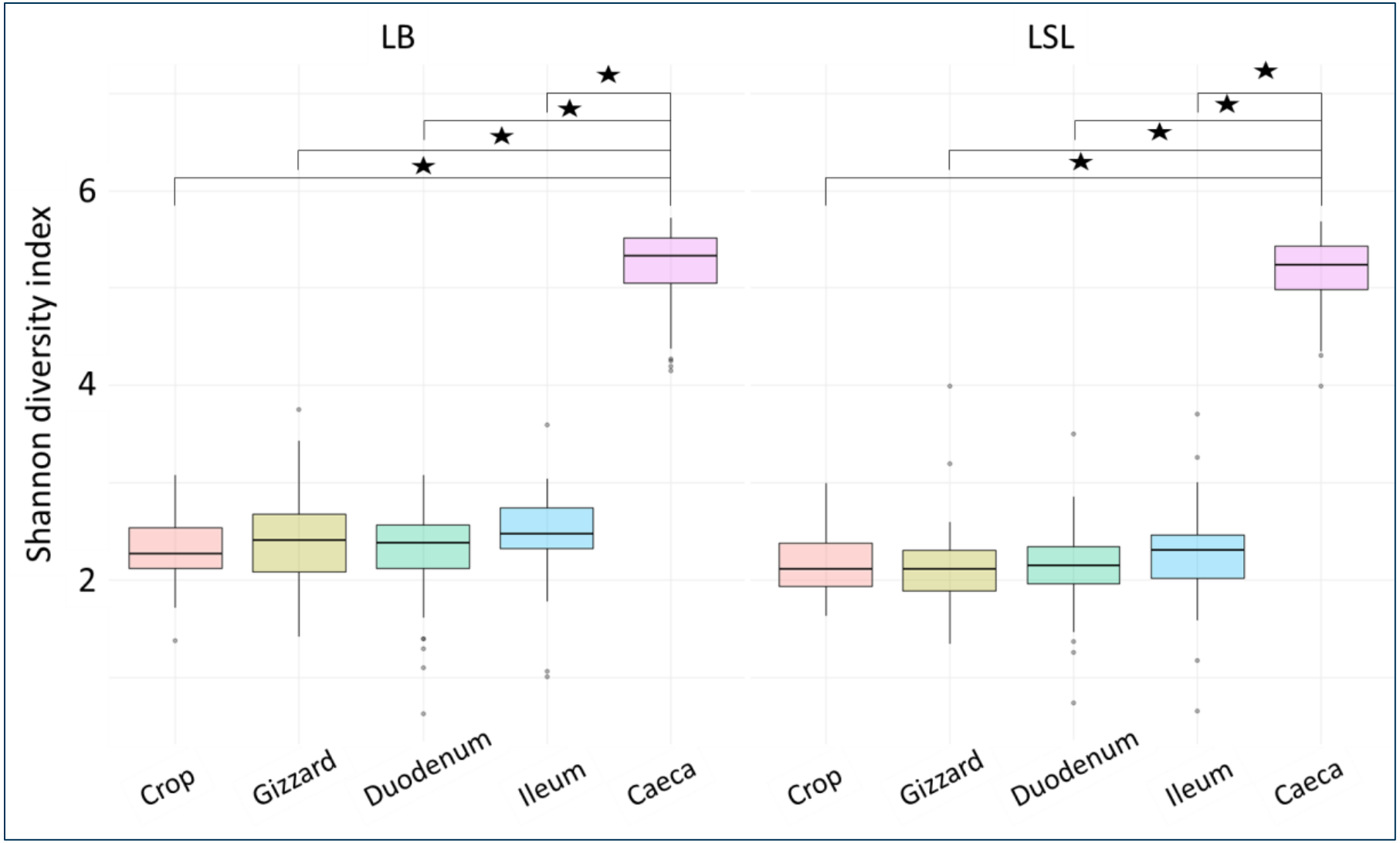
Target amplicon sequencing (n=500)

Shotgun metagenomics (n=120, weeks 16 & 24)

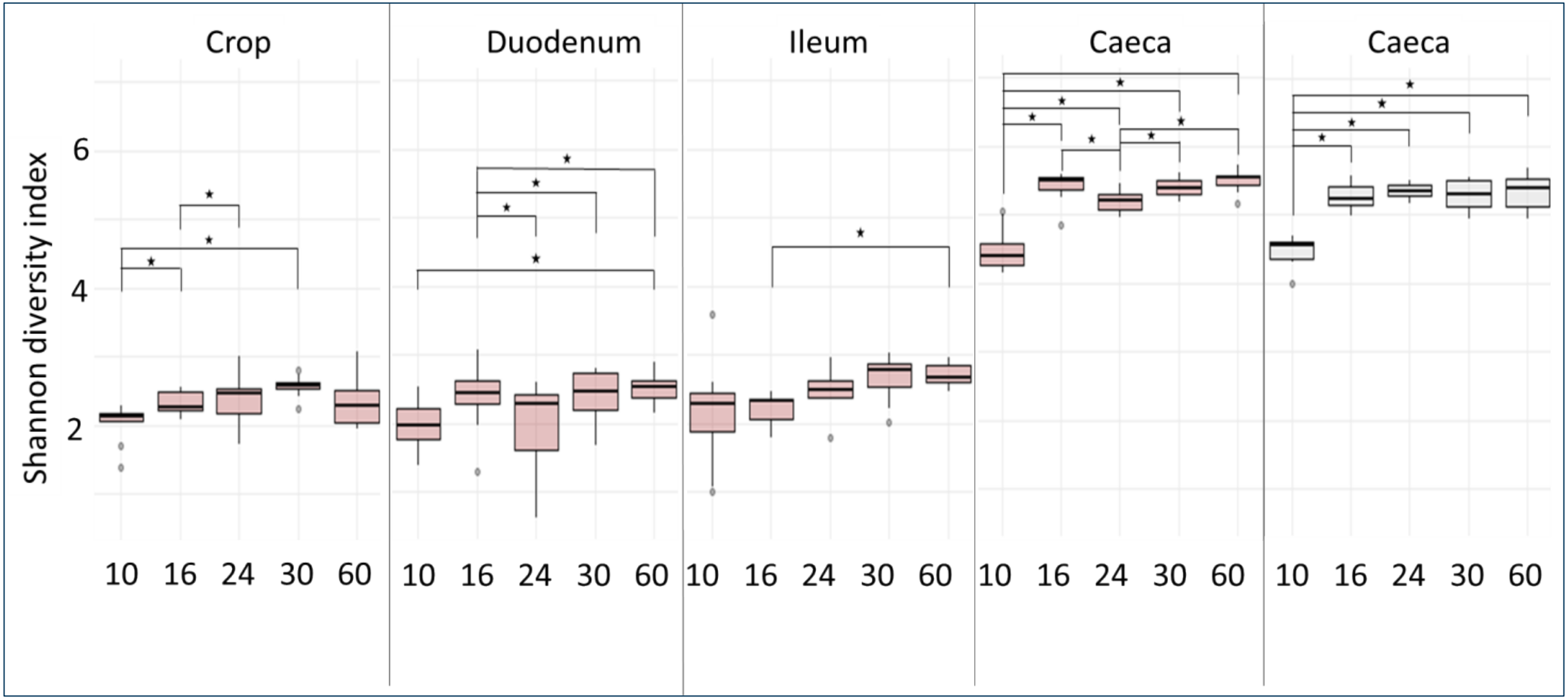
Lohmann Brown-Classic (LB)
Lohmann LSL Classic (LSL)

RESULTS

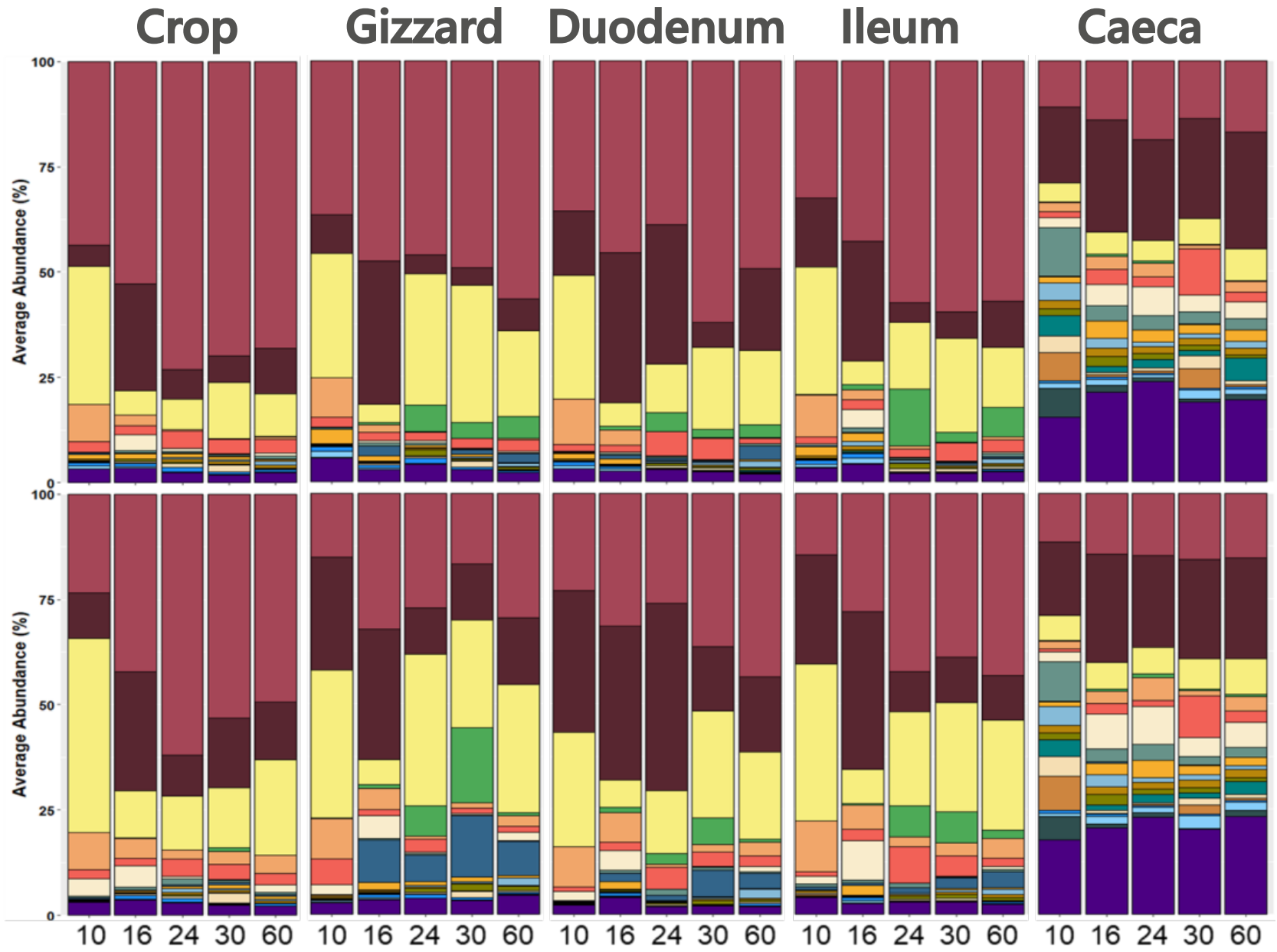
Significant differences for the factors **breed, age and GIT section**

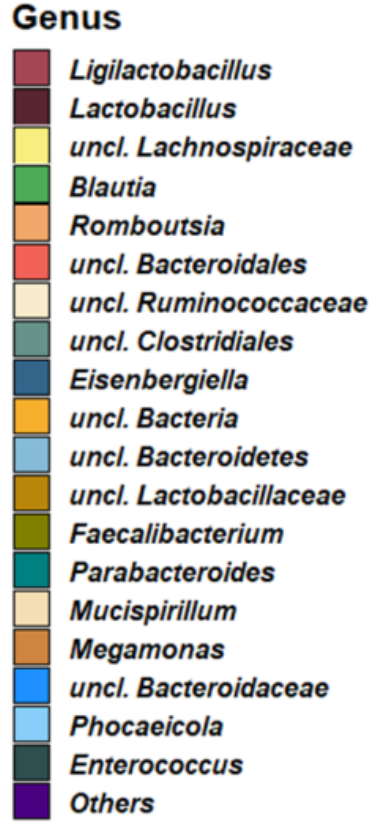


RESULTS



RESULTS



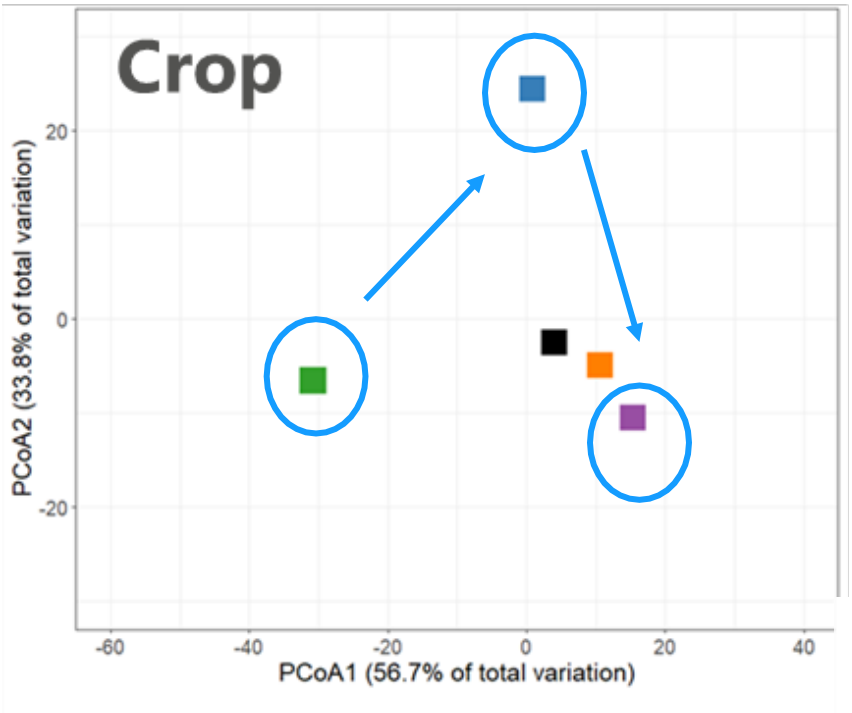


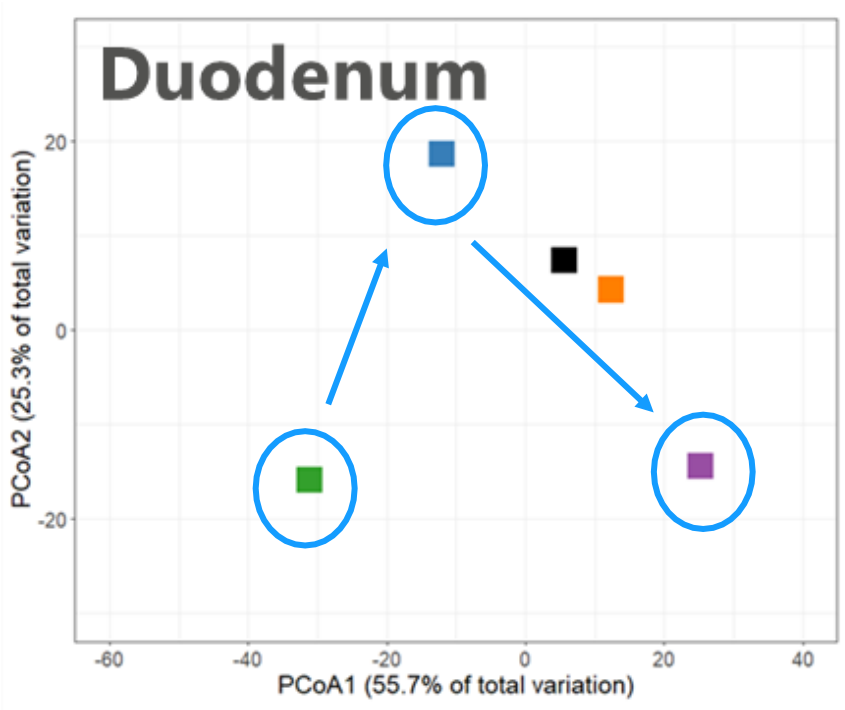
↓ ***Lactobacillus*** **wk 16-24 in crop gizzard and ileum**

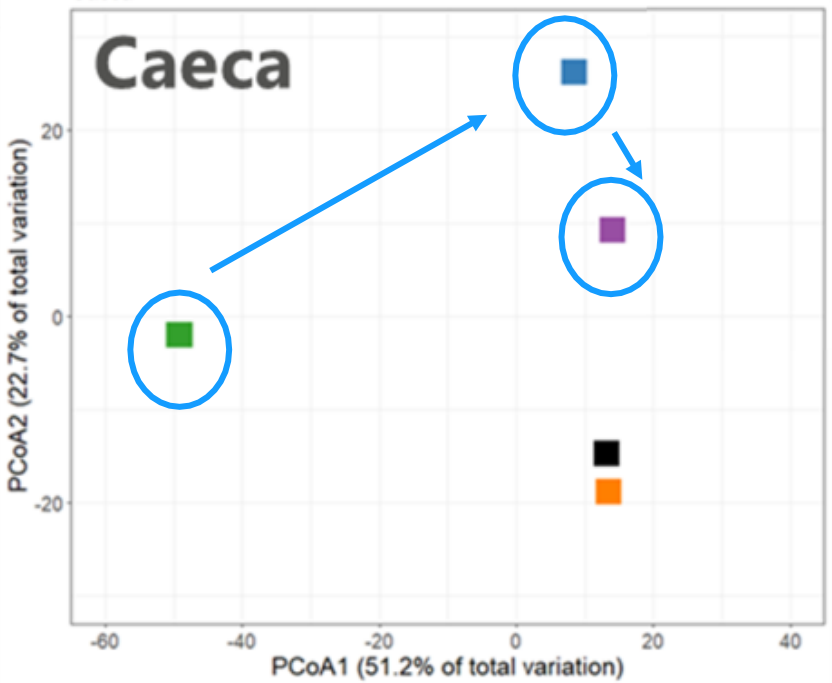
↑ ***Blautia*** **wk 24 in SI**

↓ ***Romboutsia*** **after wk 10**

RESULTS







Week 10
Week 16
Week 24
Week 30
Week 60

Strongest microbiota shift between weeks 16 and 24

RESULTS

Which functions and metabolisms are affected by the maturing process?

- KEGG orthology: **11.489 Kos**
- High impact of the productive stage:
  - **decrease** in functions abundance
  - Some functions were **not detected** on week 24

16 vs 24 weeks	Breed
• protein metabolism • carbohydrate metabolism • co-factors and vitamins • lipid metabolism • amino acid metabolism • digestive system	• genetic information processing • signal transduction • membrane transport and metabolism

RESULTS

P assimilation: inositol-phosphate pathway

- **Up-regulation of K13024** (inositol-hexakisphosphate/diphosphoinositol-pentakisphosphate 1-kinase) **LSL vs LB crop week 16**

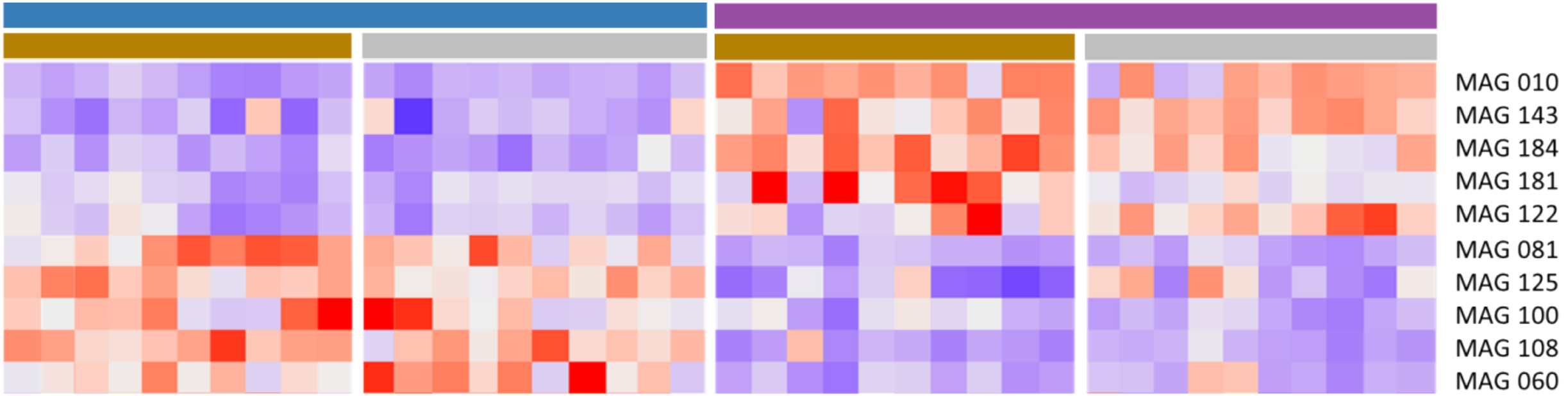
- **Up-regulation K22231 – K22233** (3-dehydro-scyllo-inosose hydrolase, scyllo- inosose 3-dehydrogenase, 5-keto-L-gluconate epimerase) and **K17237** (InsP transport system substrate-binding protein) **LB vs LSL caeca week 24**

Down-regulation of K22233 (5-keto-L-gluconate epimerase) (iolO) **LSL ileum from week 16 to 24**

RESULTS

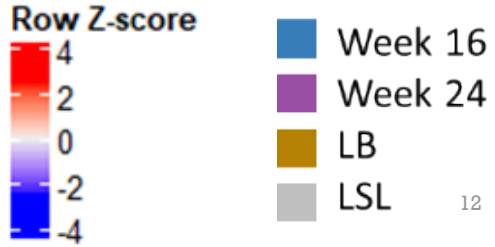
- **204 MAGs** across 3 sections and 2 breeds
- **48 with high quality** (completeness >90%; contamination <5%)
- Average length of **2.5Mb** and **GC content of 46.6%**
- **MAGs differed between breeds, weeks 16 and 24 and GIT sections**
- Some **MAGS** could **not be assigned to a species**

RESULTS



- Top 5 MAGs week 16: Amino acid utilization, Hydrogenesis and oxidative phosphorylation

- Top 5 MAGs week 24: Ethanol fermentation and complex carbon degradation



CONCLUSION

- Same **diet** / housed under **similar conditions – breed and age effect on microbiota**
- **Major shift** in the microbiota between weeks **16** and **24**
  - bacterial fluctuations due to the starting of the laying period
- **Metagenomic** analysis confirmed the shift and highlighted **functional adaptations**
- It remains unclear if the changes in the feeding influenced the microbiota shifts or if the anatomical and physiological alterations affected the GIT microbiota

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THANK YOU FOR YOUR ATTENTION

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