

INTAQT Final conference
11th September 2026
Hamburg, Germany

INTAQT One Quality

Husbandry systems and innovative practices to be implemented in the project with living labs

intaqt
one quality

Enrico Sturaro, UNIPD
Rennie C. Eppenstein, FiBL



Structure of the Task

Length: from M8 to M48

Leader: Enrico Sturaro (UNIPD)

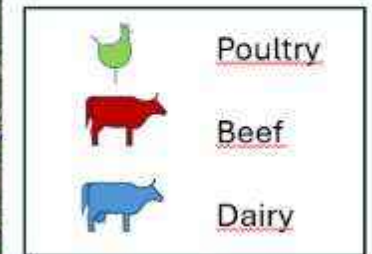
Involved partners: INRAE, FIBL, UNIPD, ACTA, TEAGASC, UNIPG.

Objectives:

The objective of Task 2.3 is to identify and implement on-farm changes in the production processes (e.g. feeding regimes, outdoor access, herd management), which are expected to improve intrinsic quality traits of the products and on sustainability traits of the farms.



Living labs are initiatives in which experimentation is conducted on real farms, in specific territorial and community contexts, with farmers and other actors involved from the beginning as equal partners in proposing ideas, testing them, improving them and promoting them further.



List of established farmer field schools per country and product category

Product	Country	Institute	Topic of living lab	Nr of farmers
Dairy	France	INRAE / ACTA	Improve sustainability of grass-fed milk production in Grand Ouest	5
Dairy	France	INRAE	Effect of grass-based diets on fat content and DM in Fourme de Montbrison cheese	6
Dairy	Italy	UNIPD	Parmigiano Reggiano: Outdoor access to improve global sustainability	6
Dairy	Ireland	Teagasc	Alternative swards in dairy production systems	5
Beef	Switzerland	FiBL	Improve carcass quality with better adapted genotypes of dairy-beef crosses for extensive pasture fattening	5
Beef	Italy	UNIPD	Testing of beef on dairy for intensive beef fattening	5
Poultry	France	INRAE / ACTA / LDC	Improvement of animal welfare and health with nestborn chicks / hatching	5
Poultry	Italy	UNIPG	Effect of enrichment and outdoor parks on meat quality and welfare	4

The INTAQT living labs

Multi-species swards



Improve intrinsic and extrinsic qualities of milk due to a maximization of pasture



On-farm broiler hatching:
What impact on health,
welfare, performance and
meat quality of the standard
chicken?



Impact of increasing pasture
intake on fat content of
« Fourme de Montbrison »
PDO cheese



Overcome challenges within
the Swiss dairy beef pasture
fattening value chain



Genetics adapted to beef-on-
dairy crosses
Alternative protein sources



Supplementation of the diet
of slow growing poultry
strains in free range runs

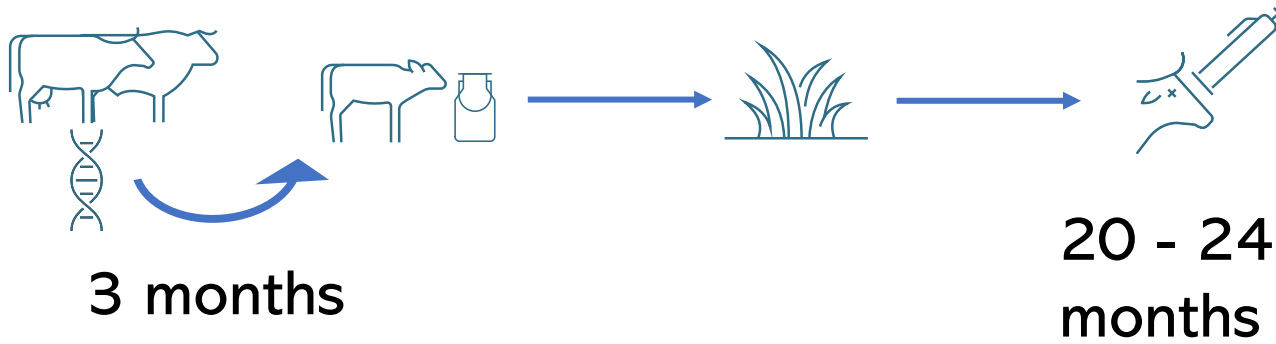


Effect of exercise pastures on
the health and performance
of indoor dairy cows
Substitution of roughage with
Sorghum



Swiss pastured beef

System:



- Dairy Beef crosses
- Grass-fed, 0% concentrates



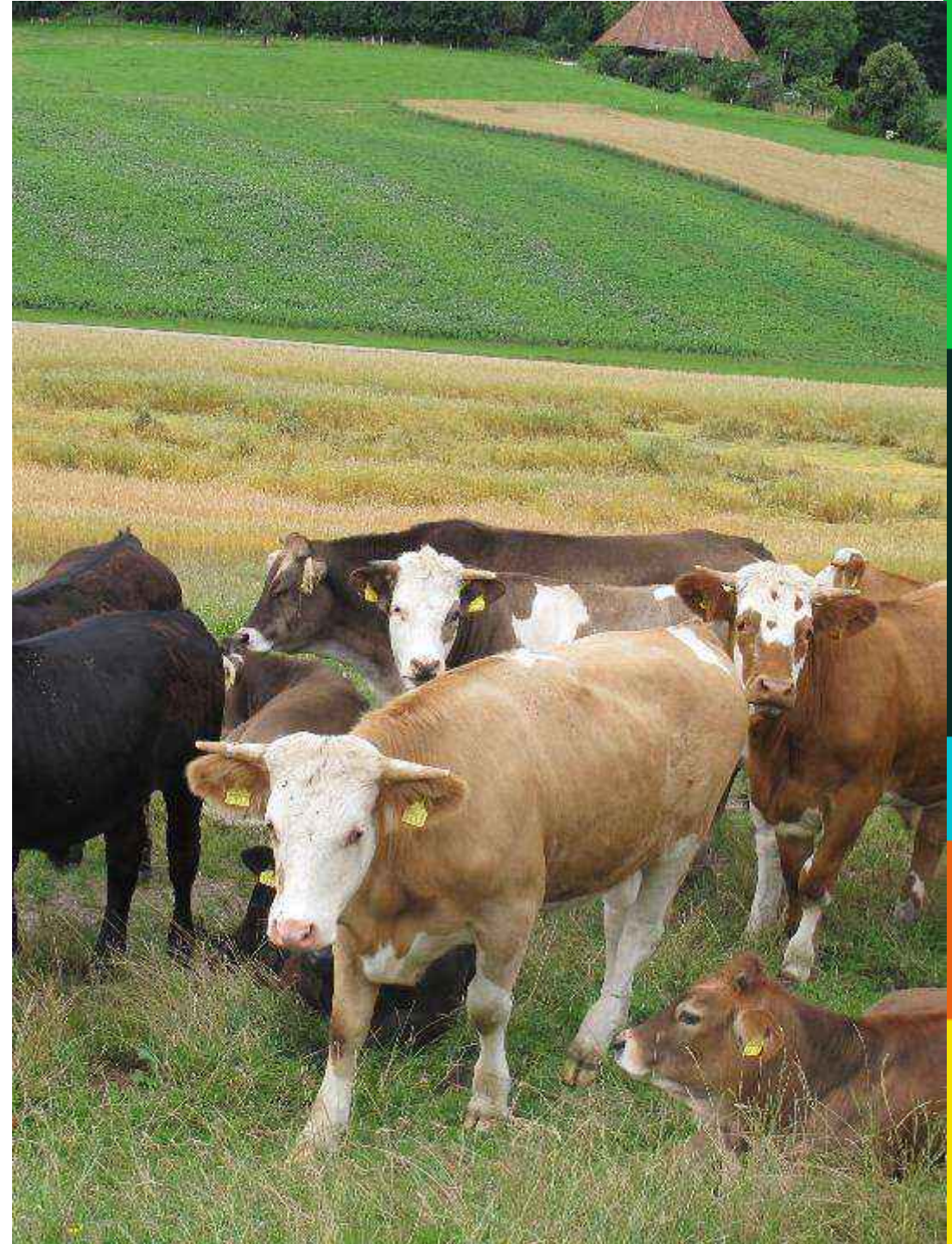
SILVESTRI



Living Lab «organic pastured beef»

Common challenges:

- High slaughter prices, but stagnation of sales
- Frequent penalties in the slaughterhouse due to **lack of carcass conformation**
- Niche production system that is still unknown to consumers



Living Lab «organic pastured beef»

Objective:

Improve carcass quality by improving:



Calf health



Better selection of genotypes
(Beef-on-dairy)



Establishment of long-term
partnerships between calf-rearing
farms and fattening farms.



Living Lab «organic pastured beef»

Ensuing activities:

Calf health



Establishment of a continuous working group open to more farmers

Adapted genotypes



Master thesis in collaboration with industry partners to validate breeding values in extensive fattening systems → follow-up project ongoing

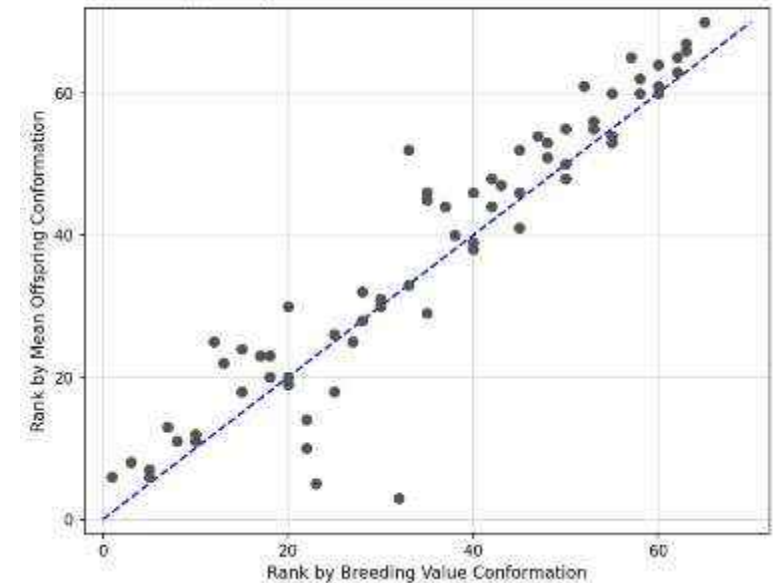
Long-term partnerships



Initiation of a large-scale value-chain oriented project to increased integration of calf-rearing dairy farms and pasture fattening farms.



Rank Validation: Conformation
Spearman $\rho = 0.9$, $n = 70$



Living Lab «intensive beef fattening»

Partners: UNICARVE: Association of beef producers with 809 farms

- 5 beef farms involved in INTAQT, with the possibility to involve other farms and to disseminate the outputs to all the members of the association



Living Lab «intensive beef fattening»

Definition of innovation to be tested:

- Genetic resources: Fattening of beef-on-dairy
- Nutrition: Alternatives to soybean as source of protein
- Grass feeding ???



Living Lab activities in Italy



- **Visit** of each farm and collection of data with questionnaires
- **Meetings** (farmers field school)
- **Definition of a protocol** to monitor **animal welfare** and **ecological footprint** to support the implementation of a label for sustainable beef production



Sustainability of the living lab after the end of the project

Beef innovation hub established and financed for 2025-2027

Demofarm realised at the University experimental farm, in collaboration with the breeder cooperative UNICARVE

Living lab « On-farm broiler hatching »

What impact on health, welfare, performance and meat quality of the standard chicken?

INRAE

ITAVI

Hutepain
Aliments

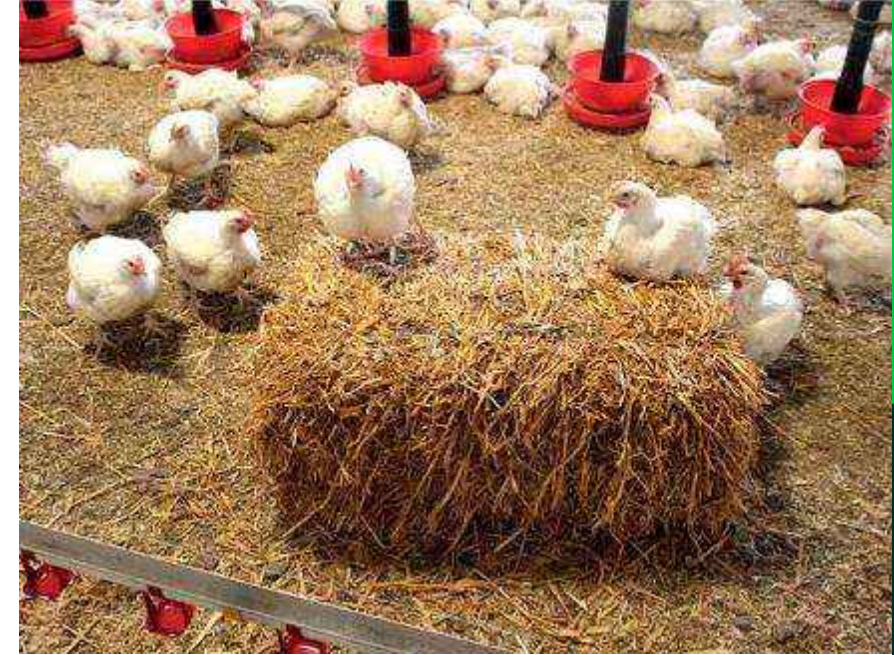
LDC



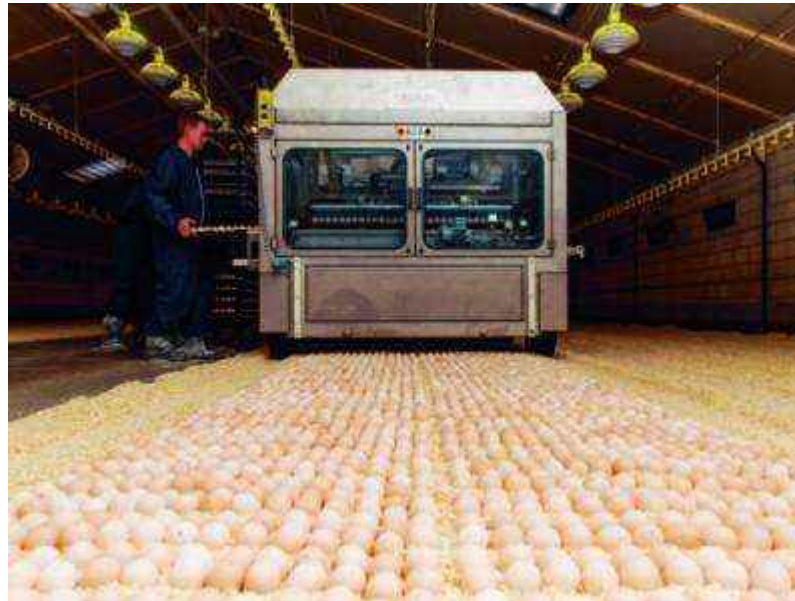
Living lab « On-farm broiler hatching »

System:

- Fast-growing chickens
- Locally produced feed
- Animal welfare: Natural light, extra-space, fostering of natural behaviors (pecking stones, straw bales, perches...).



Innovation:



Living lab « On-farm broiler hatching »

Results:



Health		
	Hatchery	Farm
Chick quality	=	
Overall chick health	=	
Footpad dermatitis rate	↘	
Mortality rate	↘	
Condemnation rate	=	

Performance		
	Hatchery	Farm
Age at slaughter	↗	
Average daily gain	↗	
Feed conversion ratio	↗	
Performance index	↗	
Weight coefficient of variation	↗	
Fillet yield	=	

Animal welfare		
	Hatchery	Farm
Start of rearing	=	
End of rearing	↗	

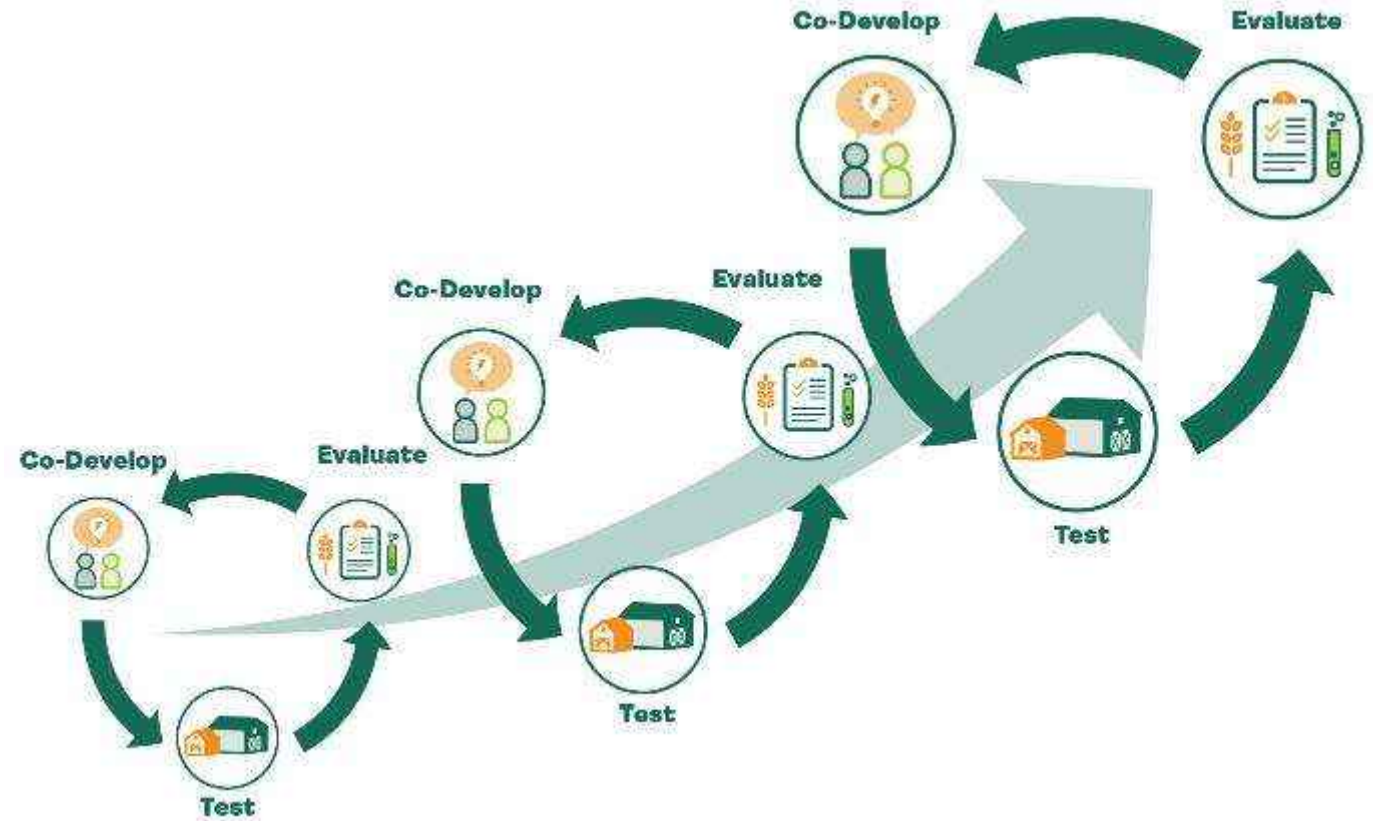
Meat quality		
	Hatchery	Farm
Sensory quality	Fillet defects	=
	Color	=
	Texture	↗
Technological quality	Cooking loss	↘
	Lipid oxidation	=
	Technological yield	↗
Nutritional quality	Dry matter, protein, fat, iron content	=



THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION
2020 RESEARCH AND INNOVATION PROGRAM

Conclusions of living labs

- Activities resulting from the living lab surpassed the initial group of farms
- Formed relationships with industry stakeholders provided grounds for further research development
- Lasting relationships formed with stakeholders



Recommendations and lessons learned

- **Commitment to regular and structured exchange** with the farmers, even when it seems tedious.
- Allowance within projects to pursue **suggestions by farmers** rather than having a fully pre-defined research agenda.
- From the beginning allocate **time and resources** for the development of further research and follow-up activities.

Thank you for your attention

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Authentication and prediction tools

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**Carmen L. Manuelian – Massimo
De Marchi, UNIPD**



Food Authenticity and Frauds

Authentic → Match between characteristic and claim is deemed authentic

Fraud → Misuse of characteristic and associated claim

- **Food fraud:**
 - 10% of all food products at customs - 1% of the global food industry,
 - costing industry \$10–15 to \$40 billion/year (FAO, 2025)
- **Food authentication is important to safeguard EU agri-food chains**



Methods based on analysis of product characteristics

EN 17972:2024 (European Committee for Standardization, CEN)



Intrinsic and Extrinsic product's characteristics

Innovative tools:

- Infrared Spectroscopy
- Metabolomics and Proteomics methods
- Genetic tools





Intrinsic and Extrinsic product's characteristics

Farming systems – intensification

Conventional – Organic

Indoor – Outdoor

Feeding

Season of production

Breed/Strains

Country of origin

Myopathies

Intramuscular fat

Fatty acid profile

Heme iron

Histidine – Containing Dipeptides

Collagen fractions

Vitamins – Antioxidants

Mineral profile

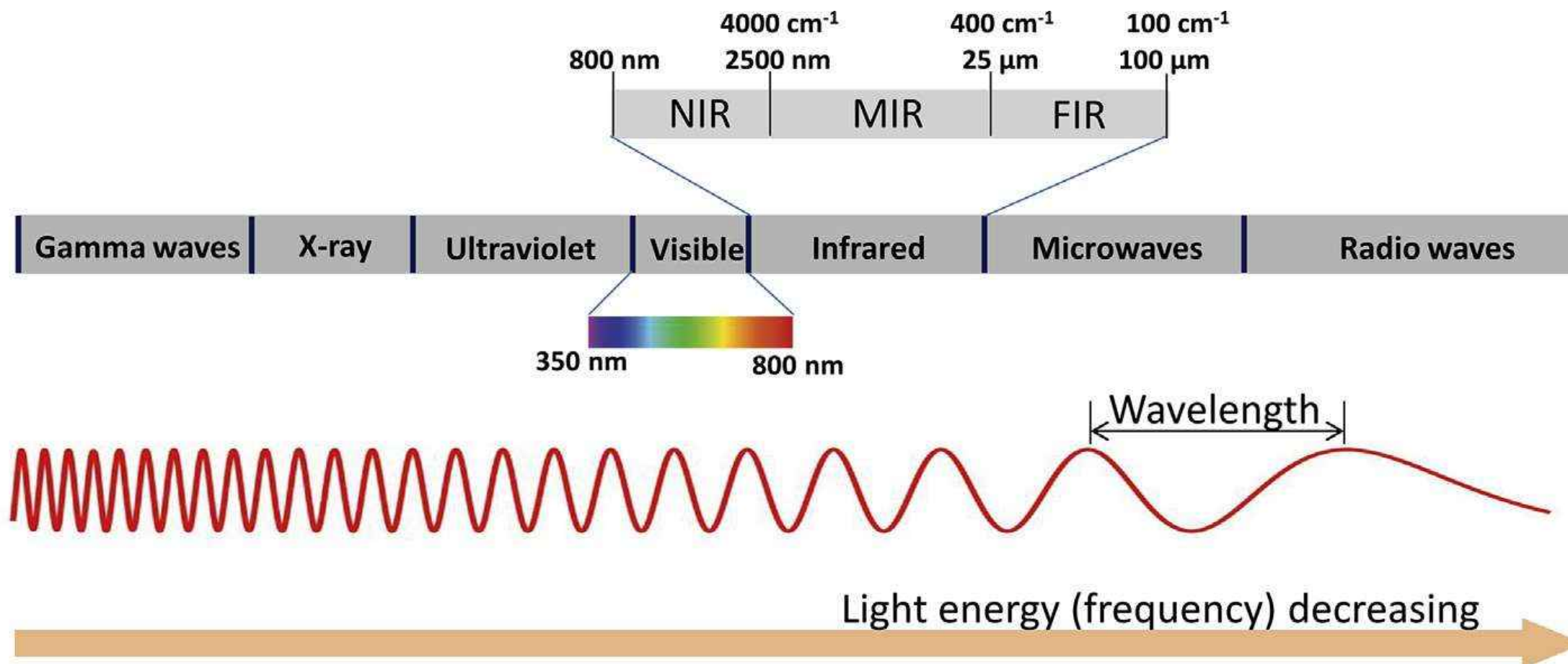
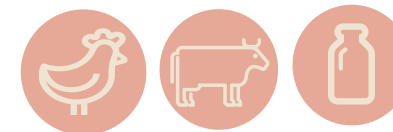
Heavy metals

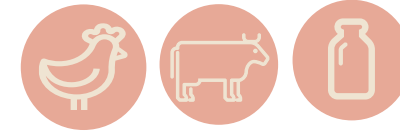
Dioxin and furans

Gross composition



Infrared spectroscopy





Infrared spectroscopy

- Low cost - rapid

Portable Spectrometers



- **Authentication** of type of farming systems (gradient of inputs, grazing)
- **Prediction** of product composition (fatty acids, protein fractions, minerals)
- **Prediction** of contaminants (heavy metals, dioxins and furans)

Benchtop Spectrometers



Authenticating milk with a benchtop MIR



	Category	Accuracy
	Summer	91%
	Winter	





Authenticating milk with a benchtop MIR

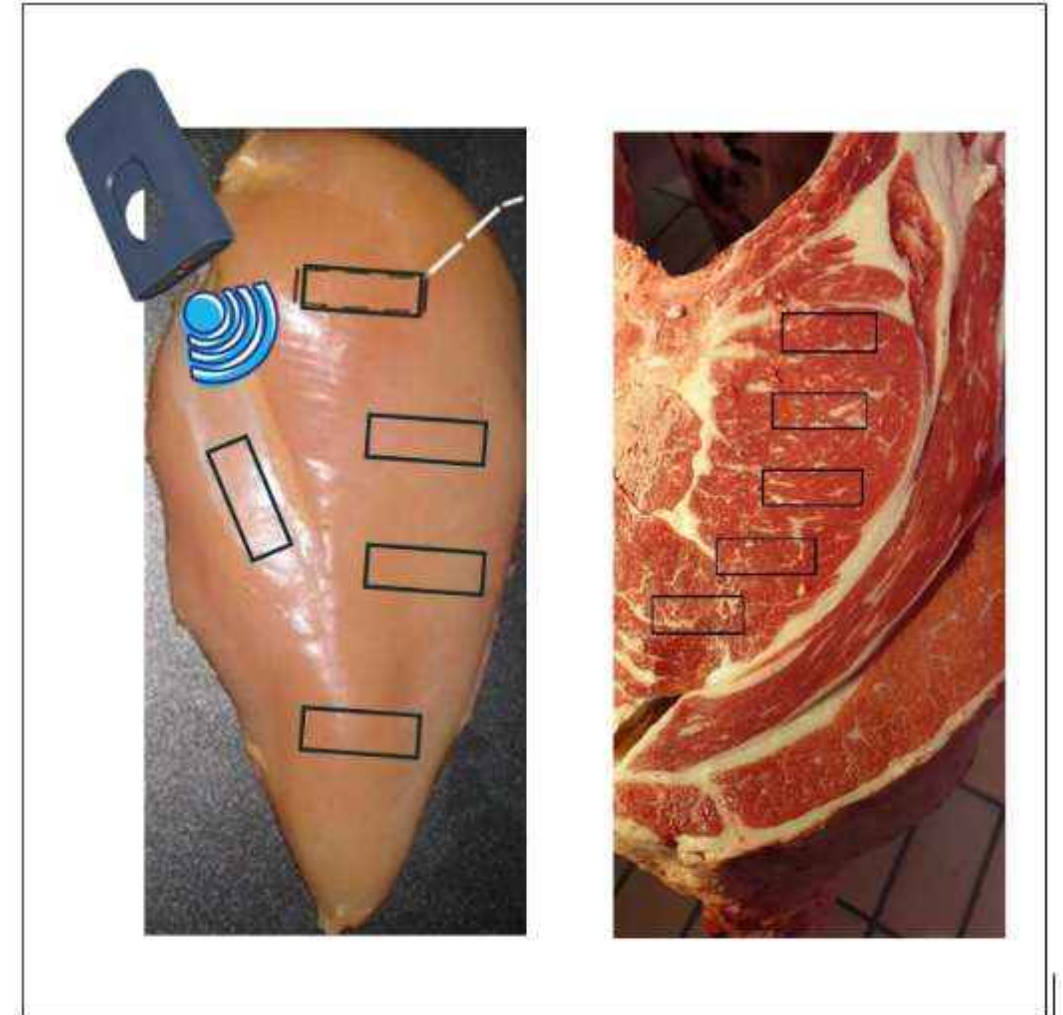


Category	Accuracy
High Feed Input relying on Maize Silage and Higher Stocking Rate on pasture farms	52%
High Feed Input relying on Maize Silage and Lower Stocking Rate on pasture farms	72%
Medium Feed Input farms	73%
Low Feed Input Intensive Land farms	78%
Low Feed Input Extensive Land farms	62%



Authenticating Poultry and Beef with SCiO

- Portable-NIR device: SCiO
- Collected at slaughter house
- Poultry
 - Conventional and Organic production
 - Indoor vs Outdoor housing
- Beef
 - Indoor vs Outdoor
 - Genetic production type





Authenticating Poultry and Beef with SCiO



Category	Accuracy
Conventional	87%
Organic	

Category	Accuracy
Indoor	92%
Outdoor	

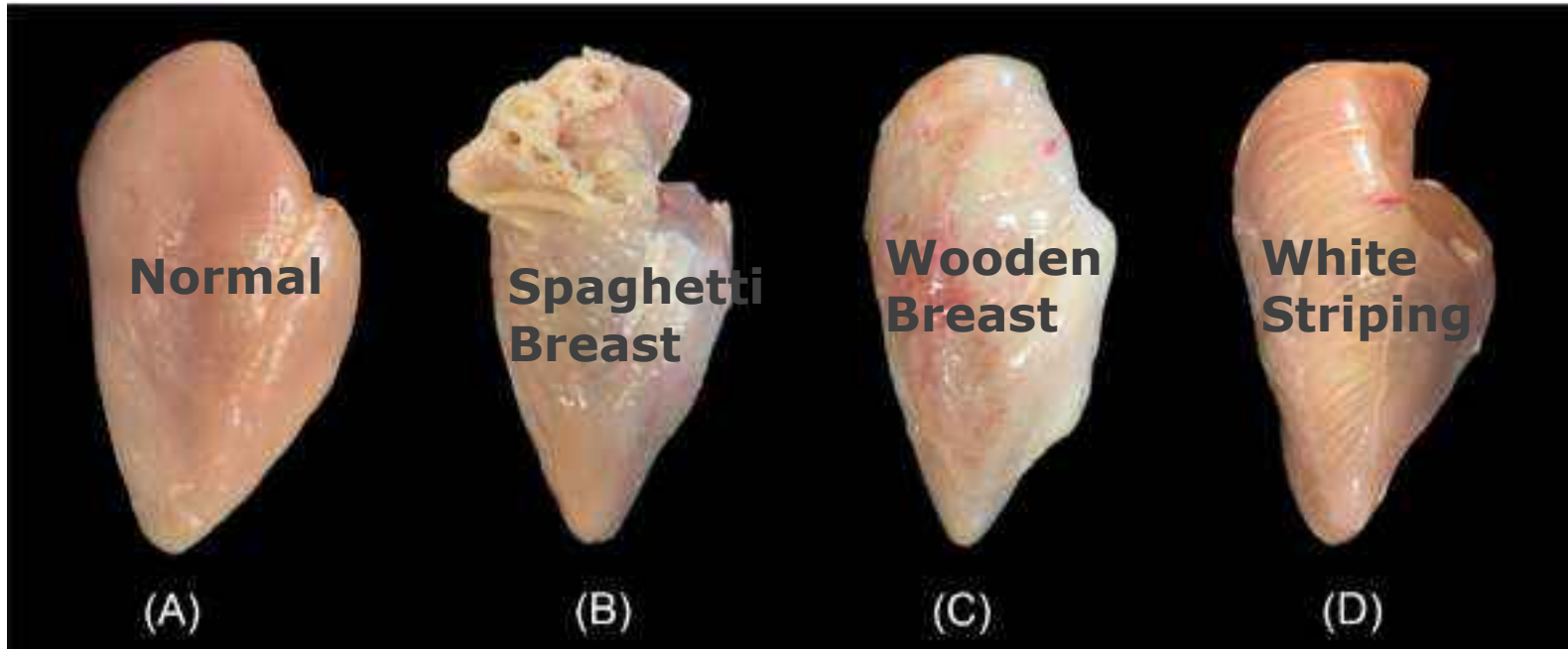


Portable-NIR for authentication beef (T4.1)

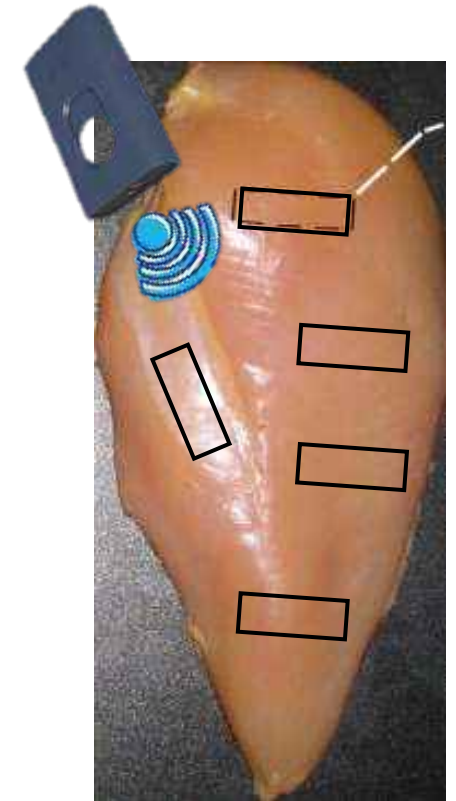


Category	Accuracy
Indoor	73%
Outdoor	
Category	Accuracy
Beef	59%
Dairy	62%
Mixed	56%

Detecting **poultry** defects with SCiO

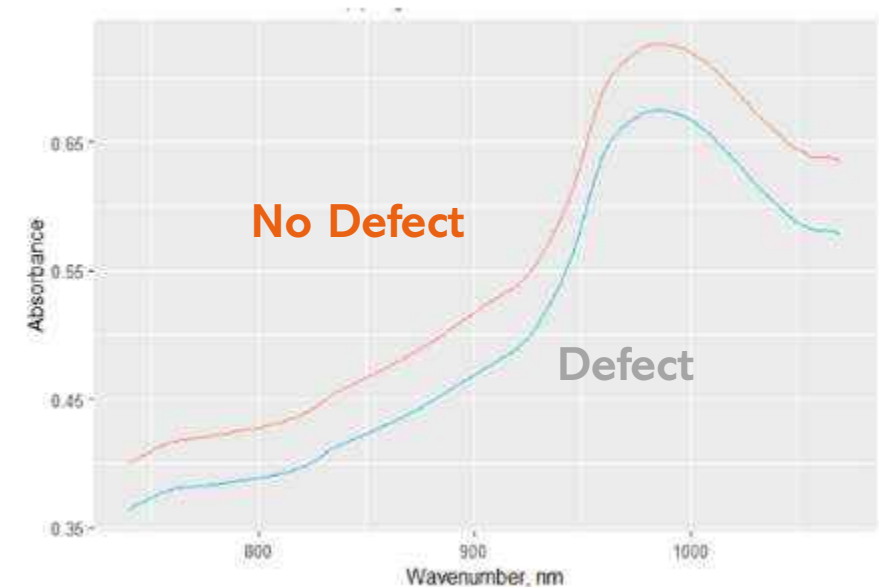


(Che et al., 2022)



Detecting **poultry** defects with SCiO

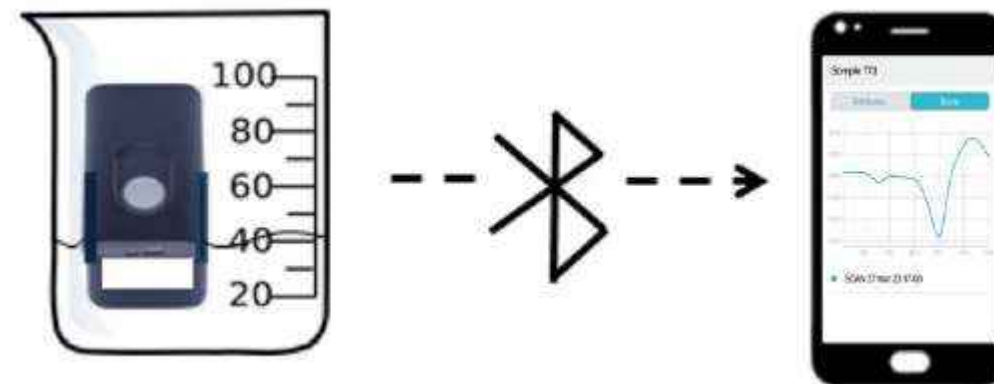
Category	Accuracy
No Defect vs. Defect (WS and/or WB and/or SB)	74%
SM (No Defect vs. SB and other)	51%
WS (No Defect vs. WS and other)	80%
WB (No Defect vs. WB and other)	75%





SCiO for milk composition

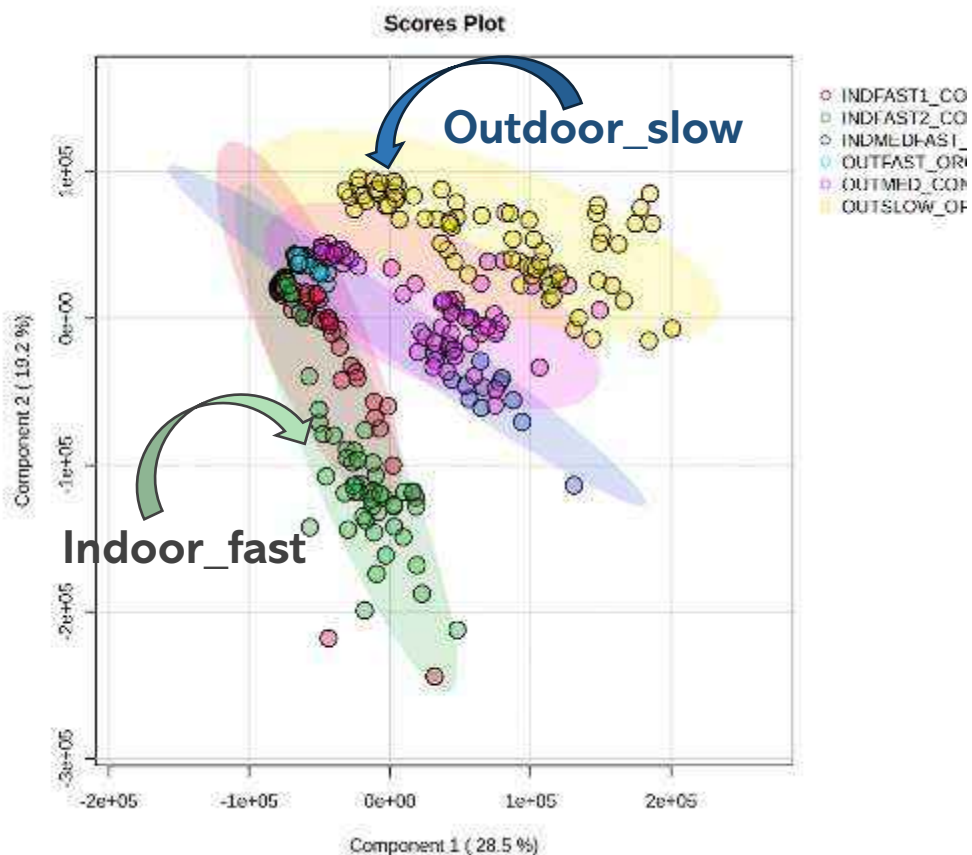
Trait	Can be used?
Fat, %	YES
Protein, %	No
Casein, %	No
Lactose, %	No
SFA, MUFA, SCFA, MCFA, LCFA, CLA	YES
PUFA, n3, n6	No



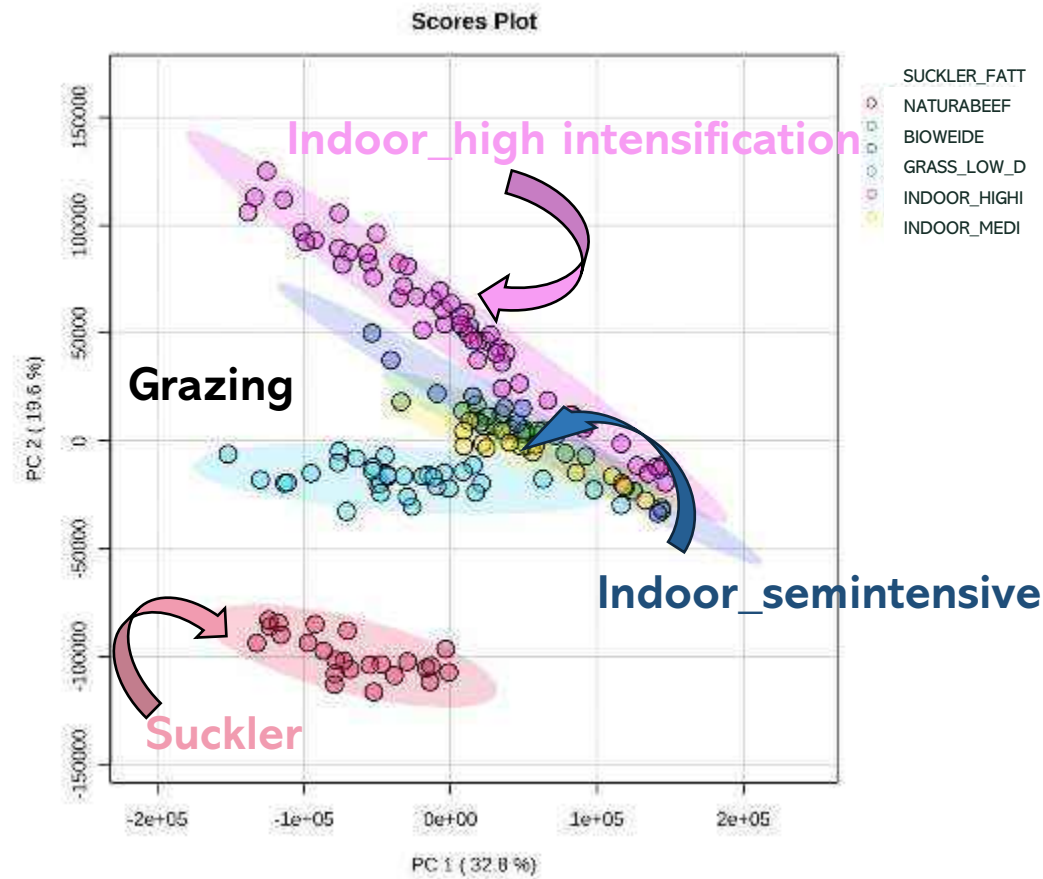
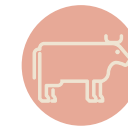
- More in <https://doi.org/10.3168/jds.2023-24302>



Authentication with molecular profiling - Metabolomics



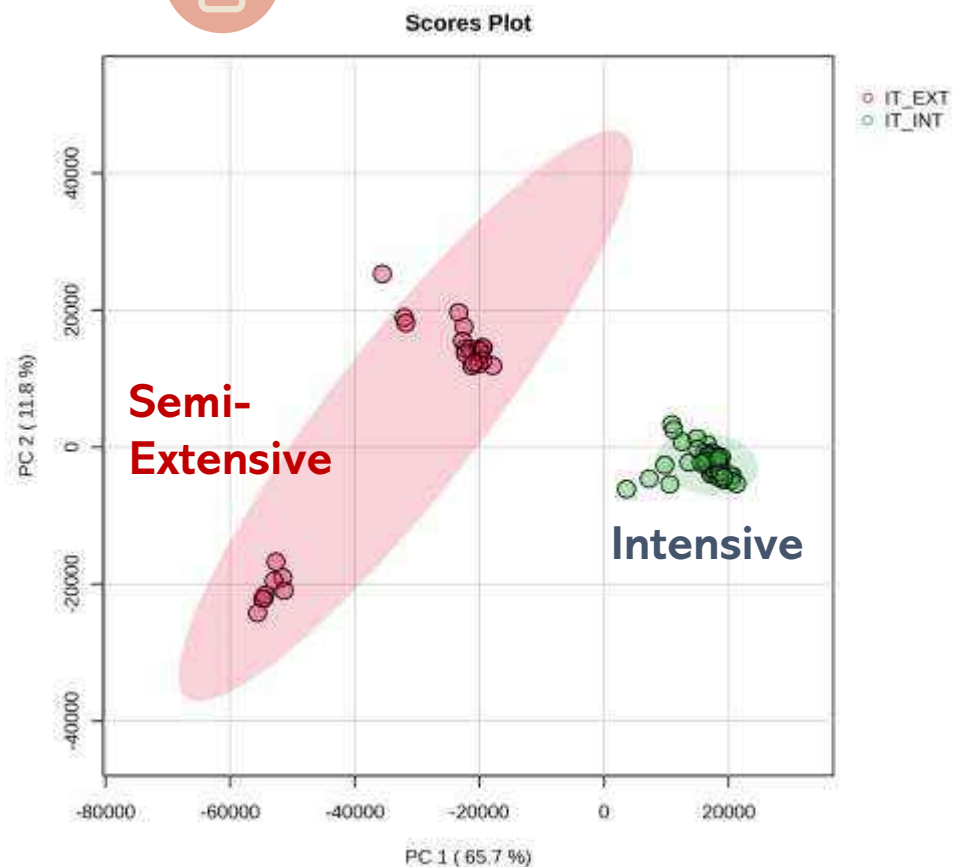
PLS-DA



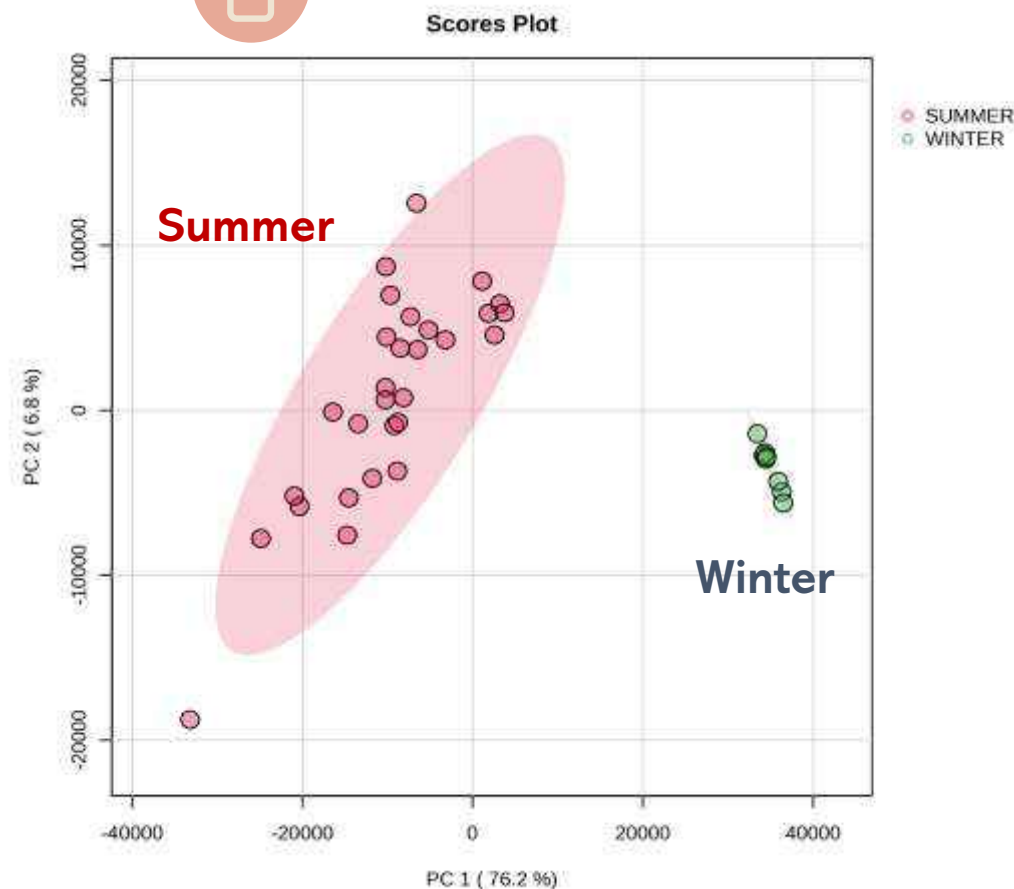
PLS-DA



Authentication with molecular profiling - Metabolomics

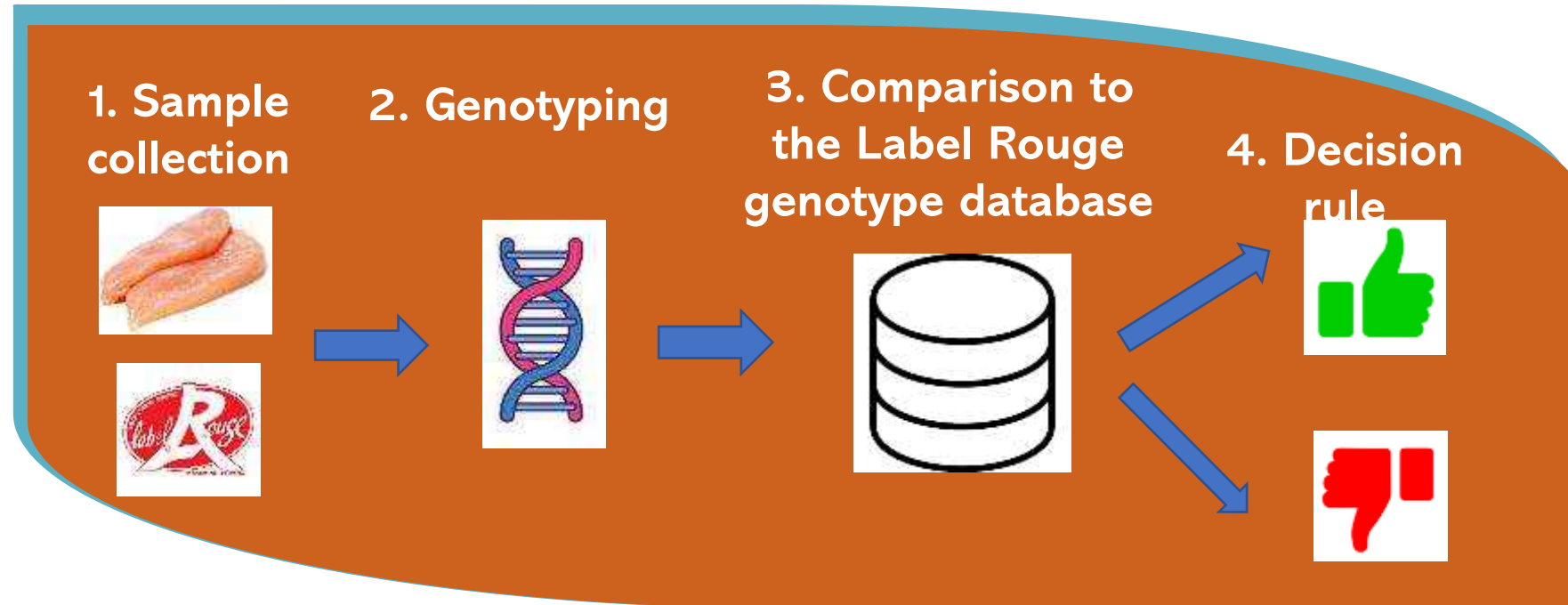


PCA



PCA

First tool for genetic authentication of Label Rouge



- The method calculates how likely it is that an unknown sample belongs to each authorized crossbreed
- High capacity to reject fraudulent samples



Main key messages

- MIR spectroscopy effectively authenticate milk season milk, but low capability to identify farming intensification level 
- SCiO good potential to authenticate organic production and outdoor systems in poultry and beef, but low capability for genetic production type  
- Poultry defects reduce the NIR absorbance of the samples 
- SCiO moderate potential to discriminate White Striping and Wooden Breast, better to identify samples without defects 
- SCiO can predict fat content, and most fatty acids groups in milk 



Main key messages

- **Metabolites allow discrimination of farming typologies and explain season discrimination**   
- **Tool developed to authenticate Label rough based on DNA** 
- **Genetic tool to authenticate main EU cattle breeds** 



Thank you for your attention

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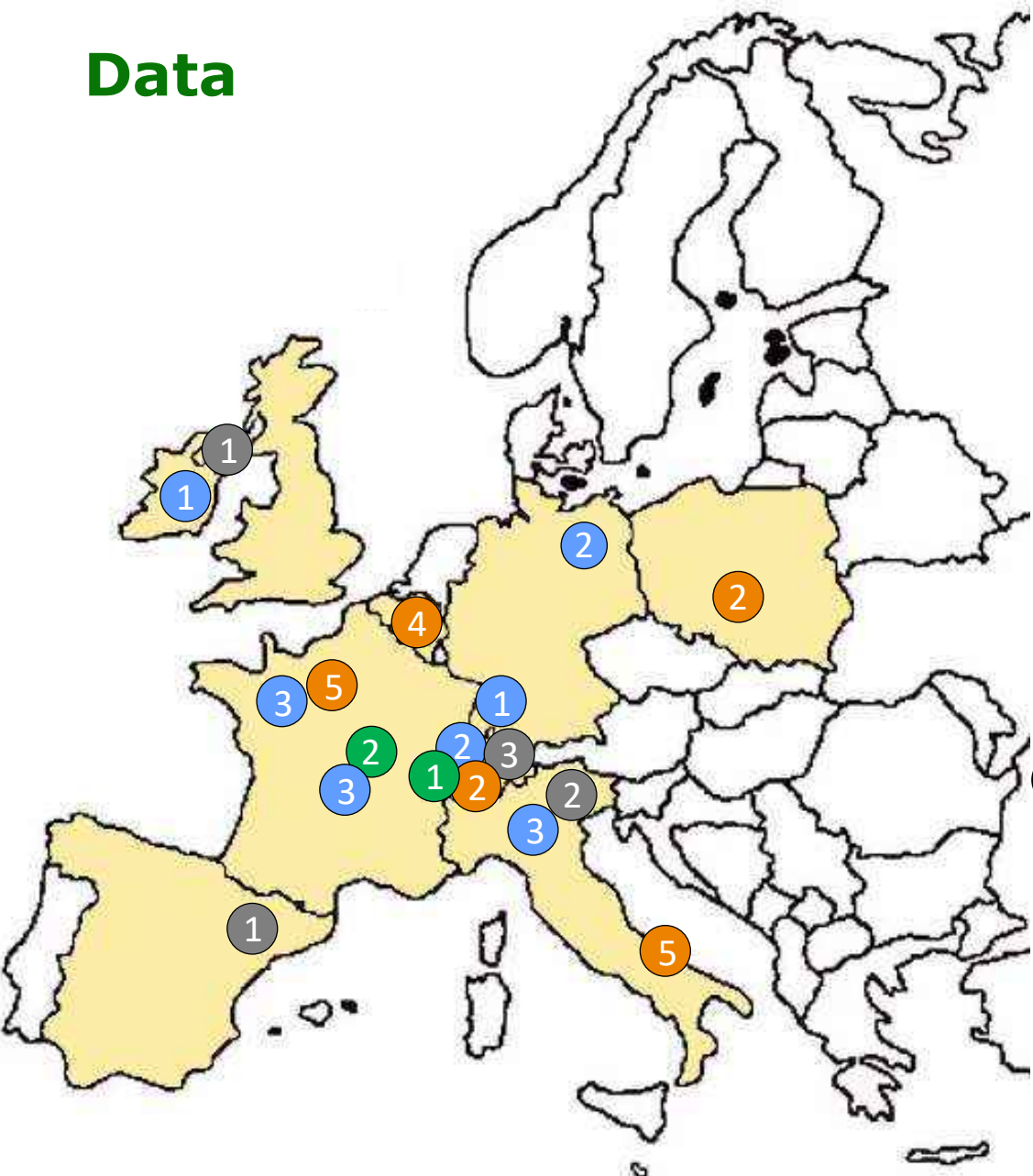
Environmental impacts and feed-food competition

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**Marco Berton, UNIPD and Eléa
Caumette, INRAE**



Data



79 broiler farms



Standard



77 dairy farms



Conventional



15 suckler farms

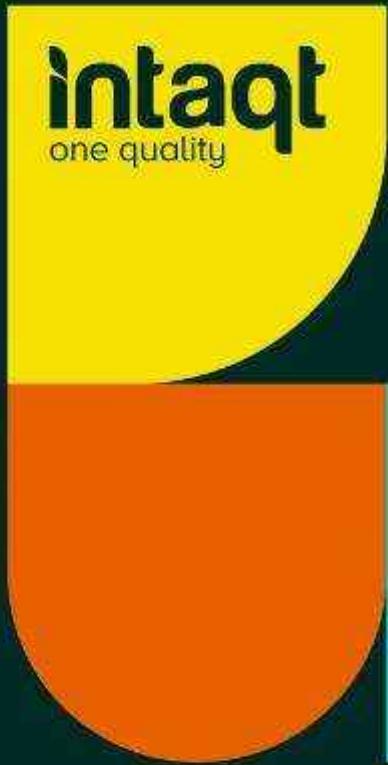


Conventional



28 fattening farms





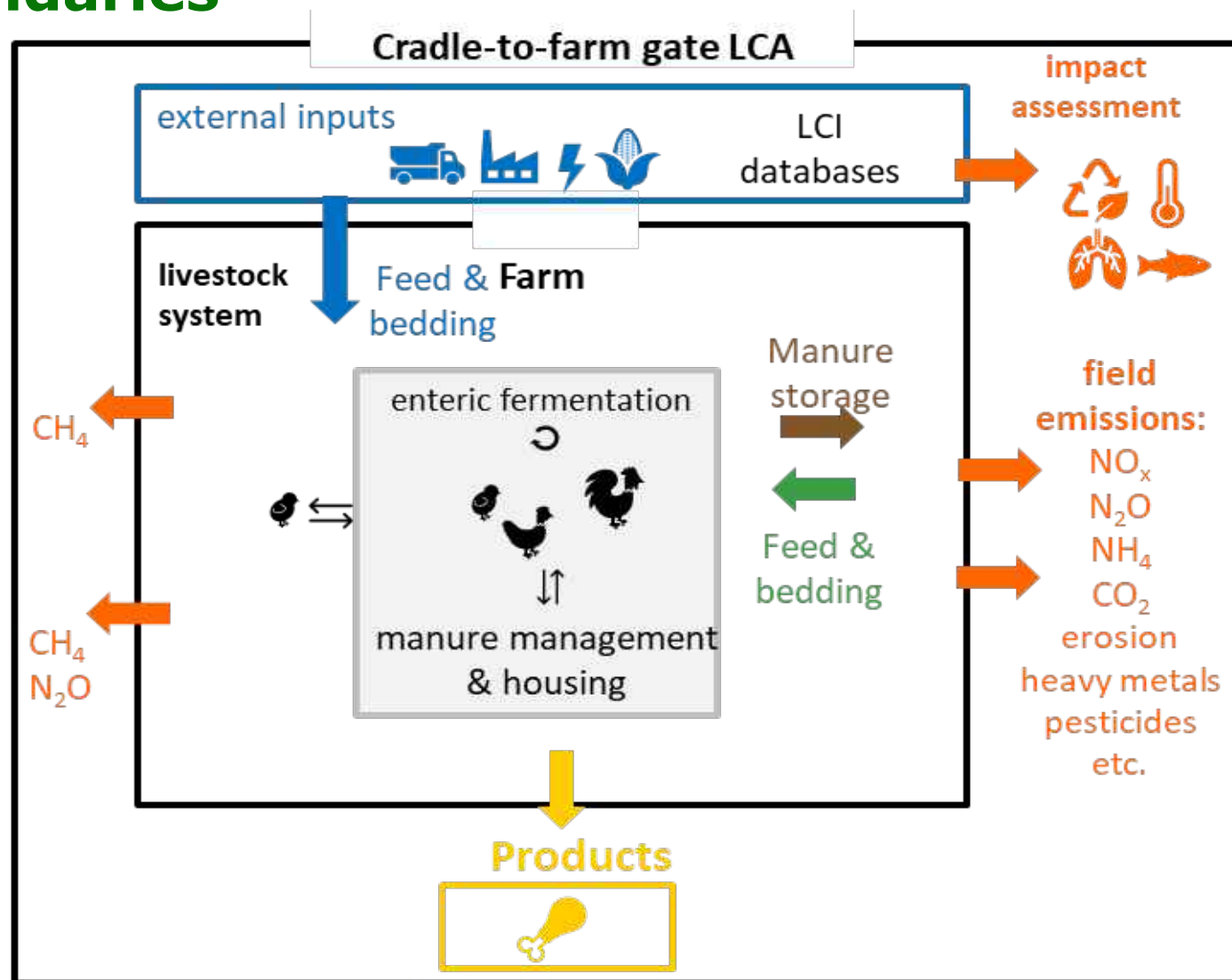
Broilers LCA results



Goal and scope definition

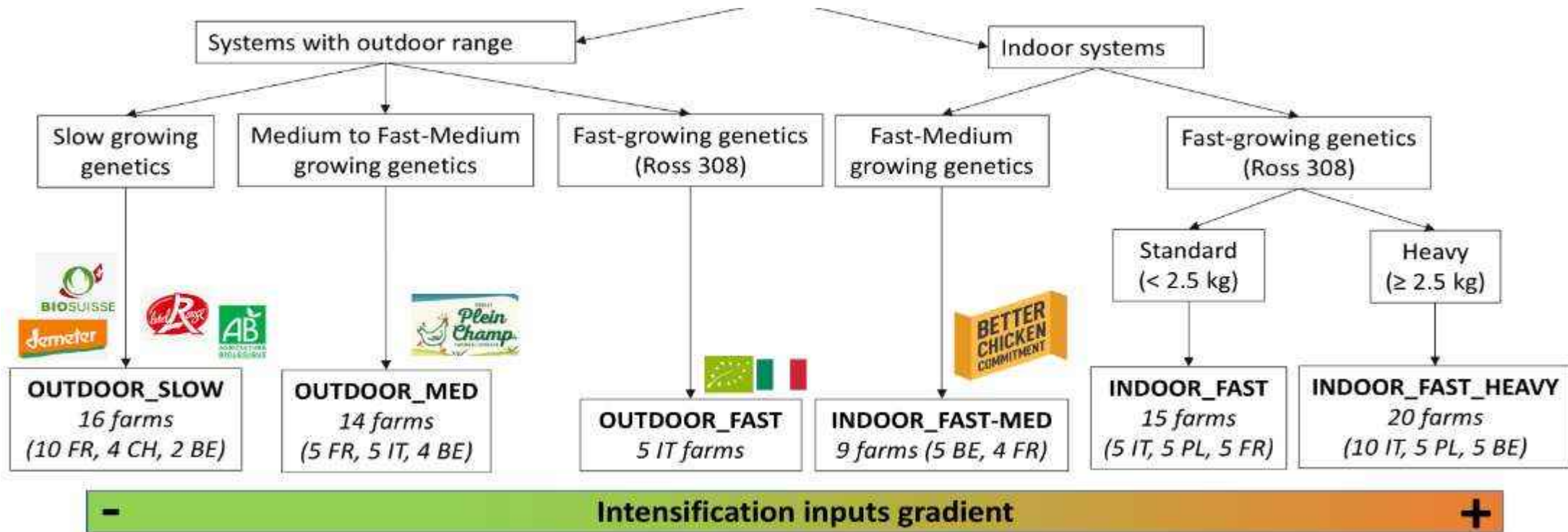
- LCA aims to assess the environmental impact associated with a product (good or service) considering its whole life cycle, from the extraction of raw materials to the end-use disposal
- Goal: to assess the environmental impact of broiler meat produced by different farm typologies differentiated along a gradient of intensification
- Model setting:
 - Attributional model (i.e. present-day picture)
 - Functional unit: 1 kg body weight
 - Impact assessment method: World+, integrated into FarmLCA software

System boundaries



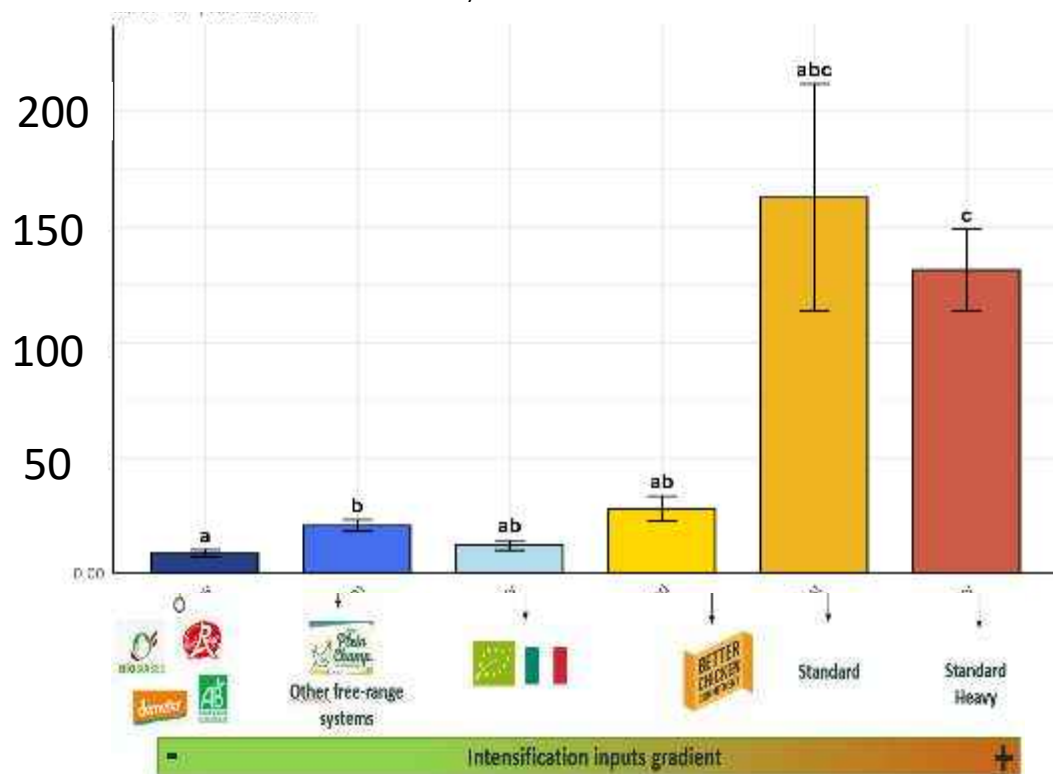
Farm typologies

- Farms clustered in Typologies based on indicators of intensification
- 1st indicator: indoor vs outdoor; 2nd indicator: genetics (growth rate)

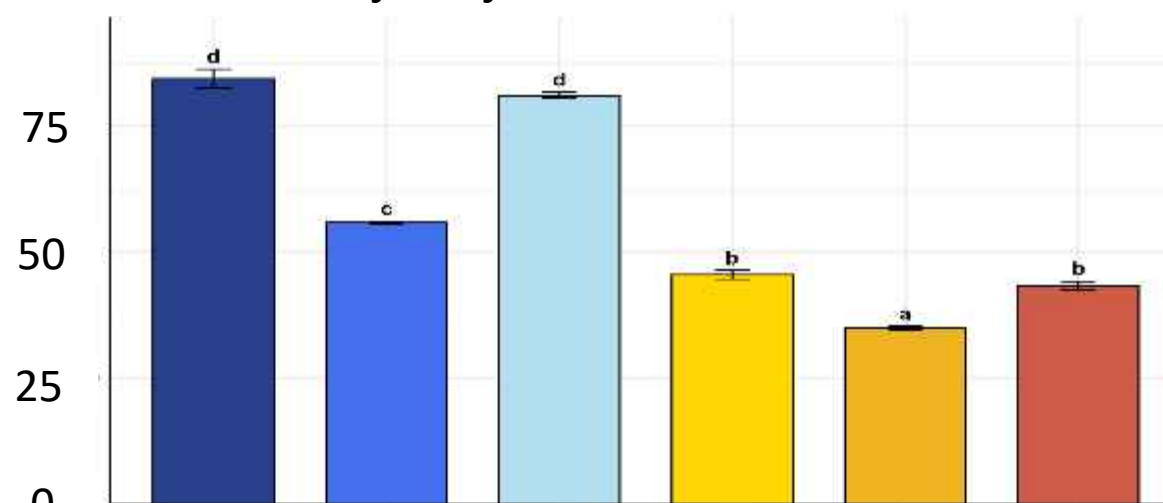


Results

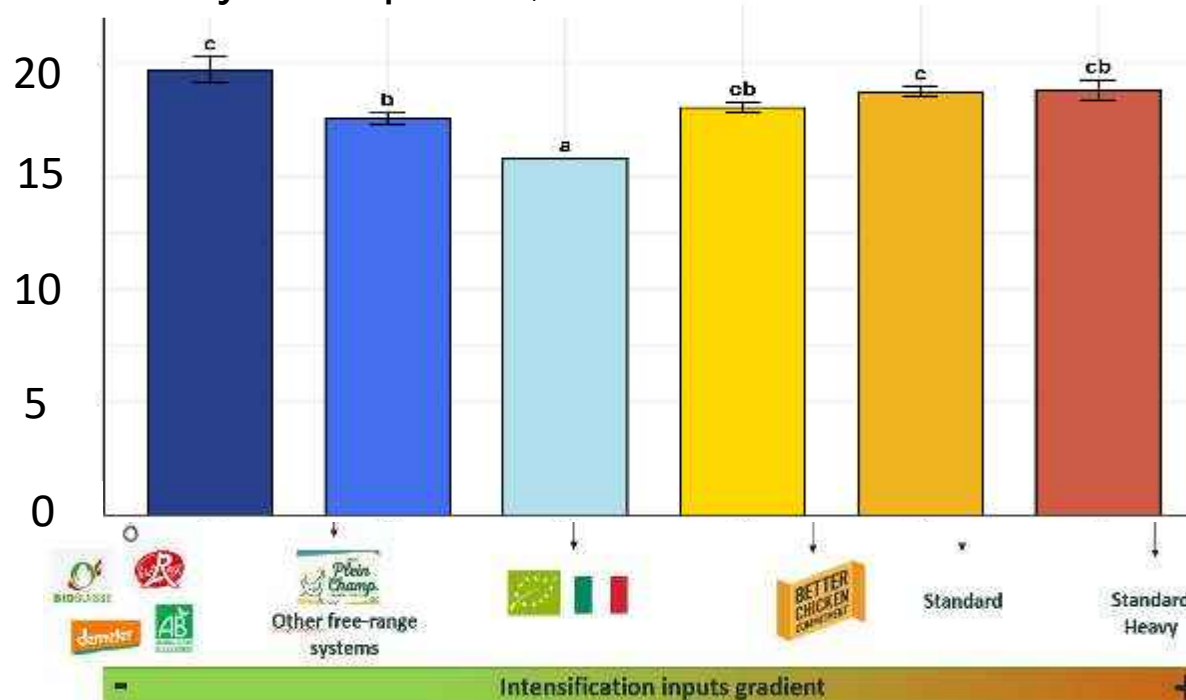
Chicken reared, 1000 heads



Duration, days / cycle

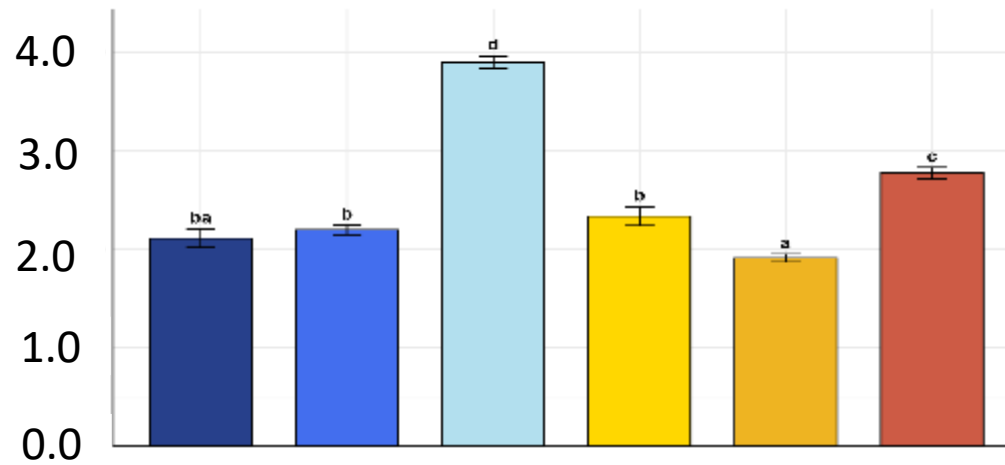


Dietary crude protein, % DM

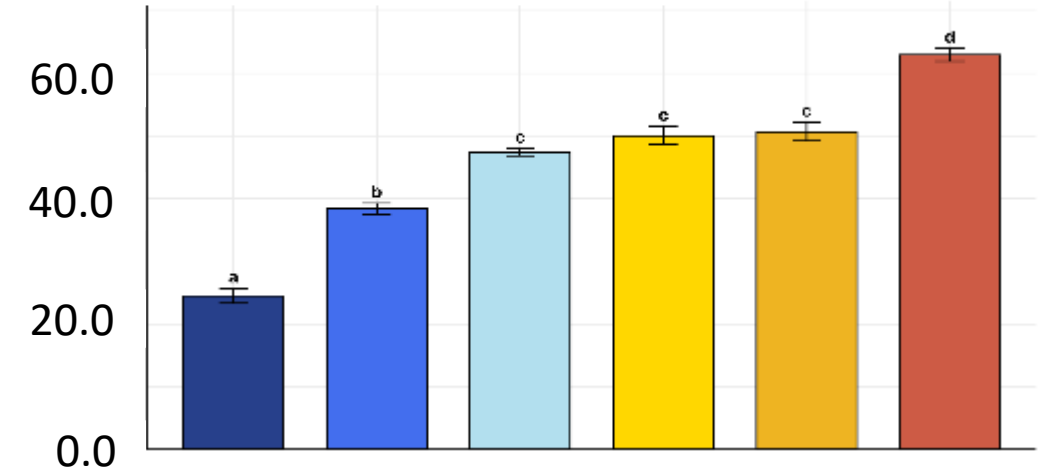


Results

Slaughter BW, kg/head



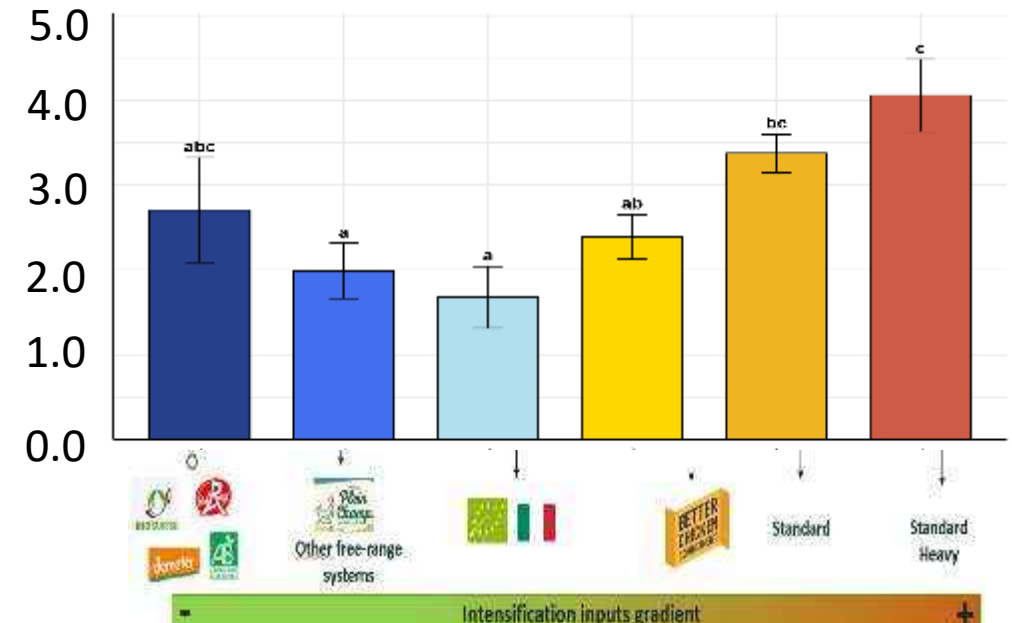
Average daily gain, kg/head



Feed conversion ratio, kg/kg

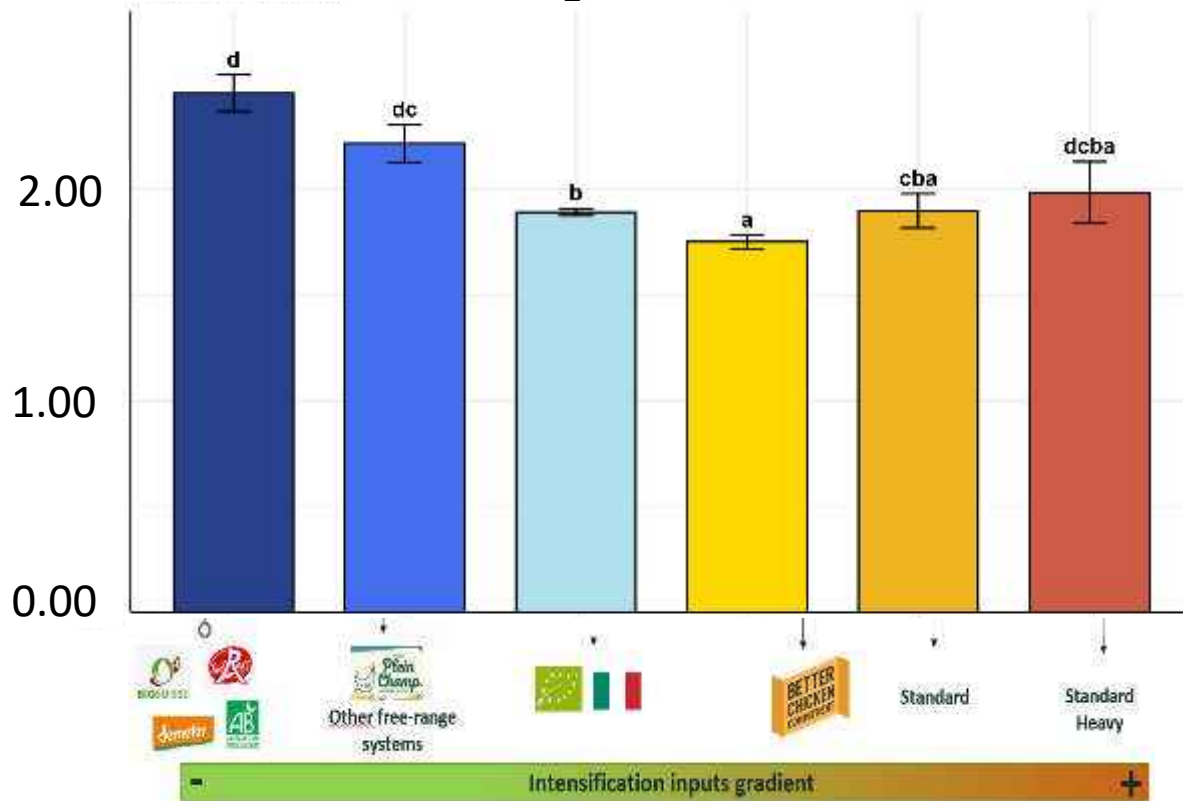


Mortality rate, %

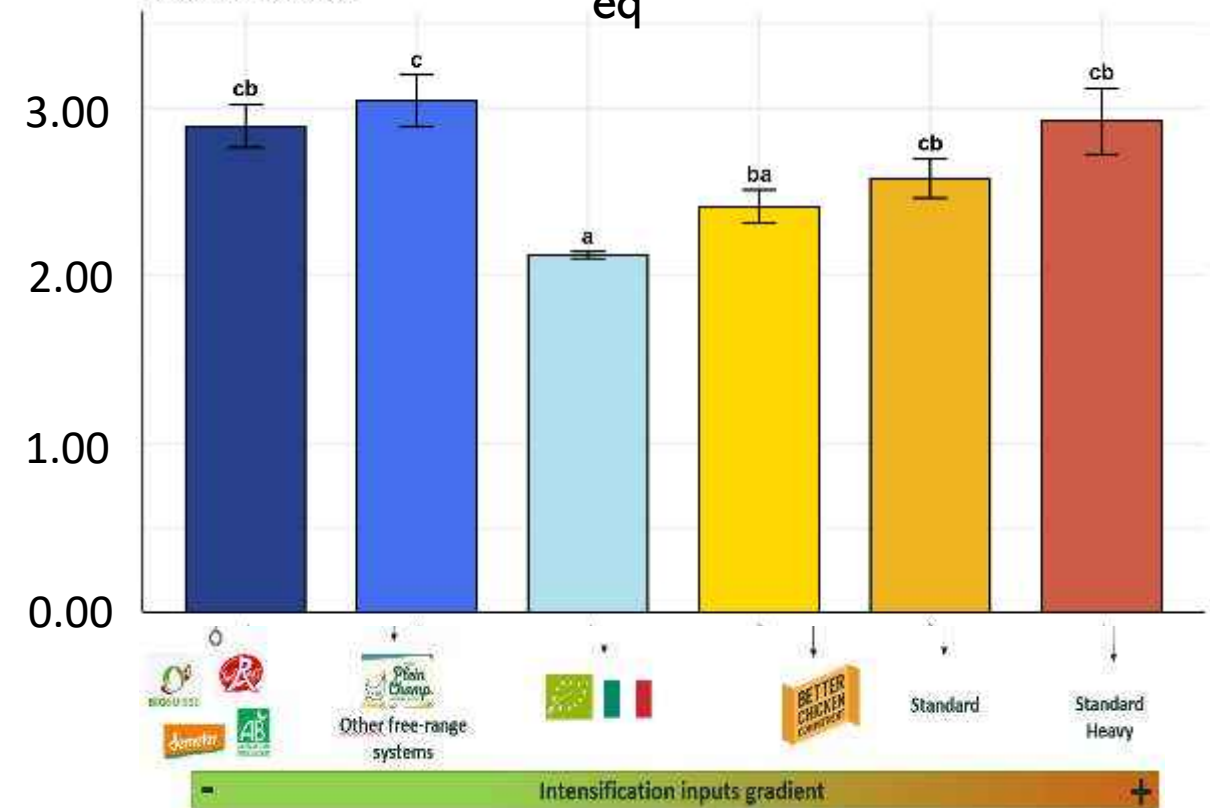


Results: impact categories, per kg bodyweight

GHG emissions, kg CO₂-eq

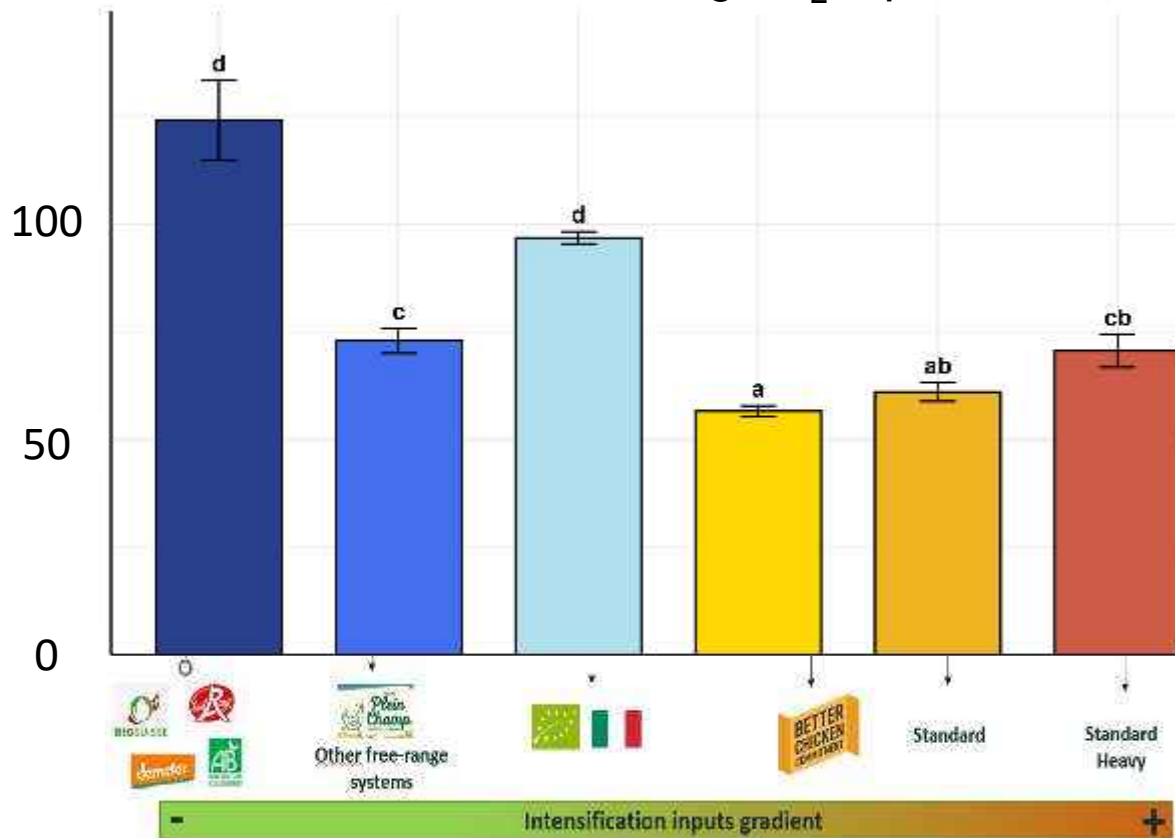


GHG emissions plus land use change, kg CO₂-eq

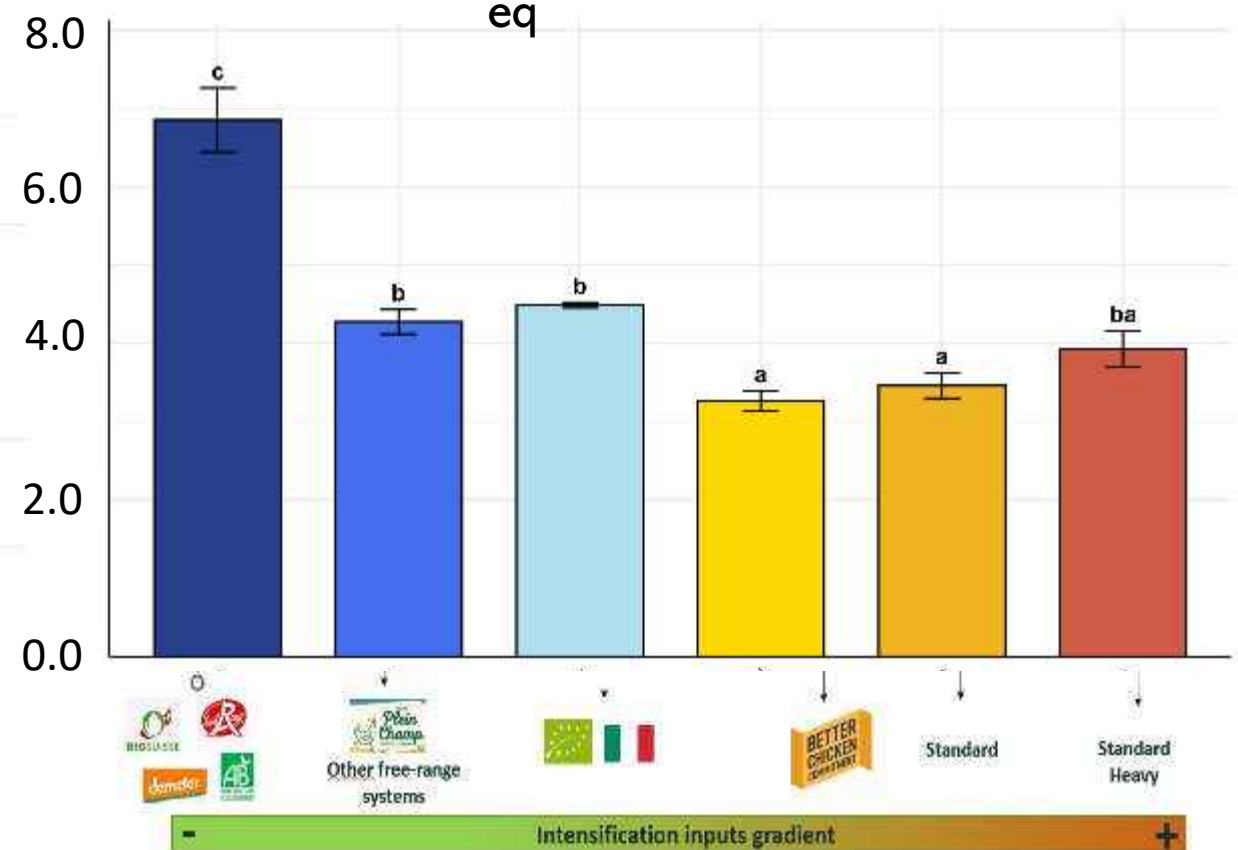


Results: impact categories, per kg bodyweight

Terrestrial acidification, 10^{-5} kg SO₂-eq

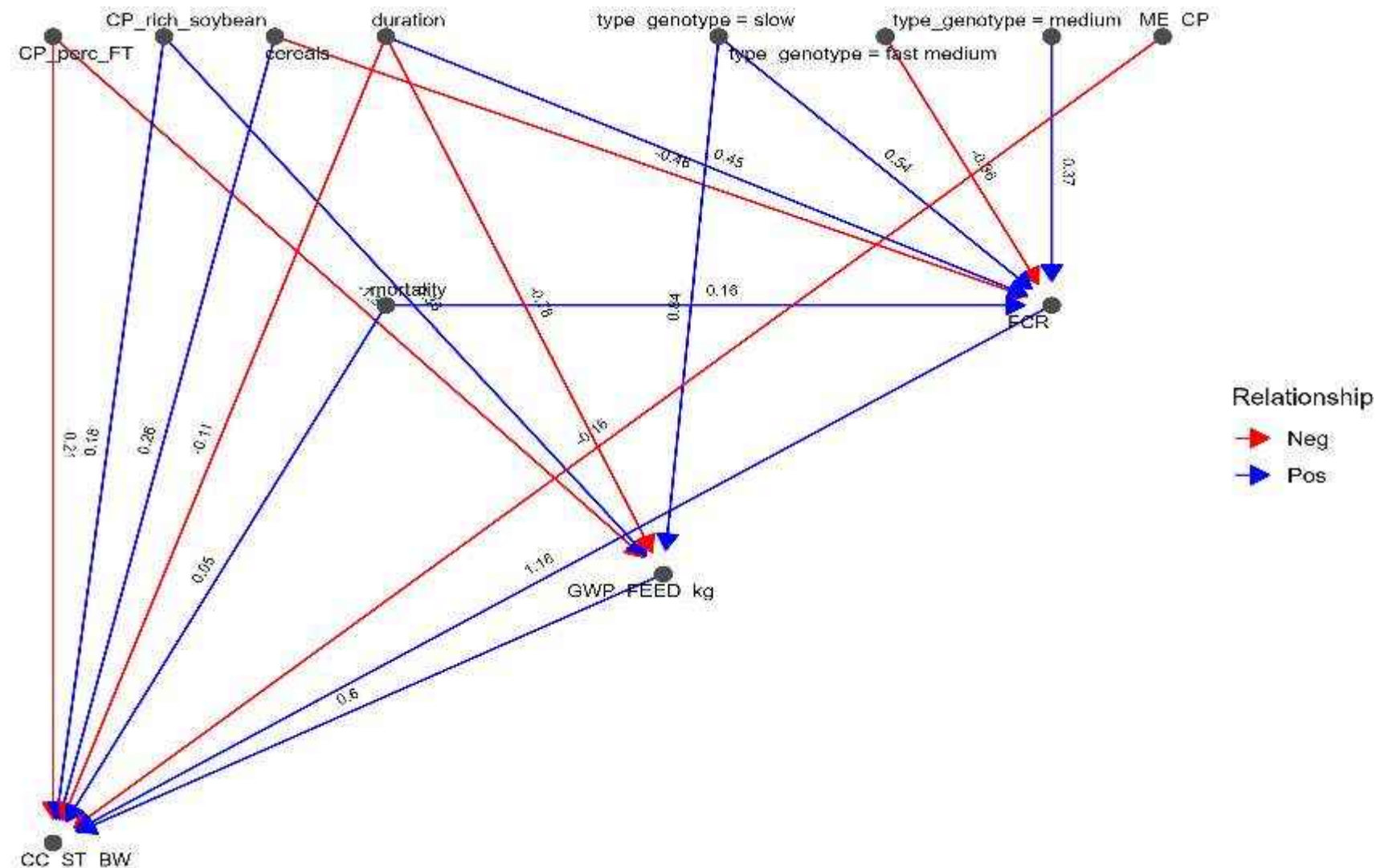


Freshwater eutrophication, 10^{-4} kg PO₄⁻ eq



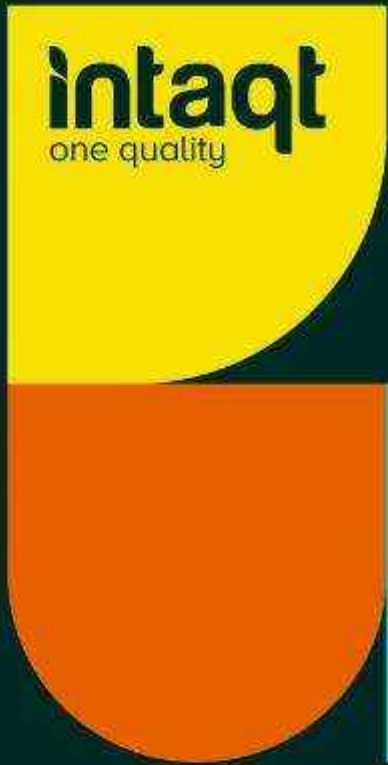
piecewiseSEM: Relationship among variables

- Estimates: z-scores
- Negative values: reduction
- Positive values: increase



Take home message

- The results of this study shows the complexity of the relationship among intensity in input investments, animal output response and associated environmental impact computed with multi-category LCA methodology.
- At a general level, the results indicated a negative association between intensity level and impact values per product unit → but could be quite dependent on the impact category evaluated.
- The observed slight increase in the impact values in the farm typology highest in the gradient of intensification highlights the potential close of positive marginal effect of additional input investments as well as the potential risk of rebounds in animal response.
- The variability observed, in particular the diversity of impact values observed within outdoor or indoor systems, can indicate the perdurance of interesting room for improvements



Ecosystem services



Beyond impacts, provision of ecosystem services

Environmental impacts:
(life cycle assessments)



↓ with intensification

Regulating ecosystem services:

Livestock can maintain ecosystems providing services

Carbon storage



Soil fertility



Erosion control



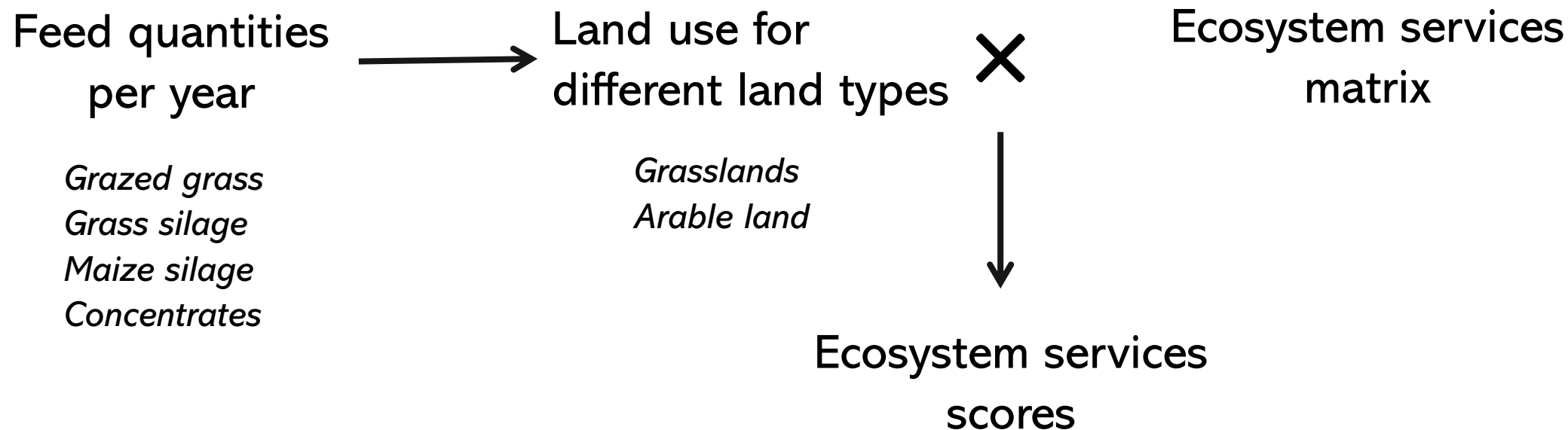
Water quality



Habitat provision



Methodology



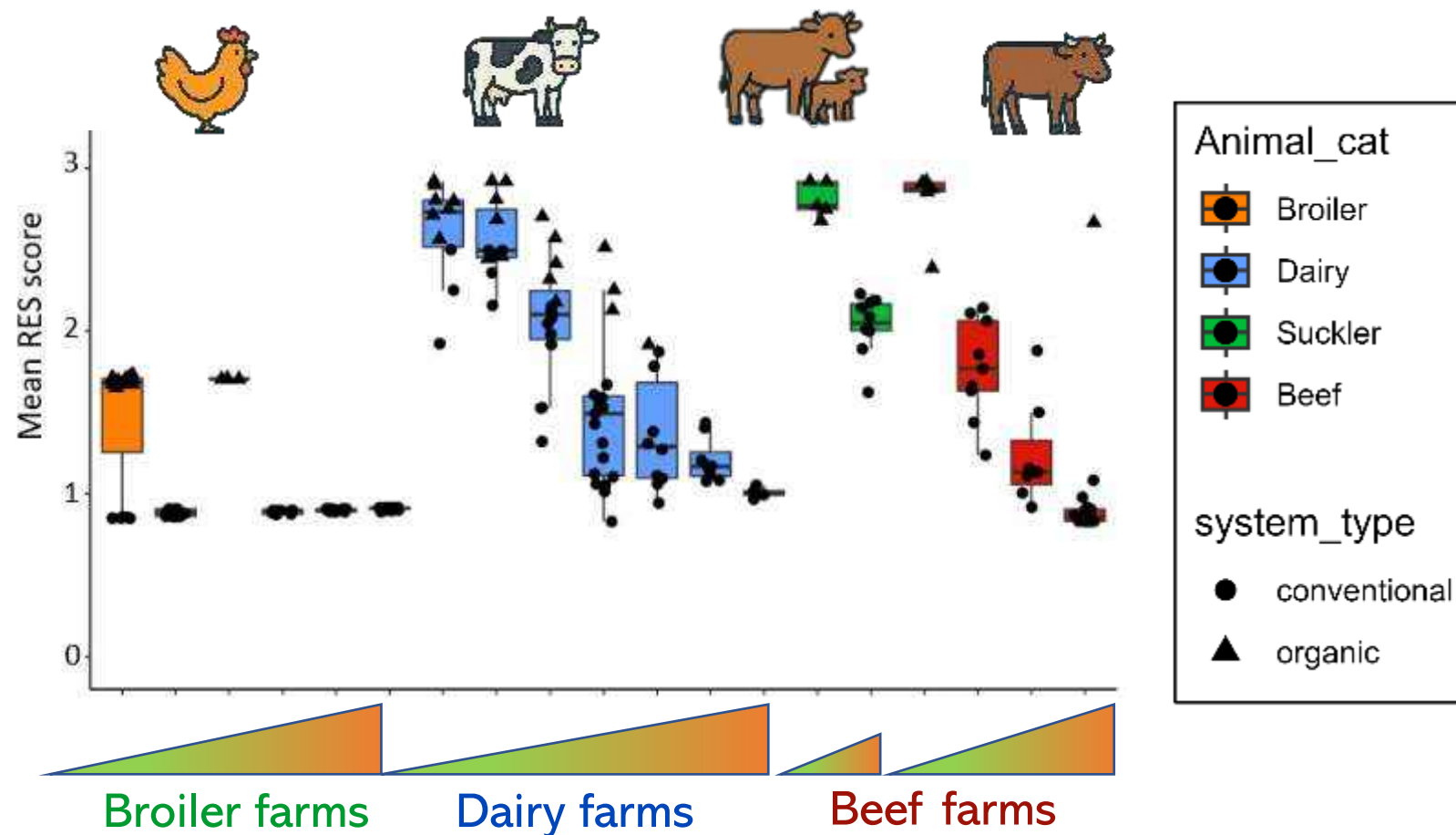
Ecosystem services matrix

Land cover	Erosion control	Pollination	Habitat provision	Soil quality	Water quality	Carbon stock	Mean RES score
Annual crops conv. FR	0.5	0.5	1	0	1	2	0.83
Annual crops org. FR	0.5	1.5	2.5	1	1.5	2.5	1.58
Annual crops legume conv. FR	1	0.5	1.5	1	0	2	1
Annual crops legume org. FR	1	2	3.5	2	0.5	2.5	1.92
Temporary grassland without clover conv. FR	2	0.5	2	2.5	2	1.5	1.75
Temporary grassland without clover org. FR	2	1.5	3	3	3.5	1.5	2.42
Temporary grassland + clover conv. FR	2	1.5	2.5	2.5	1	1.5	1.83
Temporary grassland + clover org. FR	2	1.5	3	3	1.5	2	2.17
Permanent grassland without clover conv. FR	2	2	2.5	3	3	2.5	2.5
Permanent grassland without clover org. FR	2	2.5	4	3.5	3	2.5	2.92
Urban discontinuous	0.3	0.8	1.4	0.1	0.1	0.1	0.47

Adapted from Joly et al., 2024



Results regulating ecosystem services (RES)



Conclusions

Environmental
impacts:
(life cycle assessments)

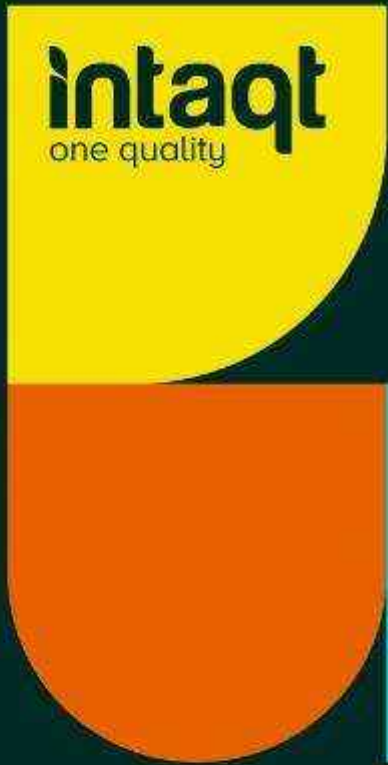


↓ with intensification

Regulating ecosystem
services:



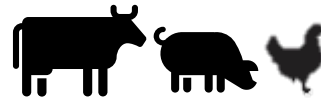
↓ with intensification in cattle



Feed-food competition

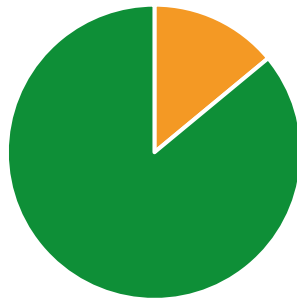


Context



6 billion tonnes dry matter per year

Non human-edible feeds



Human-edible feeds

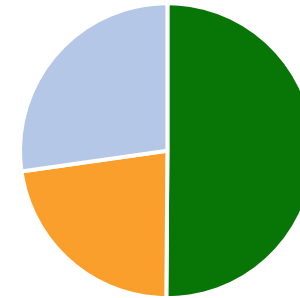


Grains:
Cereals,
Leguminous,
Soja

Feed-food competition

Half of the agricultural area

Arable land



Permanent grasslands



Livestock intensification:
good or bad for **feed-food competition**?

Schader et al., 2015
Mottet et al., 2017
FAOSTAT, 2023

Material & Methods

Livestock intensification:
good or bad for **feed-food competition**?

2 indicators of **efficiency**

**Protein feed
conversion ratio
(FCR)**



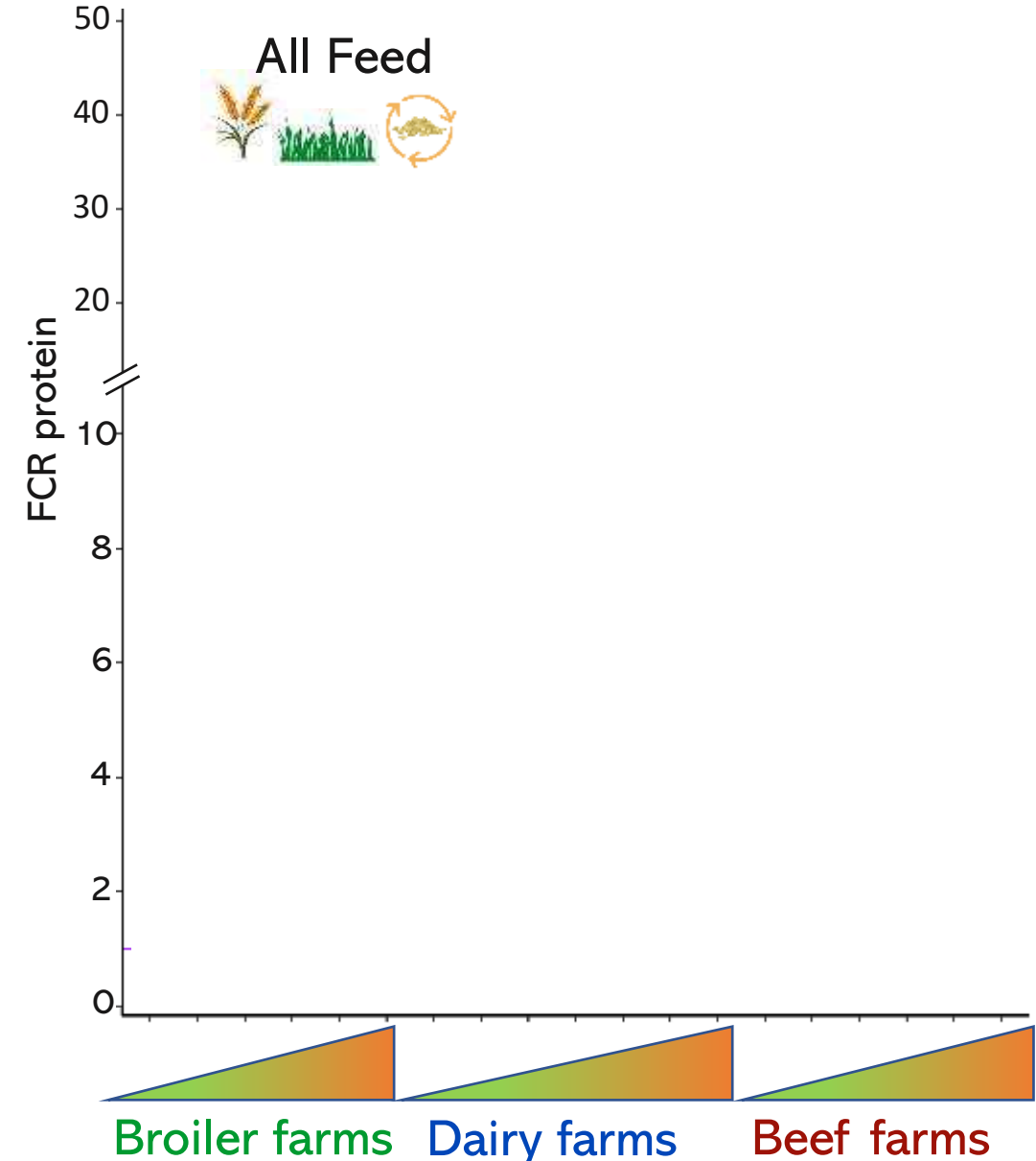
All feed or only human-edible feed
considered

Land use
=



All land or only arable land considered

Feed efficiency

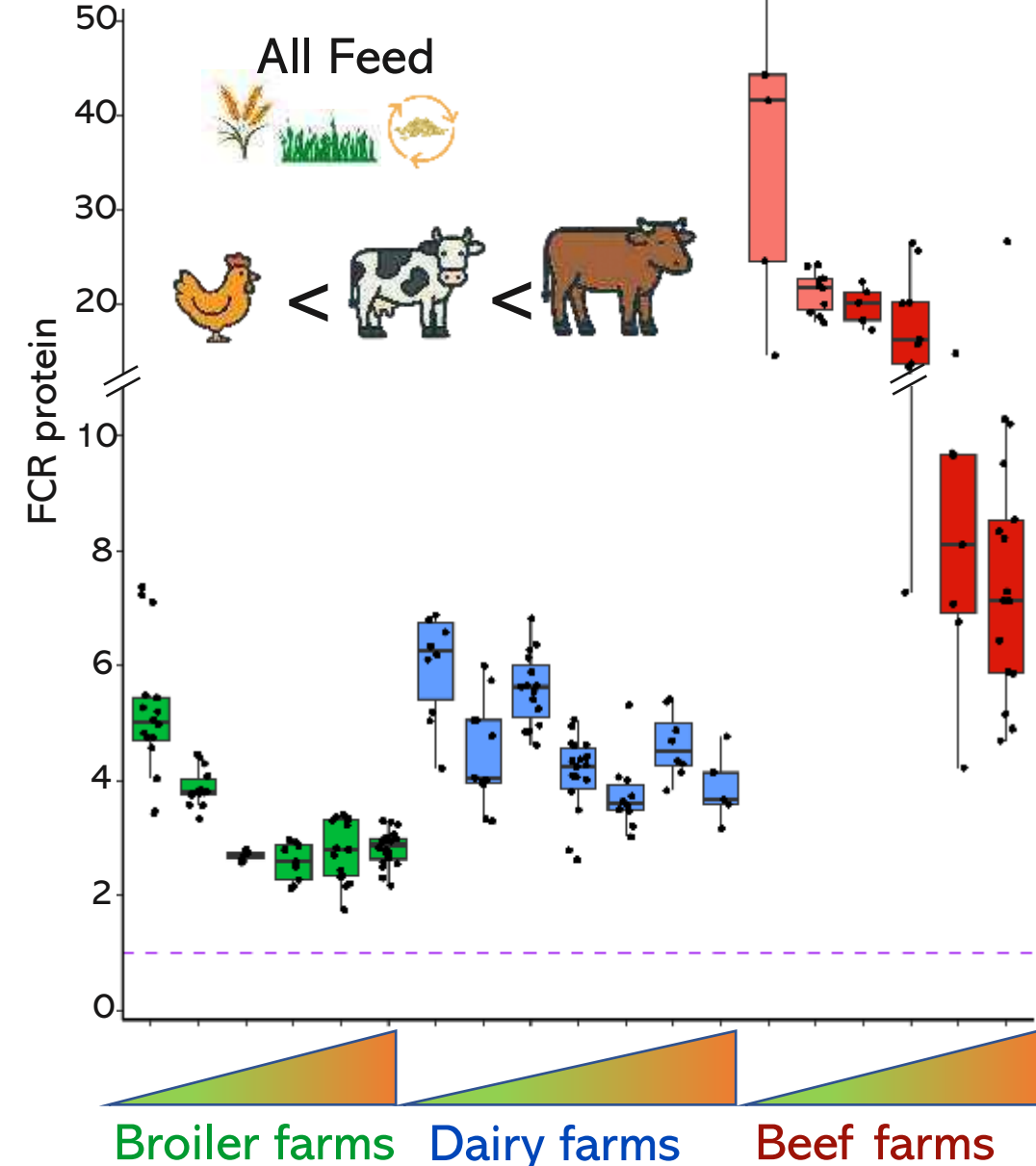


Productions

- Broiler farms
- Dairy farms
- Beef suckler farms
- Beef fattening farms

FCR: Feed conversion ratio
(kg feed protein/kg produced protein)

Feed efficiency



Human edible feed

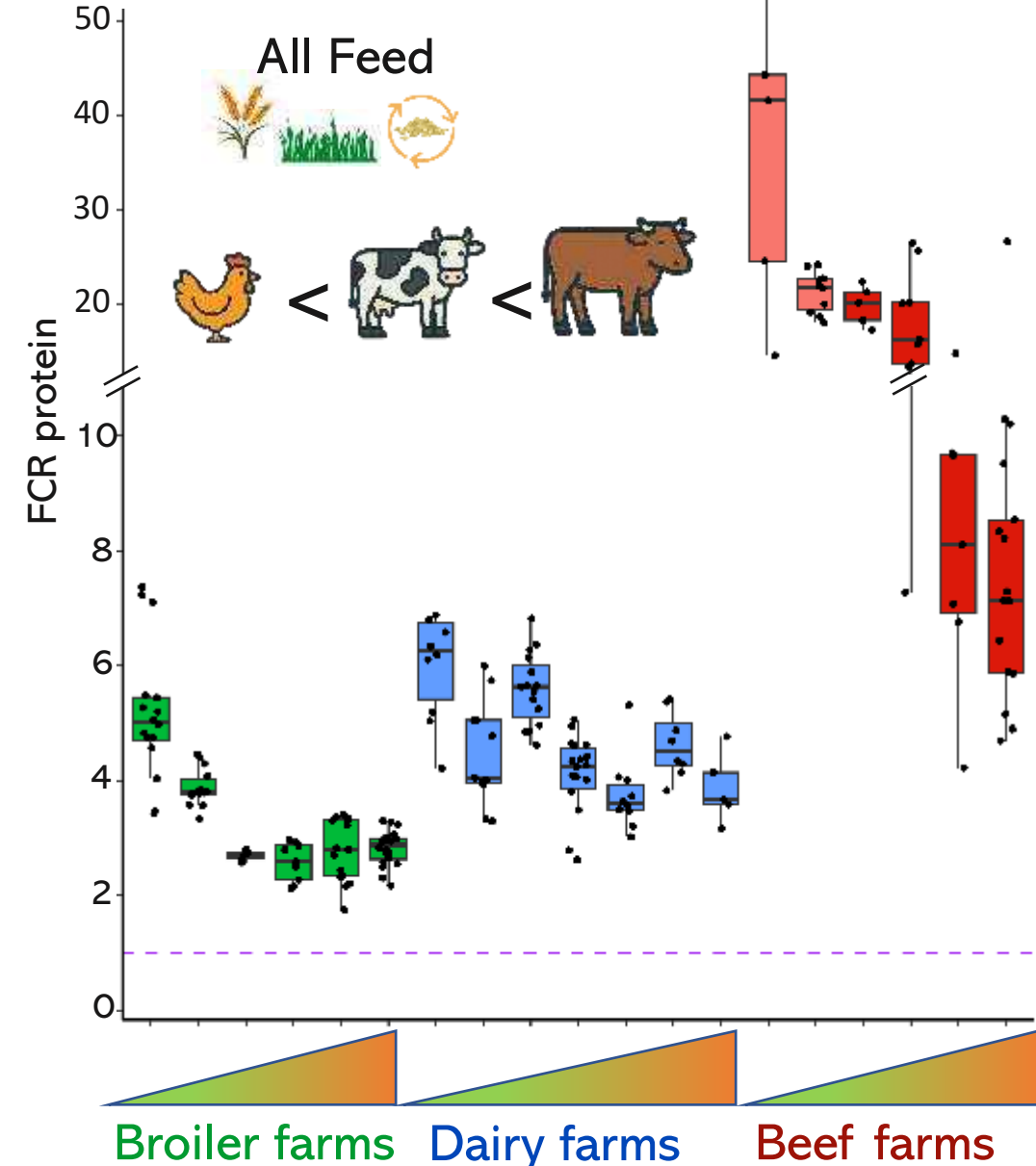
Edibility coefficients
from Ertl et al., 2015

Productions

- Broiler farms
- Dairy farms
- Beef suckler farms
- Beef fattening farms

FCR: Feed conversion ratio
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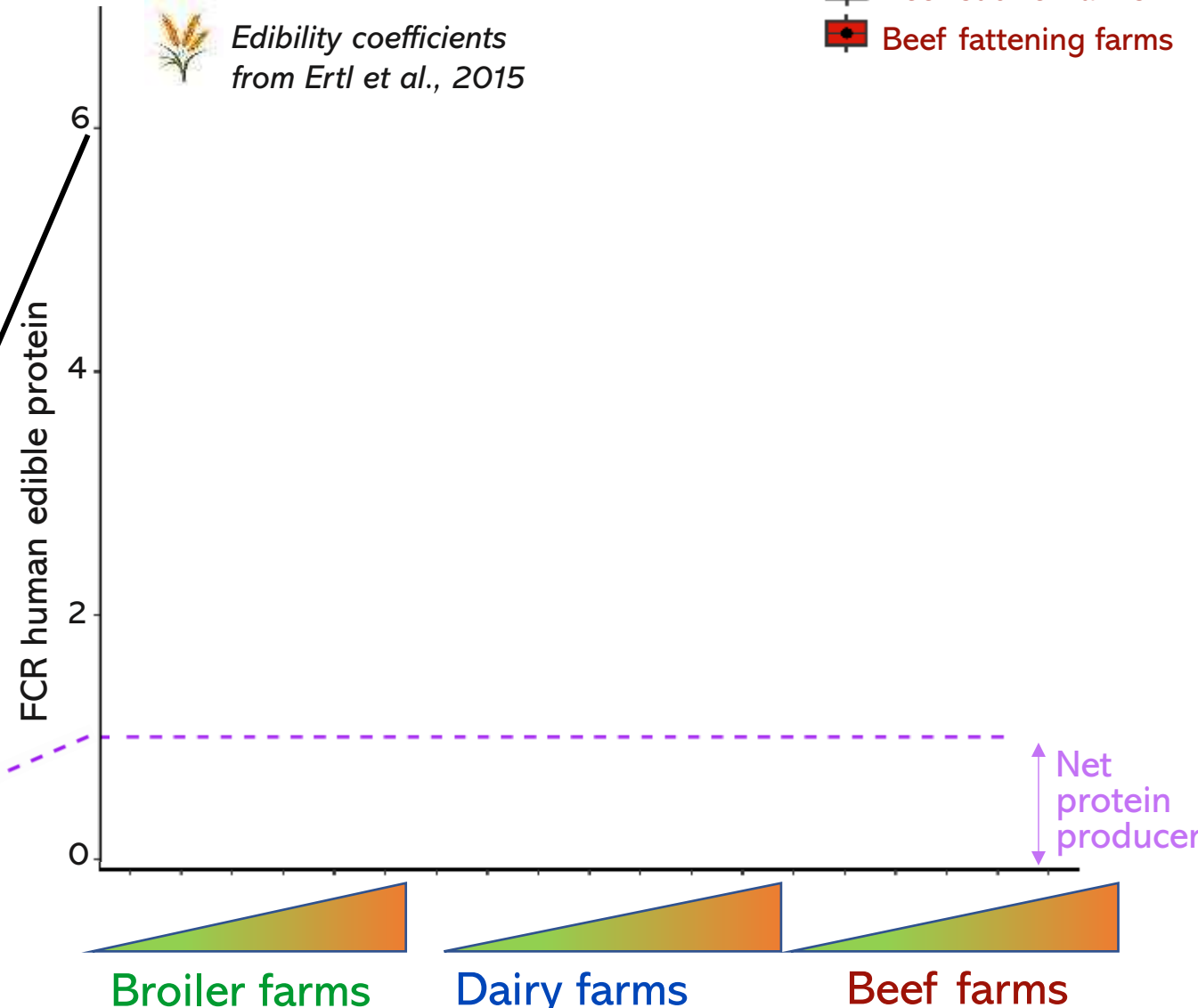
Feed efficiency



FCR: Feed conversion ratio
(kg feed protein/kg produced protein)

Human edible feed

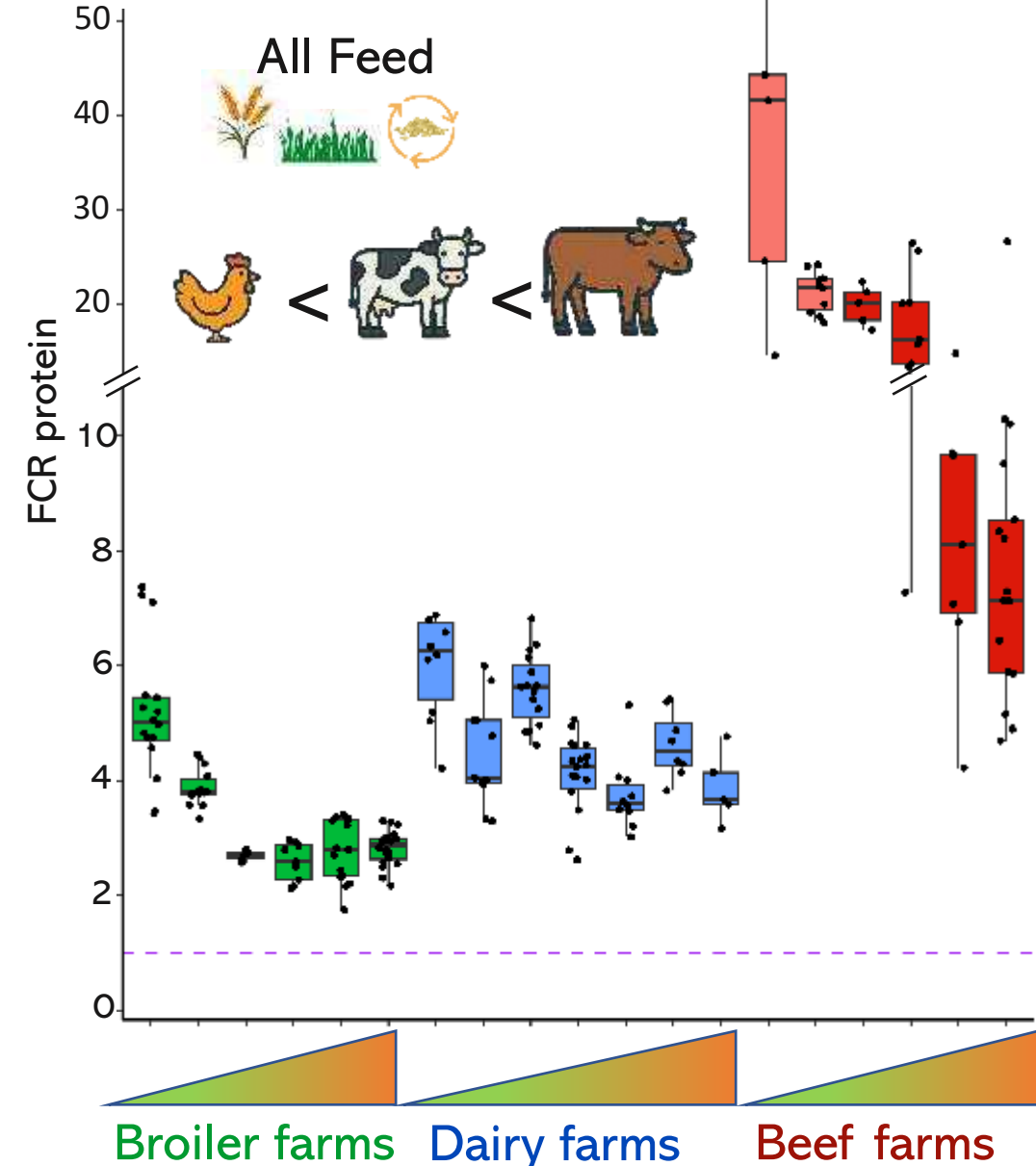
Edibility coefficients
from Ertl et al., 2015



Productions

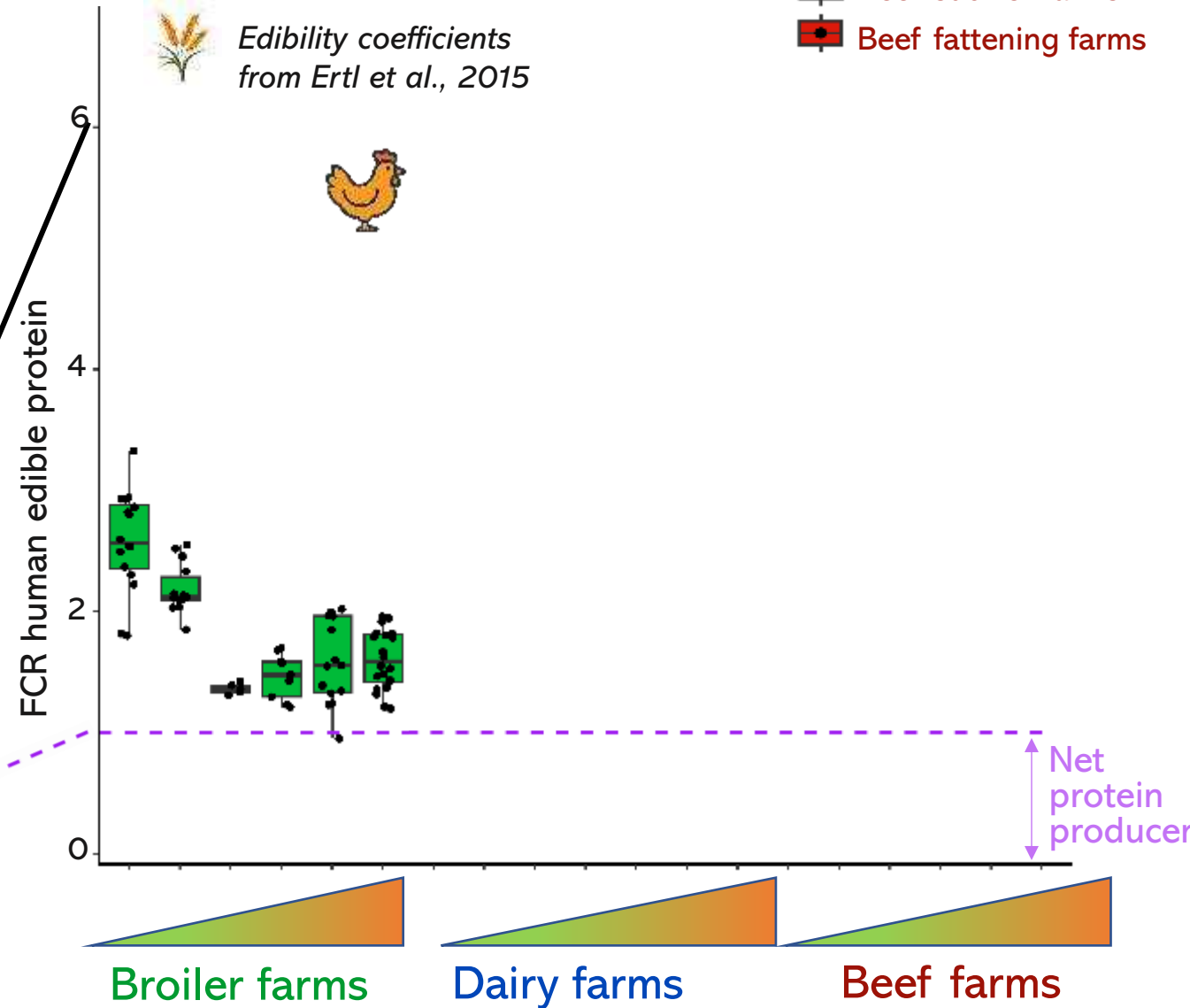
- Broiler farms
- Dairy farms
- Beef suckler farms
- Beef fattening farms

Feed efficiency



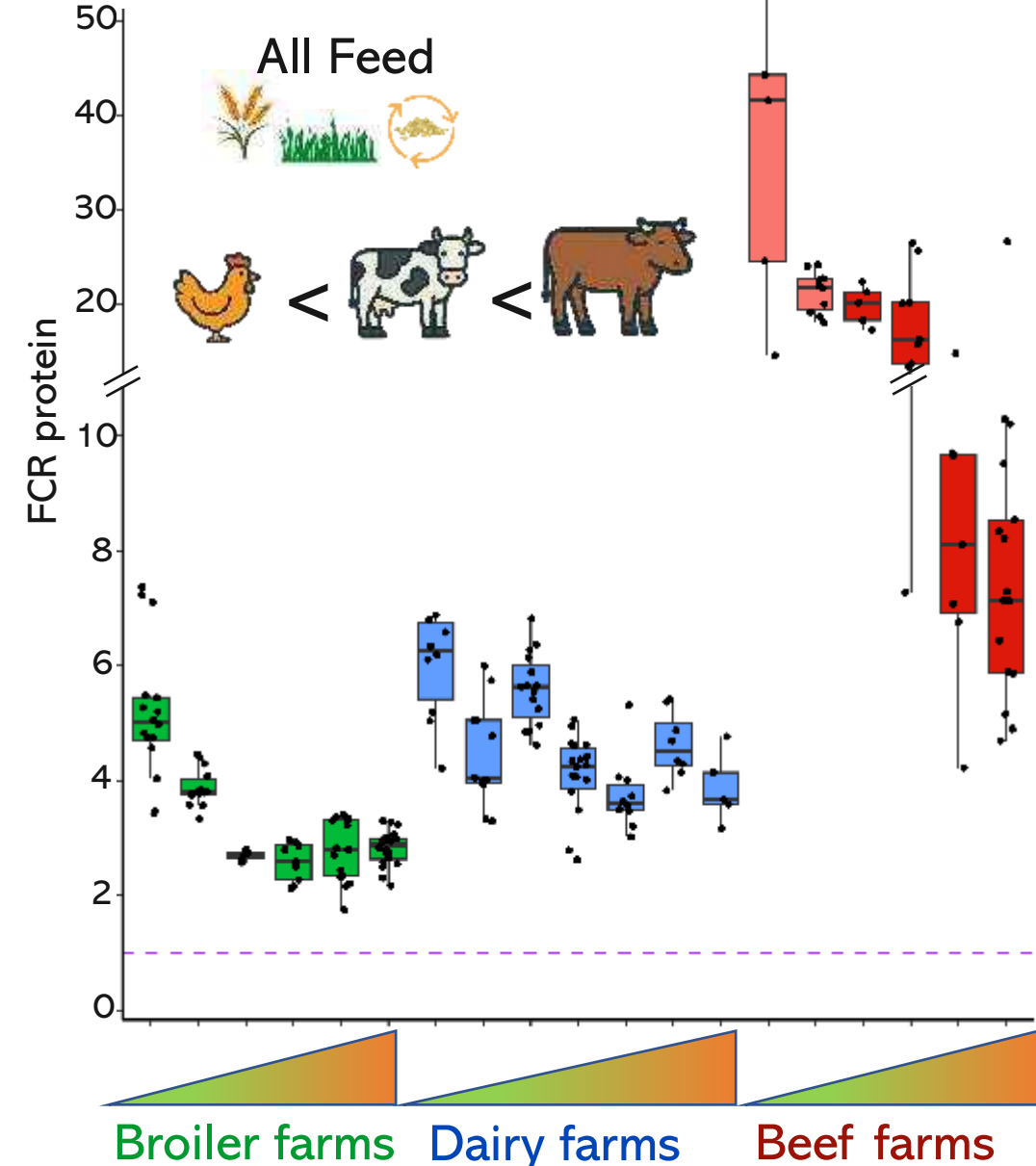
Human edible feed

Edibility coefficients from Ertl et al., 2015

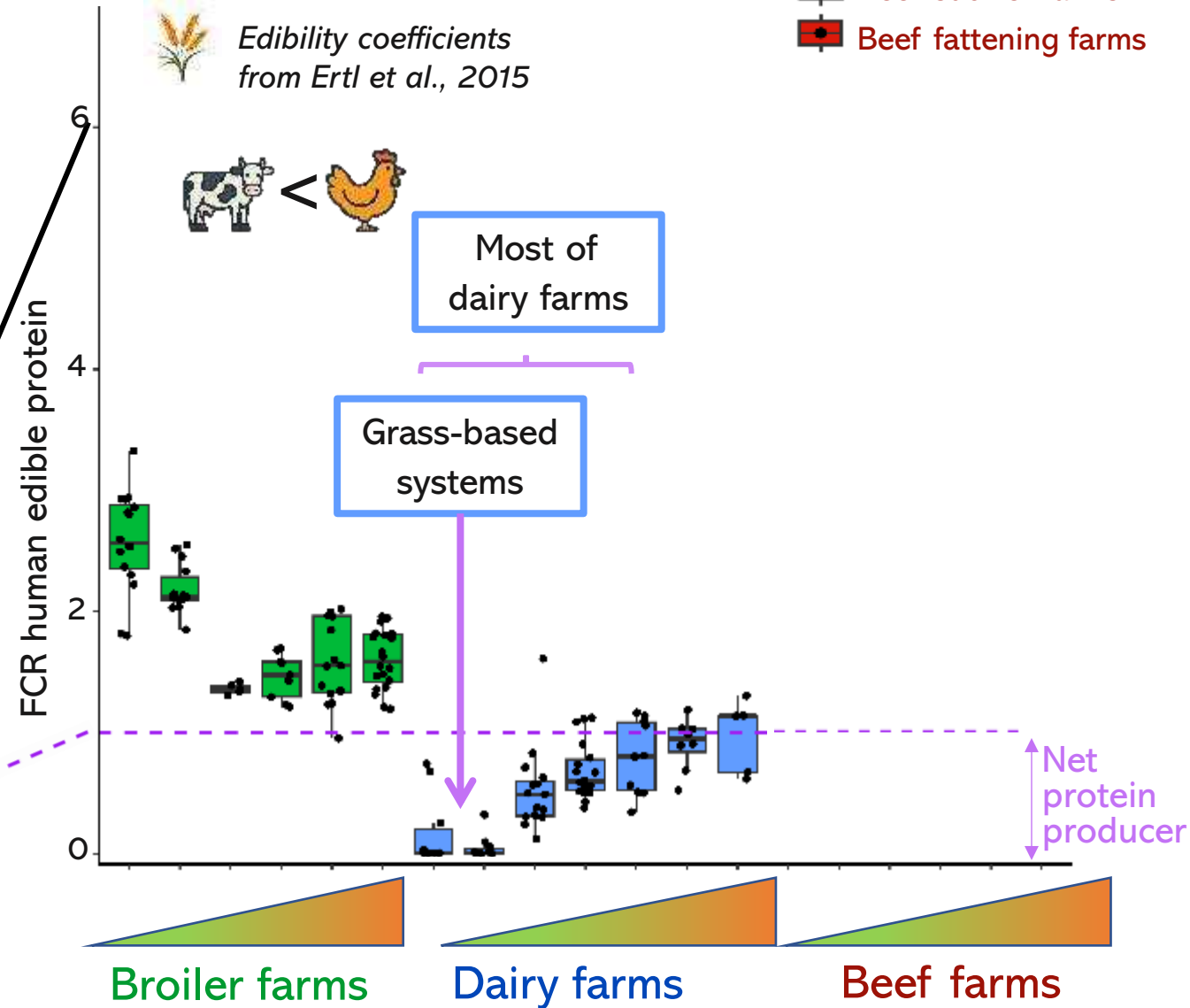


FCR: Feed conversion ratio
(kg feed protein/kg produced protein)

Feed efficiency



Human edible feed

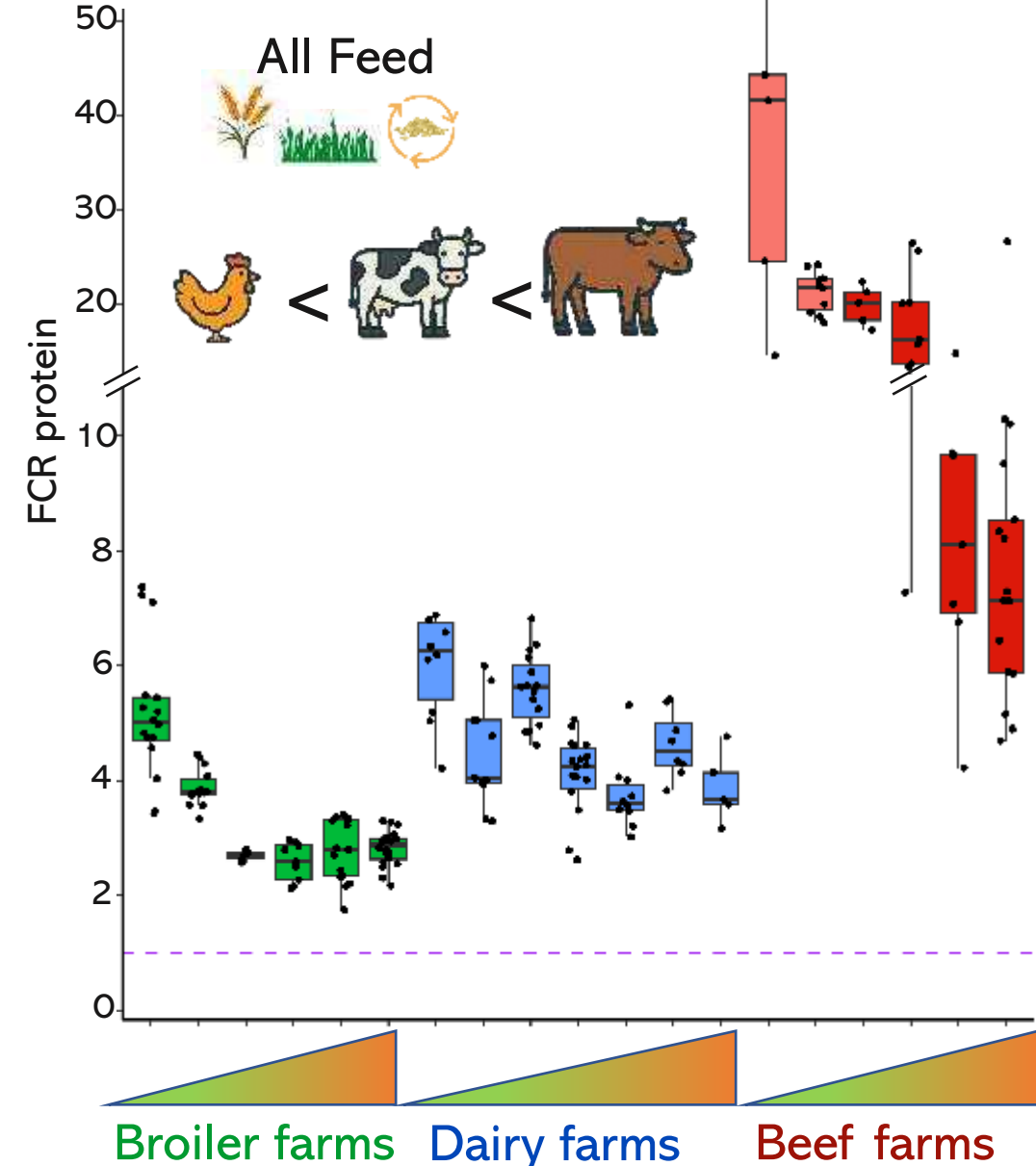


Productions

- Broiler farms
- Dairy farms
- Beef suckler farms
- Beef fattening farms

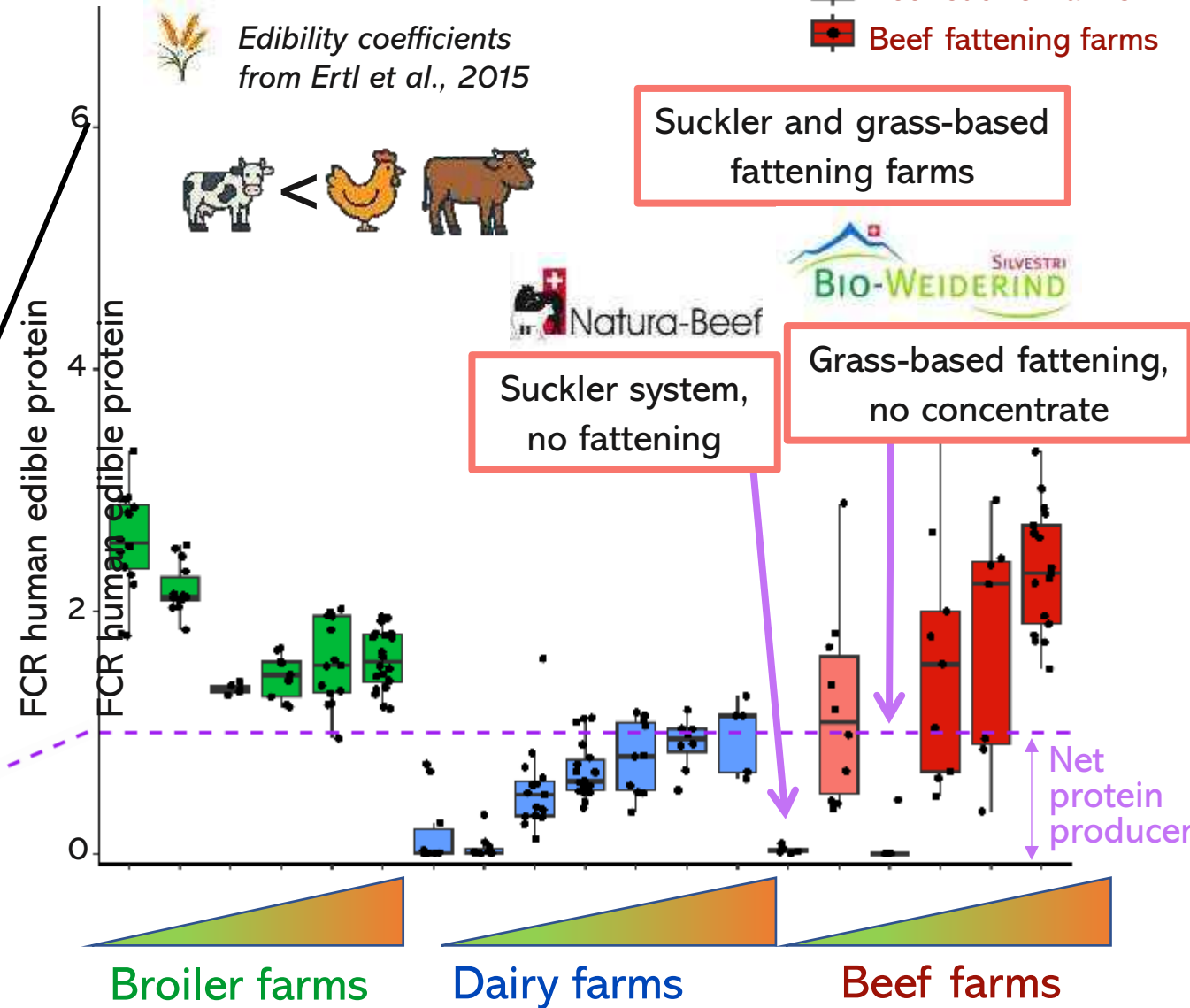
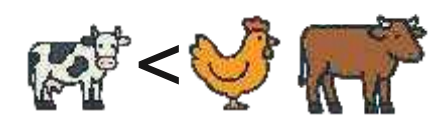
FCR: Feed conversion ratio
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Feed efficiency



Human edible feed

Edibility coefficients from Ertl et al., 2015



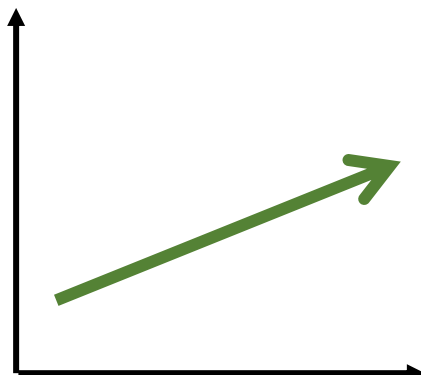
- Productions**
- Broiler farms
 - Dairy farms
 - Beef suckler farms
 - Beef fattening farms

FCR: Feed conversion ratio
(kg feed protein/kg produced protein)

Conclusion

Efficiency

/ animal
/ kg feed
/ ha

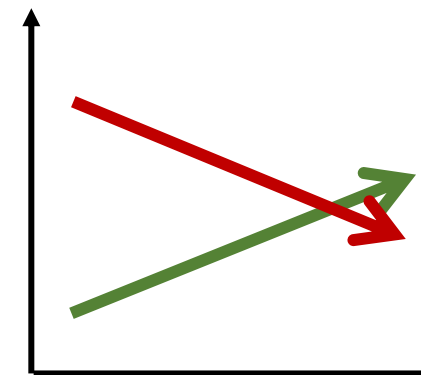


Intensification

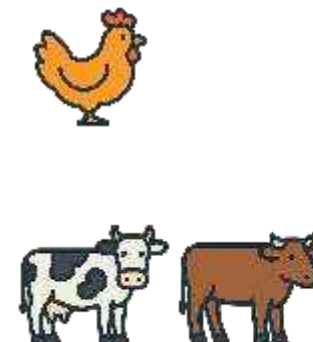


Net efficiency

/ kg edible
feed
/ ha arable



Intensification



Livestock intensification:
good or bad for **feed-food competition**?

**Livestock
intensification**



Intensifying production (?! \ animal welfare, quality)

limits

worsens

**Feed-food
competition**



Shifting towards more
extensive systems



**Net protein
producers**



In Summary...



In summary...

Environmental
impacts/kg

Ecosystem
services

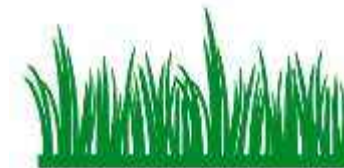
Feed-food
competition



*Yes but until a
certain point



Intensification in...



More impacts/kg but also more ecosystem
services and less feed-food competition!

Thank you for your attention

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INTAQT Final conference
11th September 2026
Hamburg, Germany

INTAQT One Quality

Is multi-performance achievable?

intaqt
one quality

Eléa Caumette and Cécile Berri, INRAE



In summary...

EXTRINSIC QUALITY

Productivity

Environmental impacts/kg product

Regulating ecosystem services

Feed-food competition

Animal welfare



*Yes but until a certain point
(fast-medium growing)



() : According to the literature



Net protein producers!

INTRINSIC QUALITY

Sensory quality

Nutritional quality

Technological quality

Health quality





In summary...

EXTRINSIC QUALITY

Productivity



Environmental impacts/kg product



Regulating ecosystem services



Feed-food competition



Animal welfare



INTRINSIC QUALITY

Sensory quality

Nutritional quality

Technological quality

Health quality





In summary...

EXTRINSIC QUALITY

Productivity



Environmental impacts/kg product



Regulating ecosystem services



Feed-food competition



Animal welfare



INTRINSIC QUALITY

Sensory quality

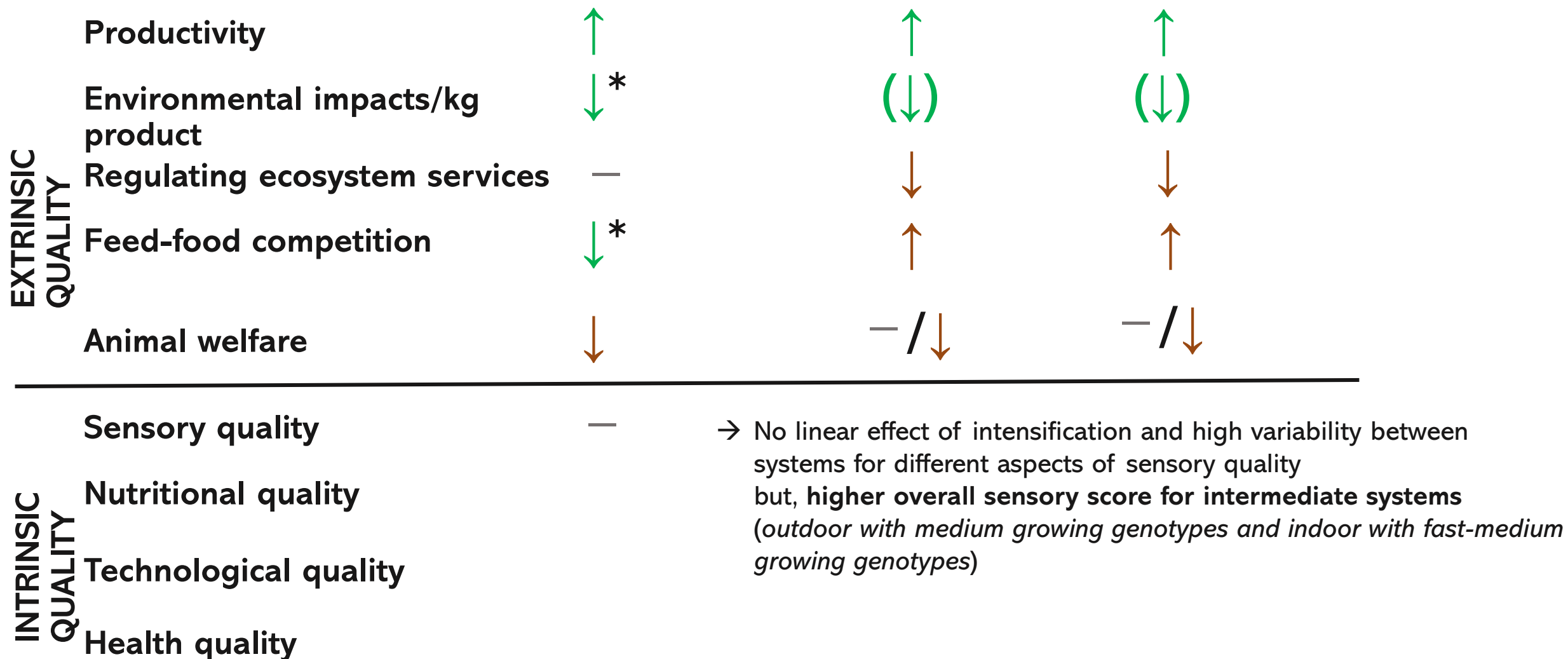
Nutritional quality

Technological quality

Health quality

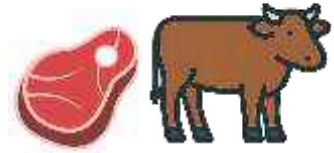


In summary...

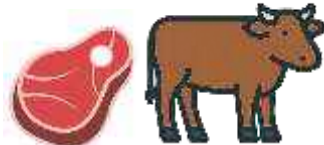


Intensification in...

In summary...

				
EXTRINSIC QUALITY	Productivity	↑	↑	↑
	Environmental impacts/kg product	↓*	(↓)	(↓)
	Regulating ecosystem services	—	↓	↓
	Feed-food competition	↓*	↑	↑
	Animal welfare	↓	— / ↓	— / ↓
INTRINSIC QUALITY	Sensory quality	—	<u>Faster growth rates:</u> ↑ breast meat yield (+ ↑ feed efficiency) but ↓ Nutritional and health quality: ↓ protein content, ↑ fat content, ↓ less iron, ↓ beneficial bioactive compounds (e.g., anserine and carnosine), ↓ amino acid availability, and ↓ Technological and commercial quality: ↑ water losses during processing, and ↑ breast muscle abnormalities	
	Nutritional quality	↓		
	Technological quality	↓		
	Health quality	↓		

In summary...

				
EXTRINSIC QUALITY	Productivity	↑	↑	↑
	Environmental impacts/kg product	↓*	(↓)	(↓)
	Regulating ecosystem services	—	↓	↓
	Feed-food competition	↓*	↑	↑
	Animal welfare	↓	— / ↓	— / ↓
INTRINSIC QUALITY	Sensory quality	—	—	—
	Nutritional quality	↓	↓	↓
	Technological quality	↓	—	—
	Health quality	↓	—	—

→ Pasture effect 
(lower omega6/omega3 ratio)



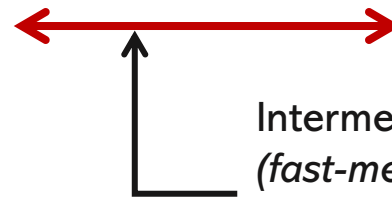
Is multiperformance achievable?

- Antagonisms at system level:



Productivity,
feed-food competition,
environmental impacts per kg

Animal welfare and
**Nutritional, technological, and health
quality of chicken meat**



Intermediate systems
(*fast-medium growing genotypes*)
as a potential compromise
according to our data



Productivity,
(environmental impacts per kg)

Regulating ecosystem services,
feed-food competition, outdoor access,
Nutritional quality

→ Pasture-based systems



- Different bundles of performances depending on the system

Overall remarks

- Regarding safety, none of the studied indicators of heavy metals surpasses the EU regulation thresholds (chromium, nickel, cadmium, arsenic, lead) 

- Whatever the system, these livestock products remain valuable source of nutrients

- Quality scores focused on 1 product per production (chicken breast, UHT milk, beef cooked in a certain way)



- Large variability within systems:

Opportunities to improve milk and meat quality within systems → to be explored



Thank you for your attention

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September 2026

INTAQT One Quality Online Course

intaqt
one quality



01. The INTAQT Online Course

CONTEXT	Prepared under WP6
CONTENT	Based on project results and the INTAQT app currently being developed
FORMAT	Ten episodes, each with a maximum duration of three minutes
COLLABORATION	The coordination team helped identify partner reviewers for each episode



02. Ten Episode Pathway



Project & quality foundations → sustainability & tools → practice & WebApp



03. Course content at a glance

EPISODE 1

Project introduction

The INTAQT project

EPISODES 2–4

Intrinsic quality

Typology and multicriteria scoring for chicken meat, beef and milk

EPISODES 5–6

Extrinsic quality

Feed–food competition, ecosystem services, LCA, animal welfare and trade-offs or synergies

EPISODES 7–10

Tools and practice

Authentication and prediction, Living Labs, data visualisation and data prediction



04. How the course is being developed

1

Technical input

Partners provide content for the assigned episode

2

First script draft

CONSULAI prepares a first draft based on the content received

3

Partner review

The responsible partners review each episode

4

Final episode

The reviewed script is prepared as a concise online episode

Maximum duration per episode: 3 minutes



05. Strategy once the course is completed

PUBLISH

Make the complete online course available on the INTAQT website

PROMOTE

Announce the course through **INTAQT communication channels and partner networks**

GUIDE USERS

Provide a **clear course landing page** with the episode sequence and direct access

EXTEND IMPACT

Keep the **course available as a project resource** after the project ends

MONITOR

Track basic **engagement indicators to exploit INTAQT final results**

Primary destination: INTAQT website



Thank you for your attention

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Sara Smith, CONSULAI

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