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Multiperformance of slow-growing and dual-purpose strains in organic chicken production: learning from the PPILOW project

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Multiperformance of slow-growing and dual-purpose strains in organic chicken production: learning from the PPILOW project

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INRAE



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SYSAAF

The 75th EAAP Annual Meeting, 1/5 September 2024 - Florence, Italy

PPILOW What is multiperformance for broiler production?



Economic performance

Zootechnical parameters
Meat yield
Costs and revenues
...

Animal Welfare performance

5 freedoms

Freedom from Hunger and Thirst
Freedom from Discomfort
Freedom from Pain, Injury or Disease
Freedom to Express Normal Behavior
Freedom from Fear and Distress

the Farm Animal Welfare Council, 1993

Satisfaction of physiological and behavioural needs,
as well as expectations ANSES, 2018

Animal health performance

Absence of disease
Food safety
Immunity and adaptive capacities
...

Environmental performance

Energy and water use
Climate change
Pollution
...

Societal performance

Work conditions
Job perception
Social involvement
Meat quality and food security
...

**MULTI-
PERFORMANCE**

Some indicators shared with those included in multicriteria sustainability assessments

Why do we consider multiperformance in organic broiler systems?



- Diversity of practices and breeds used with different performance and environmental impacts throughout Europe
- Still a need to improve animal welfare and limit mortality, in relation to the **outdoor access challenging the animals** and **ethical issues**

Objective of PPILOW: Identify, test and evaluate animal welfare-improving practices by taking into account environmental, economic and social impacts including human well-being
One Welfare concept (Garcia Pinillos et al., 2016) and Multiperformance

H2020 PPILOW partners and collaborators



PPILOW

Poultry and Pig Low-input and Organic production systems' Welfare

2019-2024



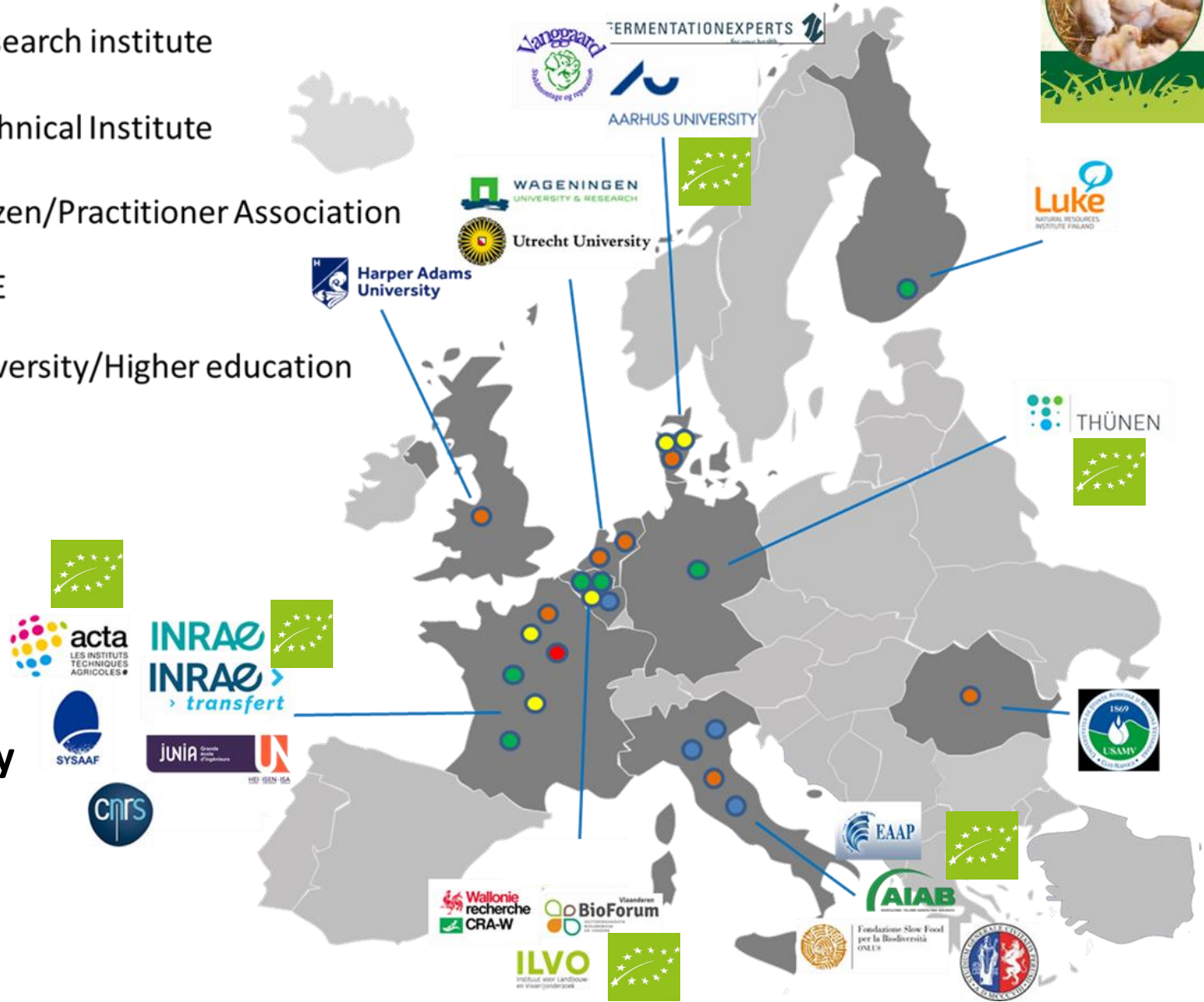
Coordination: **INRAE**

22 PPILOW Partners in 9 countries

9 National Practitioner Groups (NPG): 5 dedicated to poultry

www.ppilow.eu

- Research institute
- Technical Institute
- Citizen/Practitioner Association
- SME
- University/Higher education



PPILOW Involvement of National Practitioner Groups

Innovative breeding and rearing strategies



Favouring positive behaviours, improving health and robustness

Avoiding feather pecking in non beak-trimmed hens and the elimination of layer male chicks



Broilers in organic free range systems (PPILOW WP6.1)

Free-range



Key request for European consumers : **Expression of species behaviours** (walking/running, foraging, social interactions...) - **welfare**

Interesting functions for the **agroecological transition** (nutrient inputs from plants and insects, closing nutrients cycles, biodiversity...)

Potential benefits are subject to the fact that **poultry use the outdoor space...** and are able to maintain **good performances, health and welfare** when exposed to biotic or abiotic stressors on the range

- **Variability of range use** between **individuals from different genetic lines** of broilers and **trade-offs between functions**

Dual-purpose breeds in organic systems (PPILOW WP5)

National legislations and knowledge for practitioners and European policy makers:
Alternatives to the elimination of layer male chicks

Layer strain

Selection based on egg production, egg quality traits

Culling of layer male chicks



FR: Article R214-17

- From 01/01/2023 : all hatcheries have to be equipped with operational material to avoid culling chick in coloured strains



DE: Article TierSchG Art. 1 § 4c

- From 01/01/2022 : makes it a punishable offence to kill a vertebrate animal "without reasonable cause" (unprofitability) or to cause it suffering and pain

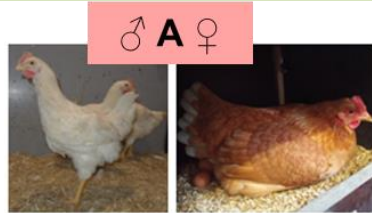


Two strategies developed in PPILOW

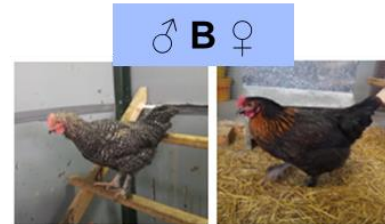
- Study of dual-purpose strains experimentally and on-farm

Multiperformance data, multicriteria analysis and business models

ACTA(ITAB)
 Thuenen Institute
 Aarhus University
 INRAE
 SYSAAF



Meat-type



Pure breed



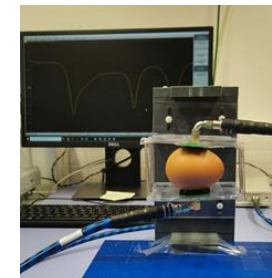
Layer-type



Pluschke et al., EAAP 2024

© Photos / Pluschke

- Development of an on-ovo sexing tool:
Non invasive method
As early as possible



PPILOW Multiperformance of organic broiler production in PPILOW?



Economic performance

Zootechnical parameters /
growth performance
Meat yield
Costs and revenues

Animal Welfare

5 freedoms

Freedom from Hunger and Thirst
Freedom from Discomfort
Freedom from Pain, Injury or Disease
Freedom to Express Normal Behavior
Freedom from Fear and Distress

Satisfaction of physiological and behavioural needs,
as well as expectations

Animal welfare assessments
Range use

Animal health

Absence of disease
Food safety
Immunity and adaptive capacities
Bone health and redox status

Environmental performance

Energy and water use
Climate change
Pollution

Societal performance

Work conditions
Job perception
Social involvement
Meat quality and food security
Consumer preference

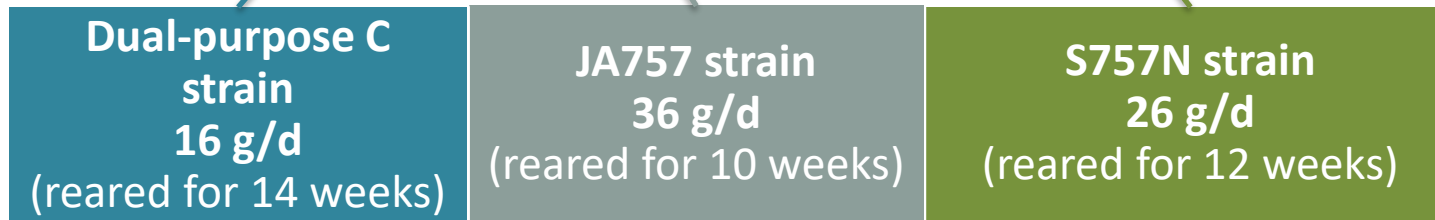
Multiperformance

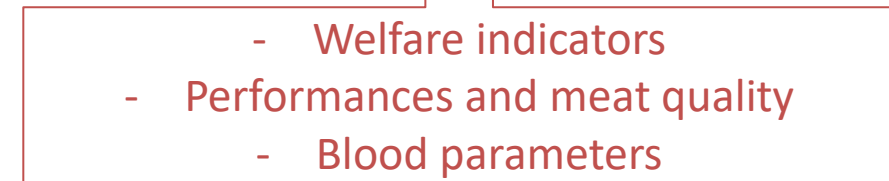
Multiperformance of broilers from different breeds and range use (France), WP6

3 strains: 1 per range; 750 animals per strain ; 50% males, 50% females



WP6



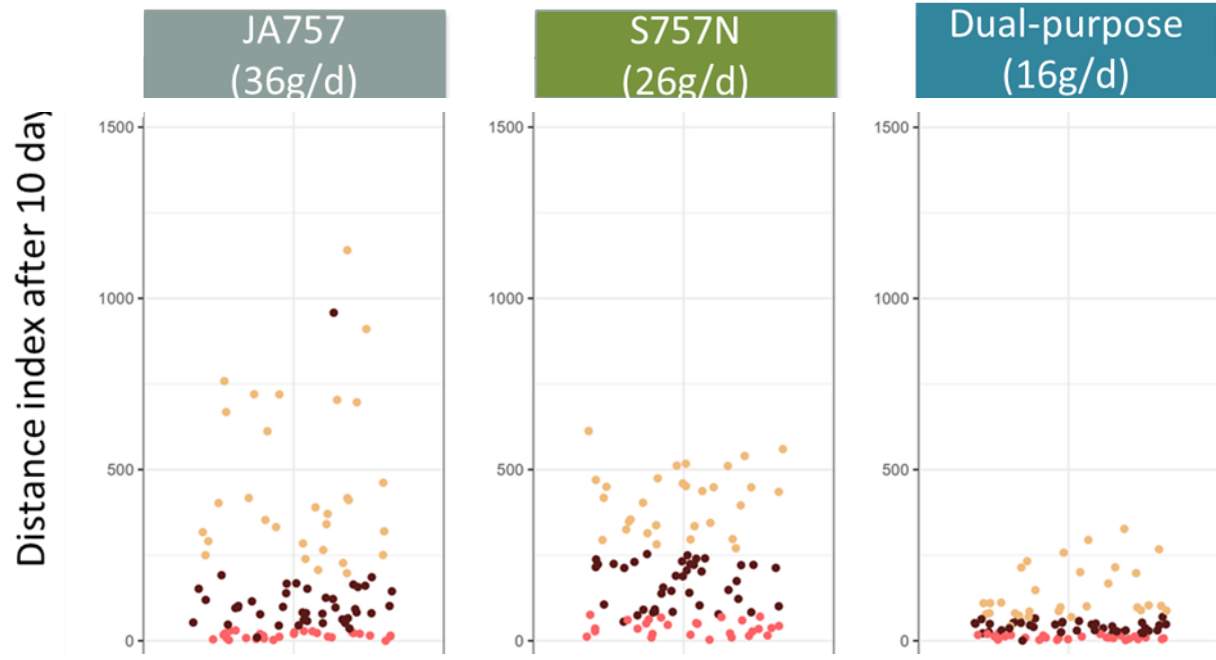
- 
- Welfare indicators
 - Performances and meat quality
 - Blood parameters

Bonnefous et al., 2023
Collet et al., 2024

Results - Variability of individual range use (WP6)

Evaluation of individual Range Use by the Distance Index from scan samplings (N=100 males per line)

Impact of range use variation within strains?



Selection :
 25 animals with the lowest Final Distance Index = low-rangers
 25 animals with the highest Final Distance Index = high-rangers

Age at slaughter (d) **86**
 Cumulated time spent outdoor (hr) 108 419

100
 296 741

121
 212 699

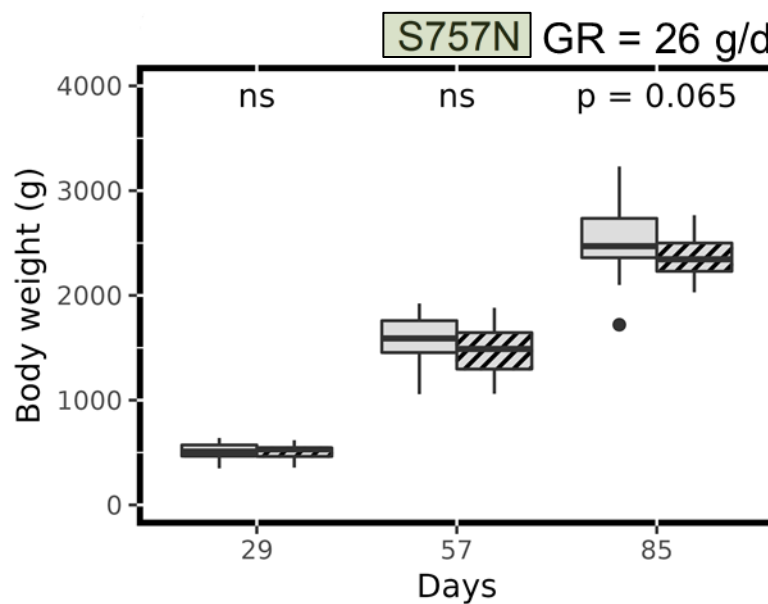
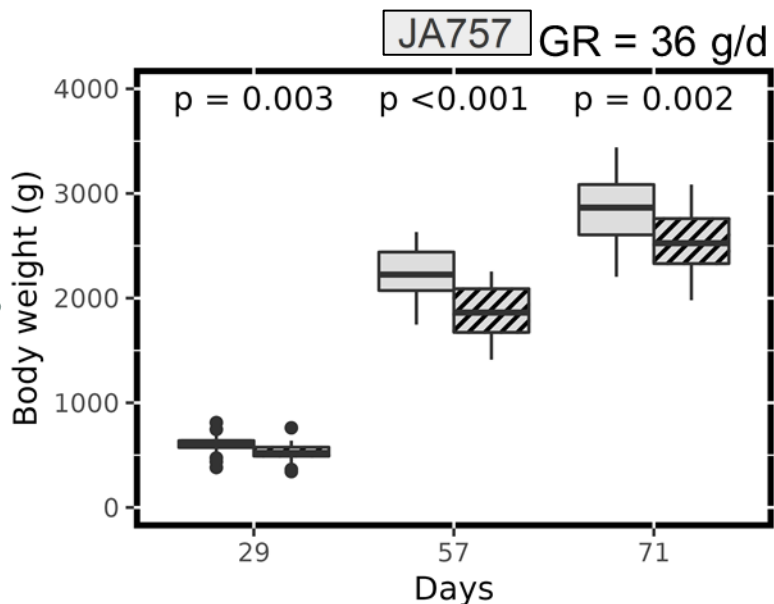
Follow-up by RFID
 Collet et al., 2024

Bonnefous et al., 2023

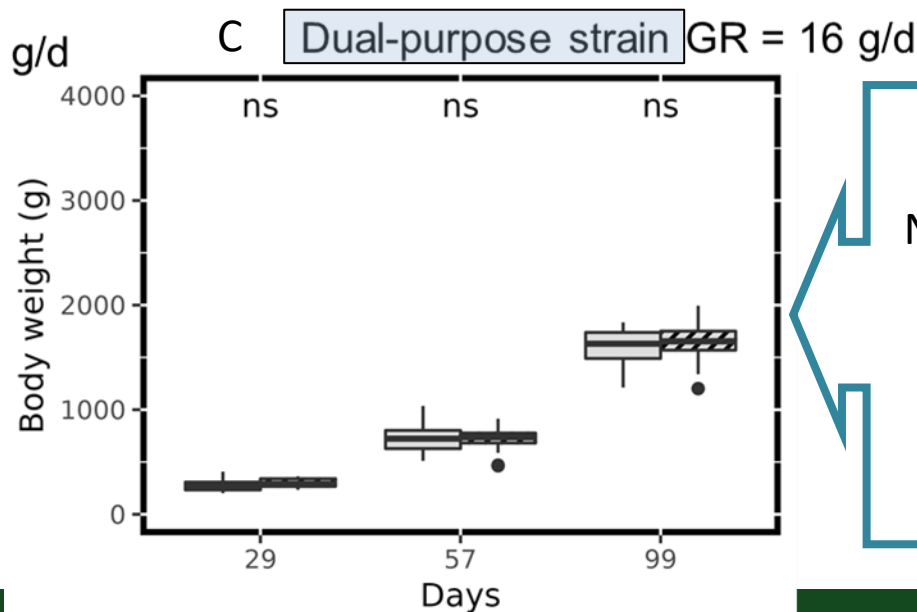


Growth performance - Relationship between range use and body weight?

Lower BW predisposal factor to higher range use?
HR birds already more active before range access?



Higher range use tends to impair final BW



No relationship between range use and body weight

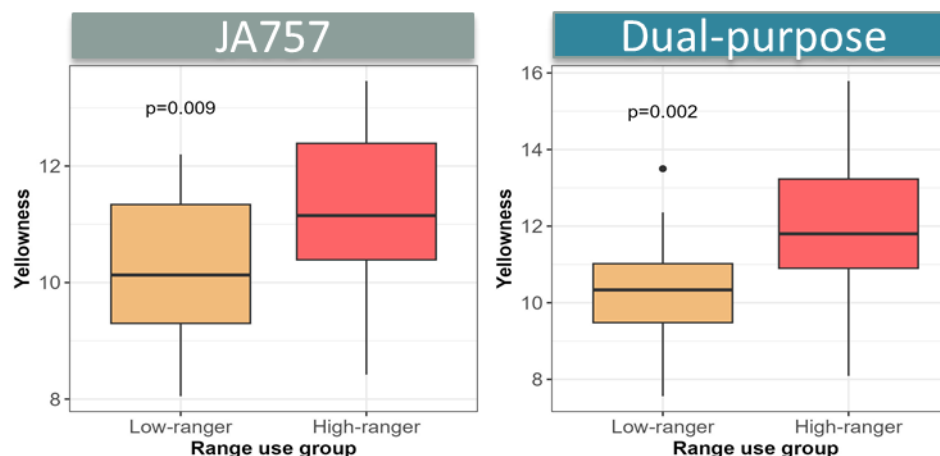
Low-rangers (solid grey)
High-rangers (hatched)

WP6

Results - Range use and meat production and quality? WP6

	JA757		S757N		Dual-purpose	
Range use	Low	High	Low	High	Low	High
Breast weight (g)	233	201	183	168	83	84

In all strains but the dual-purpose, carcass/breast/thigh weights higher in Low Rangers than in High Rangers

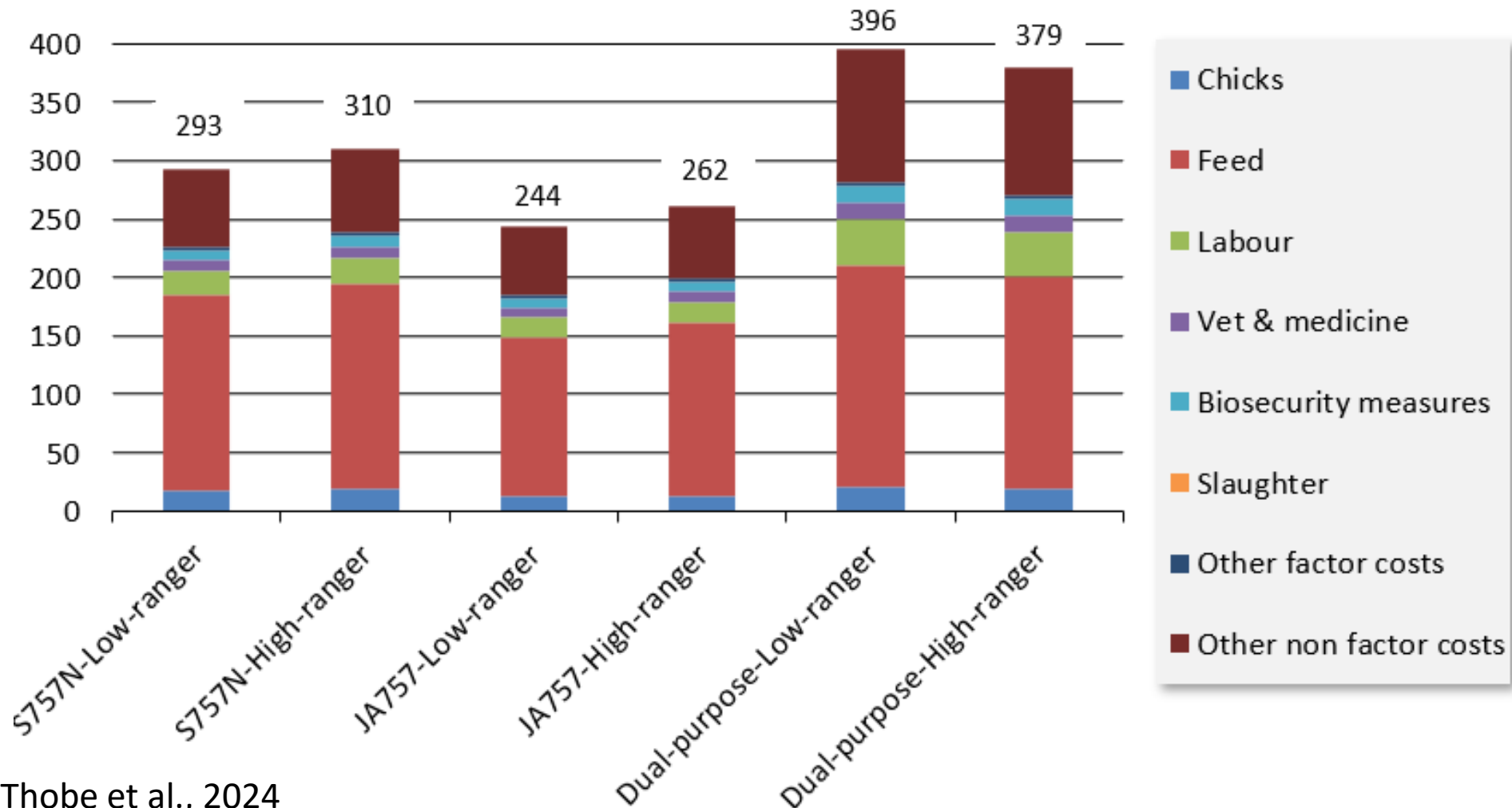


Foraging favors the intake of grass that contains coloring carotenoids

Economic performance

Comparison of production costs (EUR /100 kg live weight)

Calculated from
2021 data



Thuenen Institute, Thobe et al., 2024

PPILOW Comparison of the on-station fattening performances of dual-purpose breeds - males (WP5)

Meat-type Crossbreed	Genotype A	Denmark	Germany	France Spring / summer	France Autumn / winter
	Live weight wk 12, g		2019	2203	1977
FCR		3.1	3.4	3.3	3.4
Pure breed	Genotype B	Denmark	Germany	France Spring / summer	France Autumn / winter
	Live weight wk 12, g		1645	1763	1577
FCR		3.3	3.5	3.4	3.7
Layer-type Crossbreed	Genotype C	Denmark	Germany	France Spring / summer	France Autumn / winter
	Live weight wk 12, g		1732	1634	1393
FCR		3.1	3.7	3.2	3.6

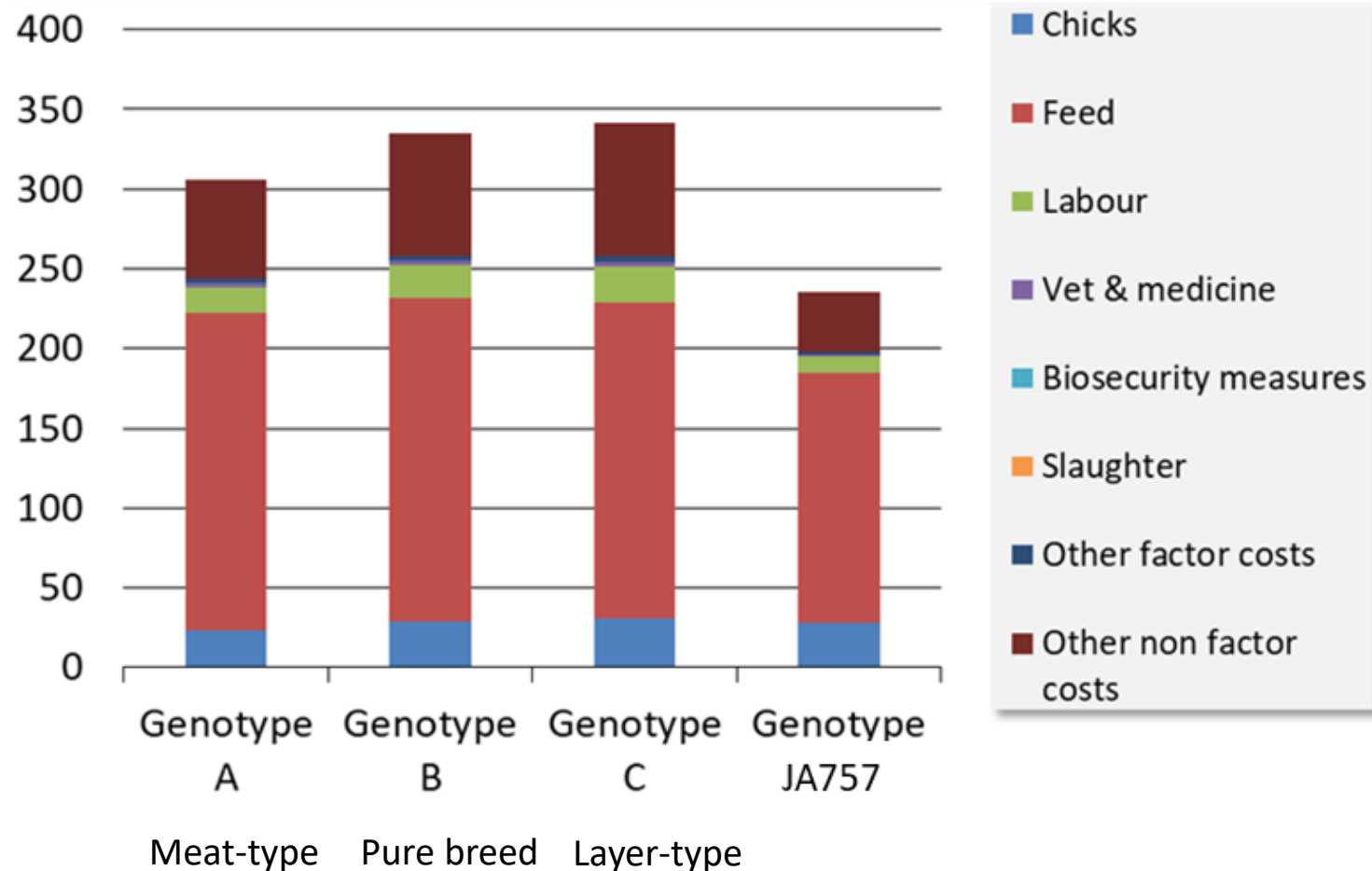
Lombard et al.,
2024

Production costs of the use different dual-purpose breeds in organic experimental facilities in Germany in WP5 - males

Thuenen Institute

Calculated from
2021 data

Production costs (€/100 kg meat)



Thobe et al., EAAP 2023

PPILOW – Dual purpose females

Results



Evolution of the laying rate through time

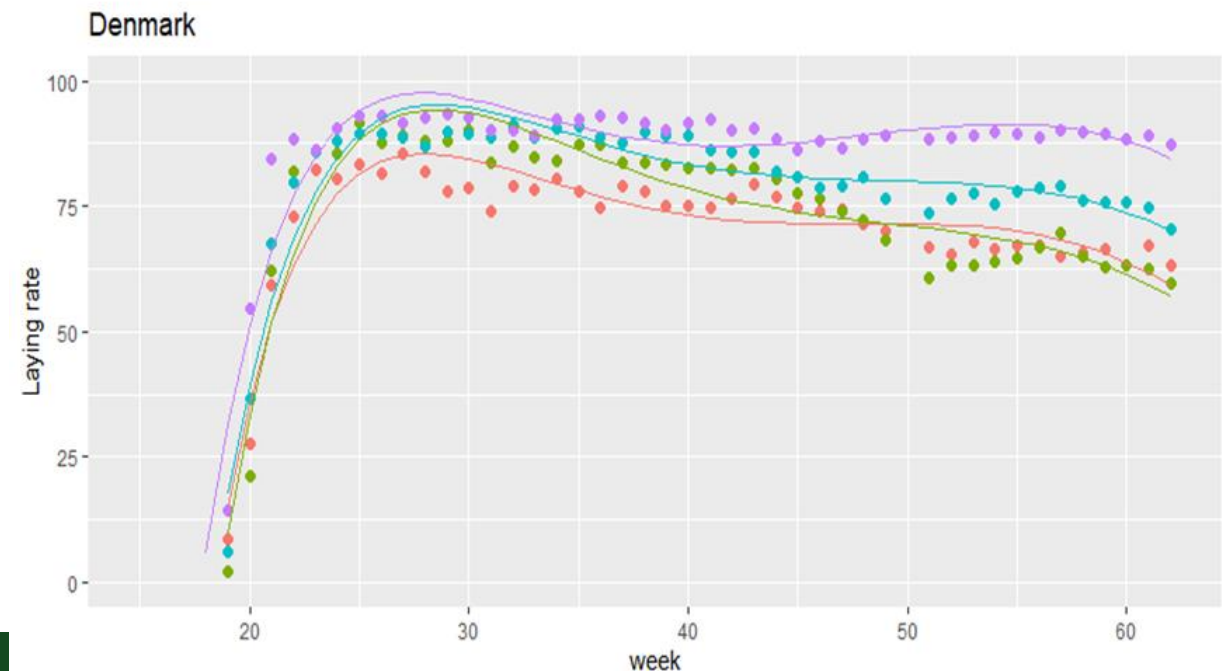
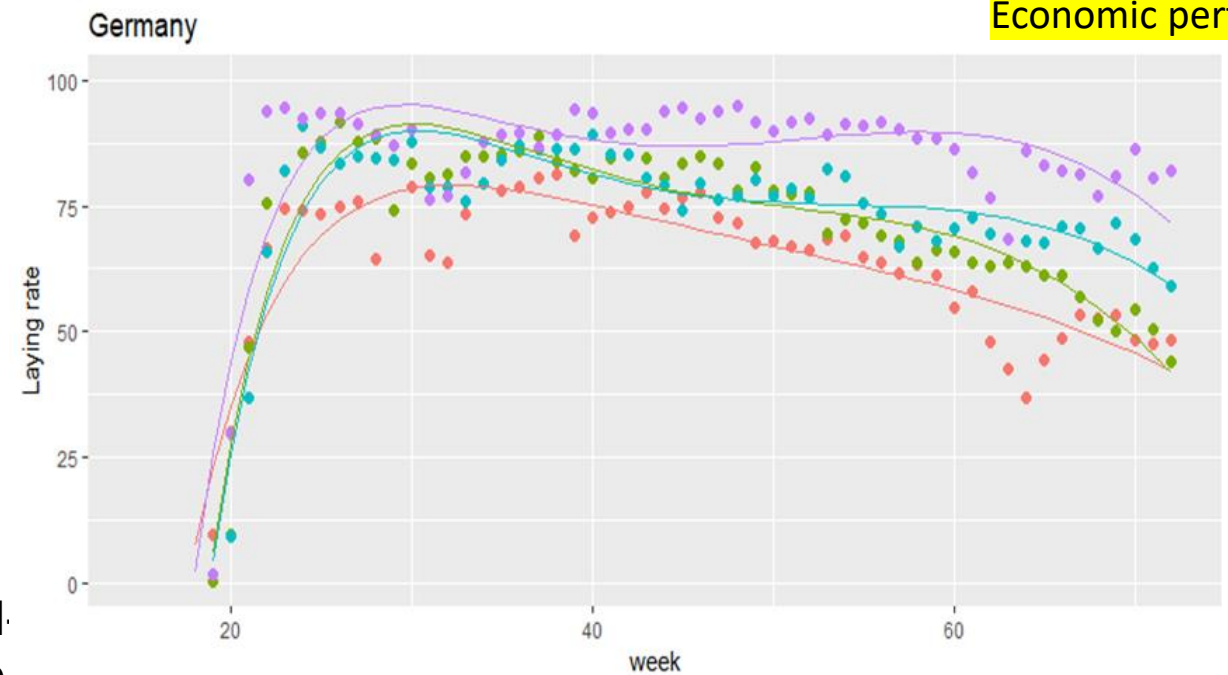
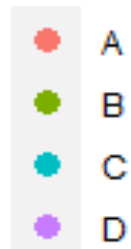
Laying rate recorded every week from week 19 to week 72 in Germany and week 62 in Denmark

Genotypes D laying peaks higher than any of the dual purpose lines and sustained for a longer period of time

Genotype A always showed the lowest laying peak

Laying persistence: **genotype B < C**

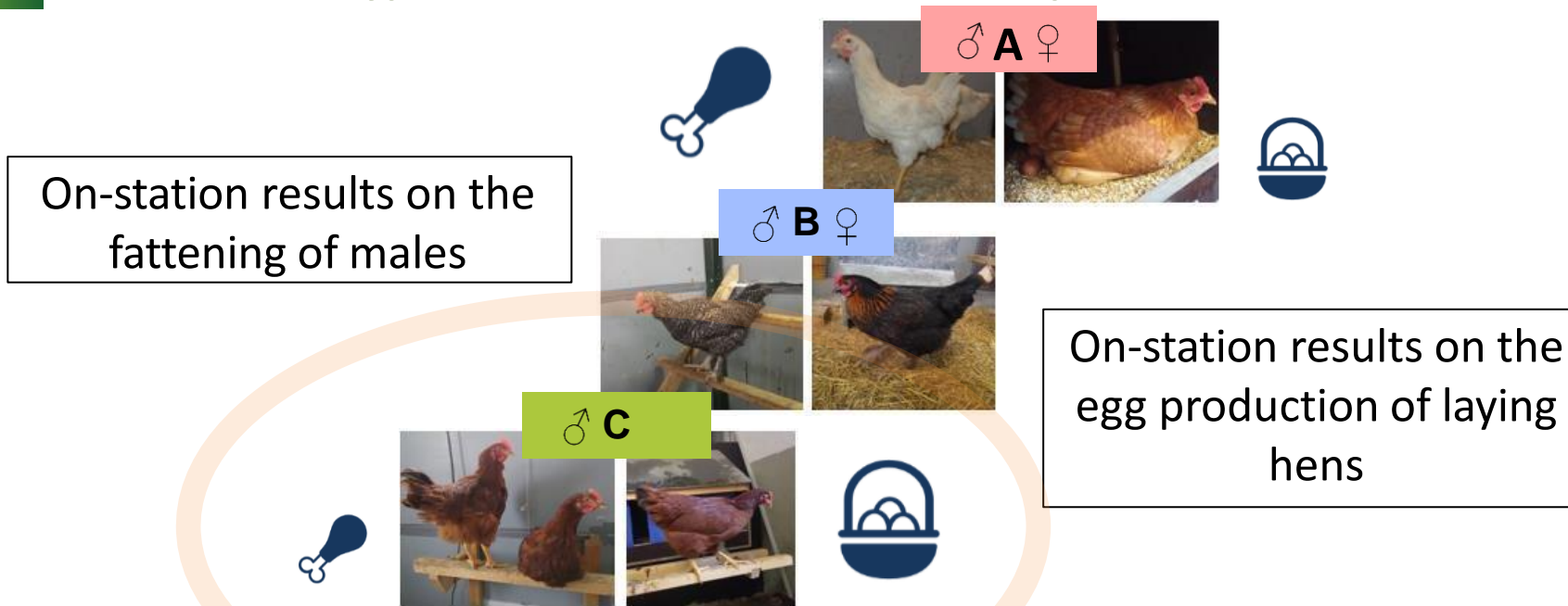
genotype



Lombard et al., 2024

Pluschke et al., EAAP 2024

PPILOW Genotypes & National Practitioner Group decision in WP5



Based on the laying data that represents the biggest part of revenues from dual-purpose genotypes, the NPG in each country selected the genotype to be tested on farm



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	France		Germany	
	C	F (S757N)	C	D (JA757)
Mortality, %	4.6	1.4	11	1.2
FCR (13 wk)	3.7	2.6	3.7	2.7
Carcass weights at 13 wk, kg	1.38*	1,98*		2.4
Carcass weights at 15 wk, kg	1.72*	2.41*		
Carcass weights at 16 wk, kg			1.8	

* Including neck



© Photos / Pluschke



F



© Photos / Pluschke



D

©Hubbard Breeders

At week 13: Avg ± SE

	C	F (label)
Legs weight (g)	448 ± 9	668 ± 12
Wings weight (g)	180 ± 3	246 ± 4
Breast weight (g)	201 ± 5	354 ± 11

At week 15: Avg ± SE

	C	F (label)
Legs weight (g)	574 ± 12	838 ± 9
Wings weight (g)	219 ± 6	286 ± 3
Breast weight (g)	269 ± 4	462 ± 6

C cuts from 40 to 30% lighter than F (label-type) cuts

Carcass conformation scores

	Genotype	Score 0	Score 1	Score 2
Wk 13	F (label)	100%	0	0
	C	0	0	100%
Wk 15	F (label)	97%	3%	0
	C	4%	39%	58%



Direct sale on-farm :

- Consumers quite satisfied to buy **small carcasses**
- Interest for the approach
- But not sold at higher price

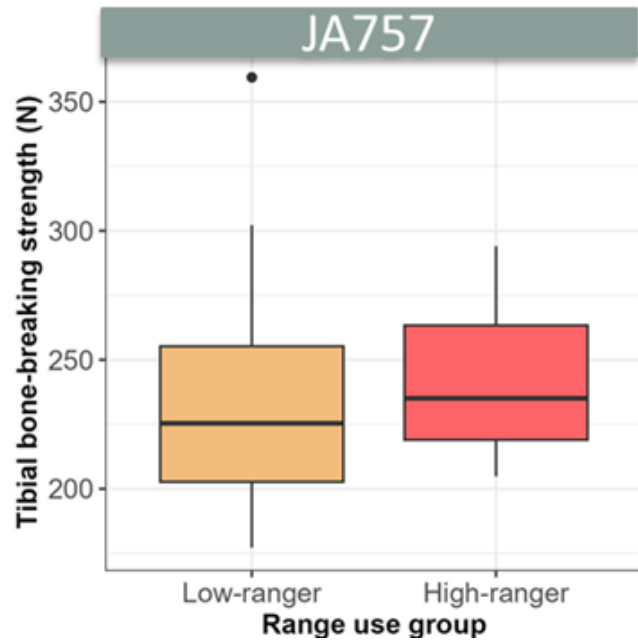
Farmer enthusiastic with the ethical concept but technical adjustments and support needed

Lombard et al., 2024

Welfare and health indicators? Different breeds on the free range (WP6)

	JA757		S757N		Dual-purpose	
Pododermatitis (severe)	48%	40%	16%	12%	0%	0%
Hock burn % (severe)	8%	0%	0%	0%	0%	0%

Low Rangers
 High Rangers



Range use

Bone health
 HR > LR in JA757
Higher locomotor activity
 of high-rangers

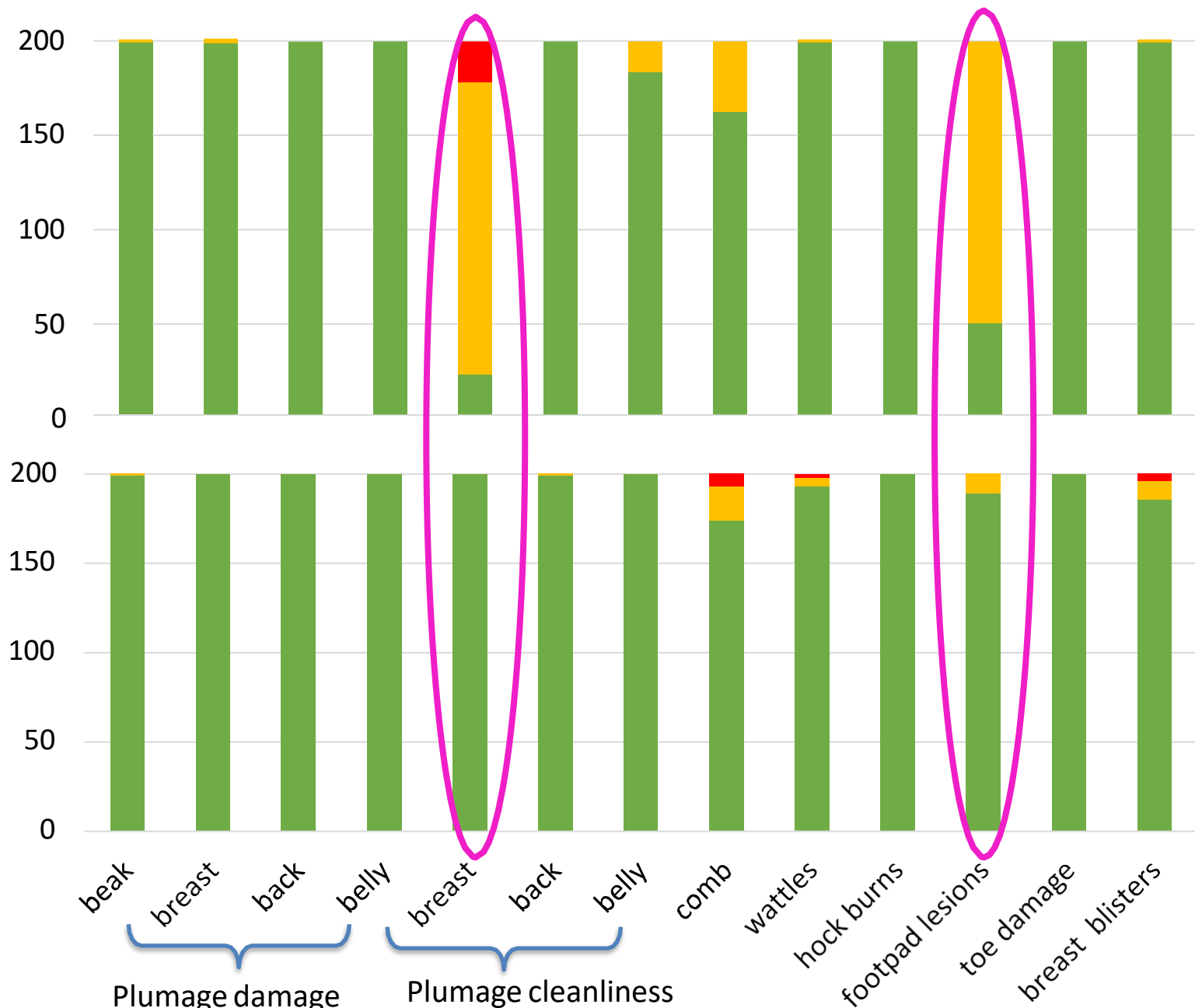
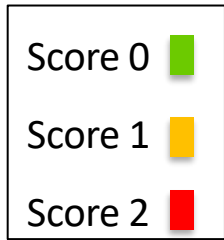
Bonnefous et al., 2023²⁰

PPILOW On-farm trials results – Welfare indicators in Germany (WP5)

Control D
n=200

JA757

Dual-purpose Genotype C
n=200

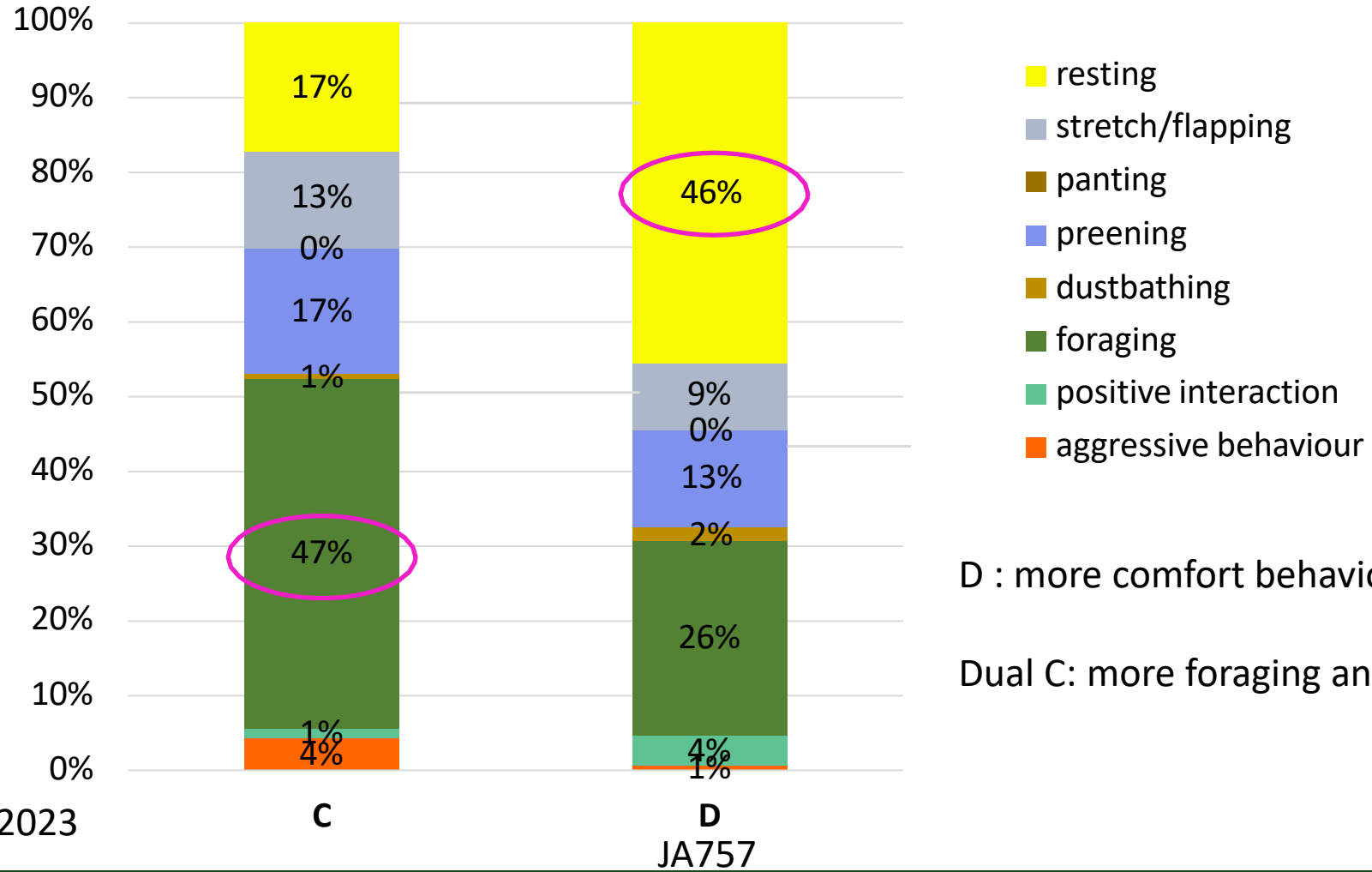


Pluschke et al., EAAP 2023



²
²
PPILOW On-farm trials results – Behaviour Observations in Germany in WP5

Proportions of behaviours during continuous observation in week before slaughter



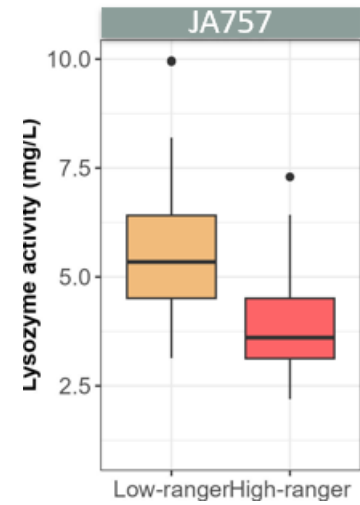
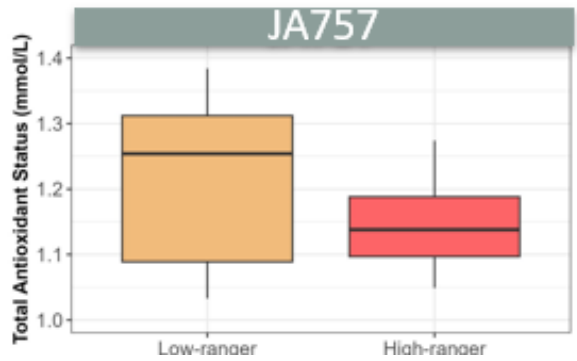
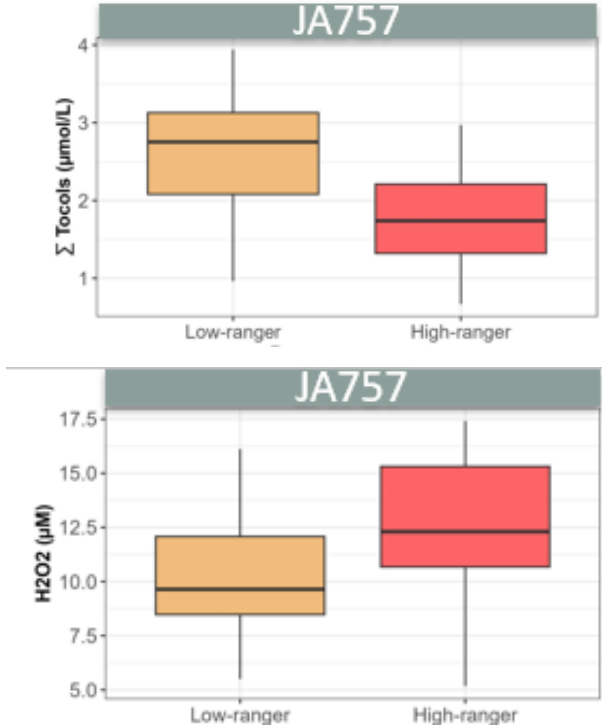
D : more comfort behaviours

Dual C: more foraging and aggressive behaviours

Results - Relationship between range use and **bird physiology (WP6)?**

Redox status

Antimicrobial defense



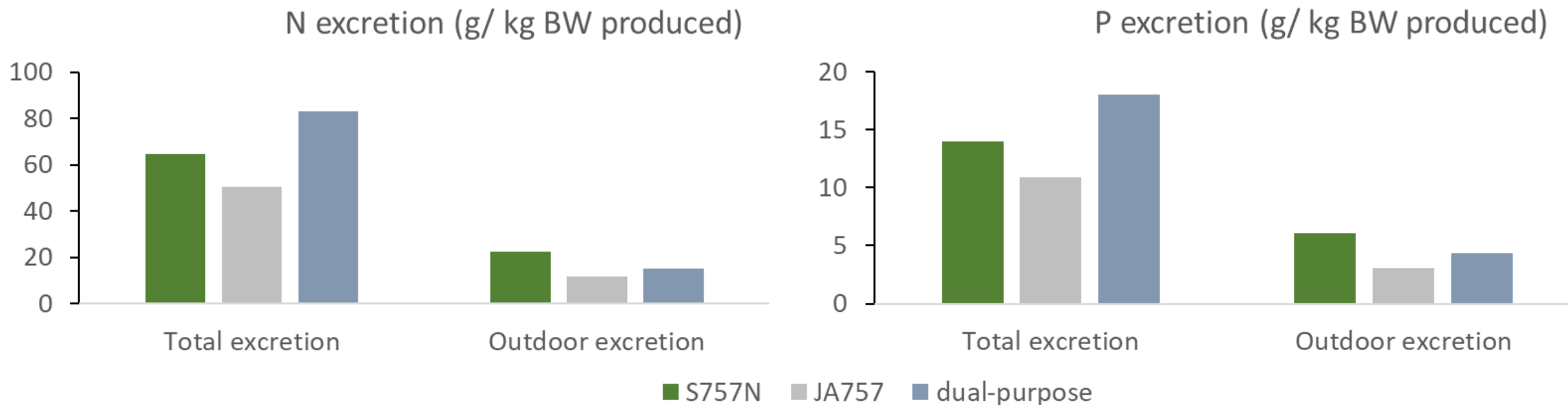
Low Rangers High Rangers

In medium-growing birds, higher physical activity (in High ranging group) may limit muscle antimicrobial potential and increase oxidative stress



Results – Nutrient excretion (WP6)

Measure	S757N	JA757	Dual-purpose
Total feed intake (kg)	6207	6072	5332
Average weight per animal at commercial slaughter (kg)	2.6	3.2	1.9
Average feed conversion ratio (g/g)	3.2	2.7	3.8



Lower nutrient excretion with medium-growing JA757

The quantity and distribution of outdoor excretion depends on the breed and range design

Working conditions, job perception and meat sensory quality compared to control label-type animals

- **JA757**: shorter rearing period, easier catching despite additional cleaning and straw bedding, lower stress and healthy working environment for the farmer
- Additional care needed for new **dual-purpose genotype C** :
 - smaller birds (feeders to adjust, feed spillage),
 - longer time indoors before range access (thermoregulatory needs),
 - much enrichment needed from start to avoid feather pecking,
 - quite stressful for the farmer/caretaker despite ethical interest
- The **meat of all strains was judged to be good** considering sensory quality



Conclusions (1)

Interest of a **multi-trait approach** to evaluate the multiple consequences of range use and search for well-adapted breeds or birds

- **Best growth performance** and **lowest nutrient excretion** with **medium-growing JA757 strain** with the best (lowest) feed conversion ratio.

- Good meat quality parameters
- **Good perception by farmers/caretakers**

Reasons why it has spread in organic farming throughout Northern Europe

But...

Animal welfare impaired in our conditions (FPD), and redox status/health parameters affected in high-ranging animals...

... and **what about the breeders?**

Fast-growing
male parental
line



+



=



Feed restriction:
*Sustainability of the
whole production chain?*

Conclusions (2)

- **Regulation (EU) 2018/848** of the European Parliament and of the Council **on organic production and labelling of organic products** and repealing Council Regulation (EC) No 834/2007.



Organic chickens born as organic chick: from organic breeders having access to the outdoor range
Questions about the genetics and breeding conditions – Exemption until 2036

- **Label-type (slow-growing) chickens:**
 - Selection on a combination of range use (assessed by RFID) and growth?
 - Outdoor rearing of parental flocks and possibility of using a veranda during sanitary events?
- **Consider slow-growing breeds (among which local ones) in interaction with the free range design (agroforestry)?**
Presentation of Castellini, EAAP 2024



Conclusions (3)

- Development of dual-purpose breeds in organic systems?



- For some organic farmers: the only ethical way to avoid the culling of layer male chicks
- Sustainability gains to find by nutrition (using by-products) for lower costs and management?
- Marketing actions towards consumers and public support?
- Consider laying performance together with meat production: cost of eggs and meat!

Slow development in the absence of EU regulation on the culling of male chicks but only national ones



*Towards sustainability assessments taking into account **all the dimensions** considered in “**multiperformance**”,
e.g. including **Animal Welfare (and health)***

All stages of the production chain to be considered?

Network of the European Partnership on Animal Health and Welfare (EUPAHW*) to work on this topic



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Thanks to all the collaborators involved to to the members of the National Practitioner Groups!



Fondazione Slow Food
per la Biodiversità
ONLUS



Harper Adams
University



Instituut voor Landbouw-
en Visserijonderzoek



Utrecht University



Thanks for your attention!

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