PPILOW

Alternatives to the elimination of layer male chicks

ITAB (Sarah Lombard, Brieuc Desaint, Antoine Roinsard)

Thünen Institute of Organic Farming (Helen Pluschke, Lisa Baldinger, Daniela Werner, Petra Thobe)

SYSAAF (Maxime Reverchon)

Aarhus University (Sanna Steenfeldt)

INRAE (Laure Ravon, Sophie Rehault-Godbert, Anne Collin)

CNRS (Katia Grenier)

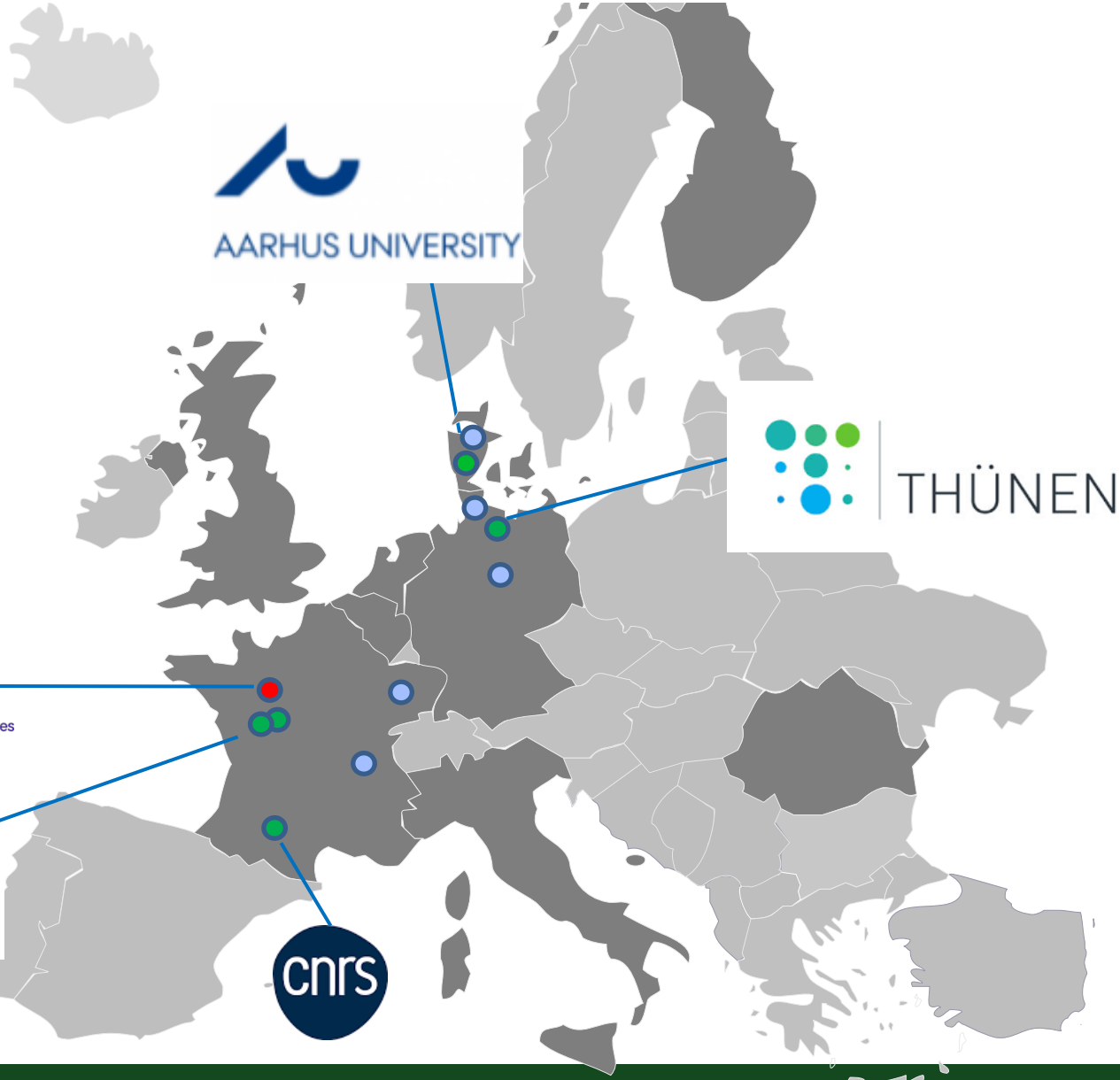
PPILOW Final conference – Africa Museum, Tervuren (Brussels)

11th-12th June 2024

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 816172

PPILOW Partners involved

- Farms involved
- Research institutes
- Technical institute



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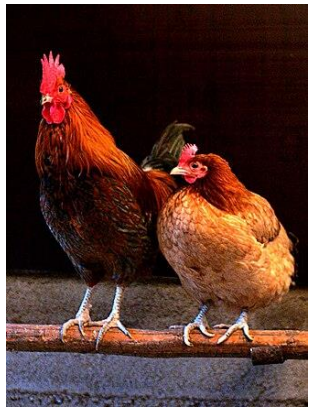
PPILOW Status of chick culling in Germany and France

Layer strain

Selection based on egg production, egg quality traits



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Progeny

Fertilized eggs

© Photos / Wikipedia

Chicks

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♀

♂

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~~***Culling of day-old male chicks***~~

FR: Article R214-17

- From 1/1/2023 : all hatcheries have to be equipped with operational material to avoid culling (male) chicks
  -> Special case when it is not possible to respect the decree

DE: Article TierSchtG Art. 1 § 4c

- From 1/1/2022 : makes it a punishable offence to kill a vertebrate animal "without reasonable cause" (unprofitability) or to cause it suffering and pain

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PPILOW Status of chick culling in Germany and France

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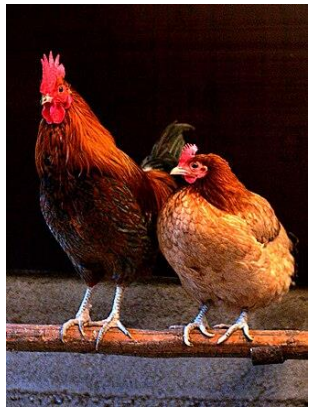

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Progeny

Fertilized eggs

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Chicks

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♂

~~***Culling of day-old male chicks***~~

Stategies :

- **Fattening of males of layer lines** → selected on egg production, males might have a low economic value (variable depending on the level of production targeted)

- **In ovo sexing**

- **Dual-purpose genotypes**

PPILOW

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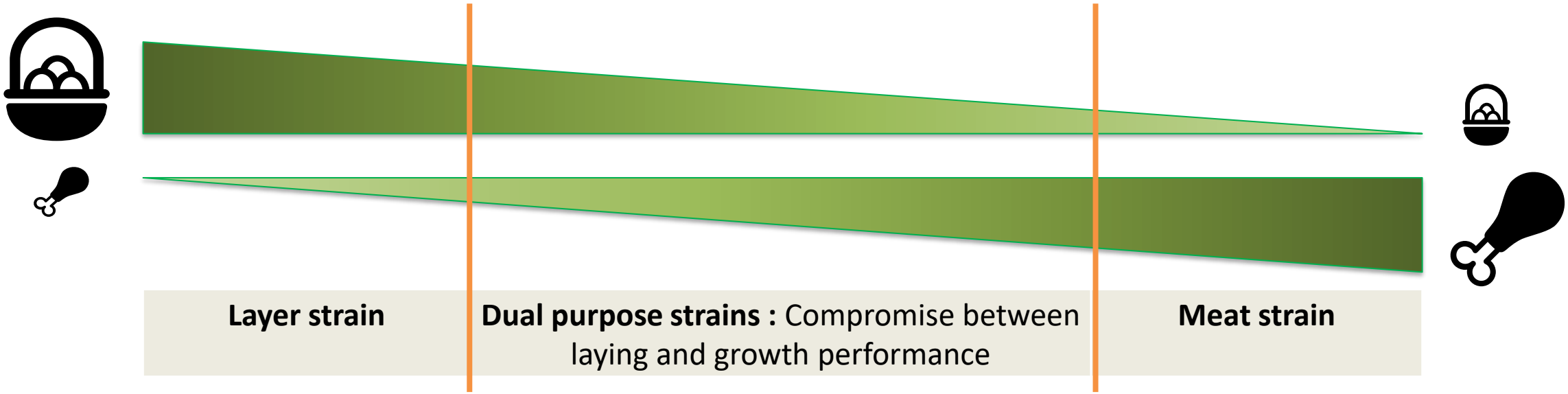
PPILOW Dual purpose genotype



- Dual-purpose strain : females reared for egg production, males for meat production

→Laying and growth performance lower than the ones of specialized strains

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PPILOW Program of the session

- In ovo sexing tools, **Sophie Réhault-Godbert** (INRAE, France)

- Dual-purpose strains as an alternative to the elimination of male chicks from layer strains :
  - On-station experiments on males and females in Germany, Denmark and France, **Maxime Reverchon** (SYSAAF, France)
  - On-farm experiments on dual-purpose males in France and Germany, **Helen Pluschke** (Thünen Institute of Organic Farming, Germany)
  - On-farm experiments on dual-purpose females in Denmark, France and Germany, **Sanna Steenfeldt** (Aarhus University, Denmark)
  - Economic evaluation of dual-purpose strains, **Petra Thobe** (Thünen Institute of Organic Farming, Germany)

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Alternatives to the elimination of layer male chicks

On-station trials with dual-purpose males and females

SYSAAF (Maxime Reverchon)

Thünen Institute of Organic Farming (Helen Pluschke, Lisa Baldinger)

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PPILOW – Evaluation of dual-purpose genotypes on experimental stations in Denmark, Germany and France

Aim: Compare genotypes' characteristics to identify which are best suited for an organic production based on dual purpose breeds.

Genotypes A is a new genotype specially created for the PPILOW project, corresponding to the crossing of a “label Rouge” broiler and a laying female.

Female: 230-250 eggs in 72 weeks

Male: 2kg in 60-70 days.

Genotype B is a rustic breed with no selection and good performance in both eggs and meat

Female: 260 eggs in 72 weeks

Male: 2 kg en 75-85 days

Genotype C is a genotype close to the profile of laying hens (Heavy layers)

Female: 274 eggs in 72 weeks

Male: 2kg in 110 days

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 816172

Methods

- 3 different dual-purpose genotypes were tested in 2 differents countries for females (Denmark, Germany)

and in 3 different countries for males (Germany, Denmark, France)

- Animals were reared at different seasons in France
- Male and female were reared separately

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Methods

	Denmark	Germany	France
Date	May – Sept 2020	Oct 2020 – Feb 2021	Feb – June 2021
Housing	Barn with access to outdoor run with willows	Mobile barns with covered outdoor runs (avian influenza)	Barn with access to outdoor run
No of animals and group size	240 per genotype, 80 per group	160 per genotype, 40 per group	750 per genotype, 750 per group
Slaughter	week 10, 12, 14	week 10, 12, 16	week 12, 14

PPILOW

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Methods

	Denmark	Germany
Date	Nov 2019 – Jan 2021	Oct 2020 – March 2022
Housing	Rearing: Barns with access to outdoor run with willows Laying: Mobile barns with access to outdoor run with willows	Rearing & start of laying: Barns with verandas Laying: Mobile barns with access to outdoor run
No of animals and group size	240 per genotype 80 per group	80 per genotype 20 per group
Rearing time	62 weeks	72 weeks

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Methods

Performance recorded :

- Body weight
- Feed comsumption ratio (FCR)
- Laying performance
- Eggs quality
- Welfare
- Behaviour

- Control : 3 different control genotypes according to the organic production rules in each country





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Difficulties encountered during the experiments

- Avian flu : restriction to outdoor access for animals
- Weather : - cold temperature and snow in winter (Denmark)

  - rain (outdoor access) Germany
- Heating : temperature variation at start-up in france

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PPILOW – Dual purpose males

Results ♂

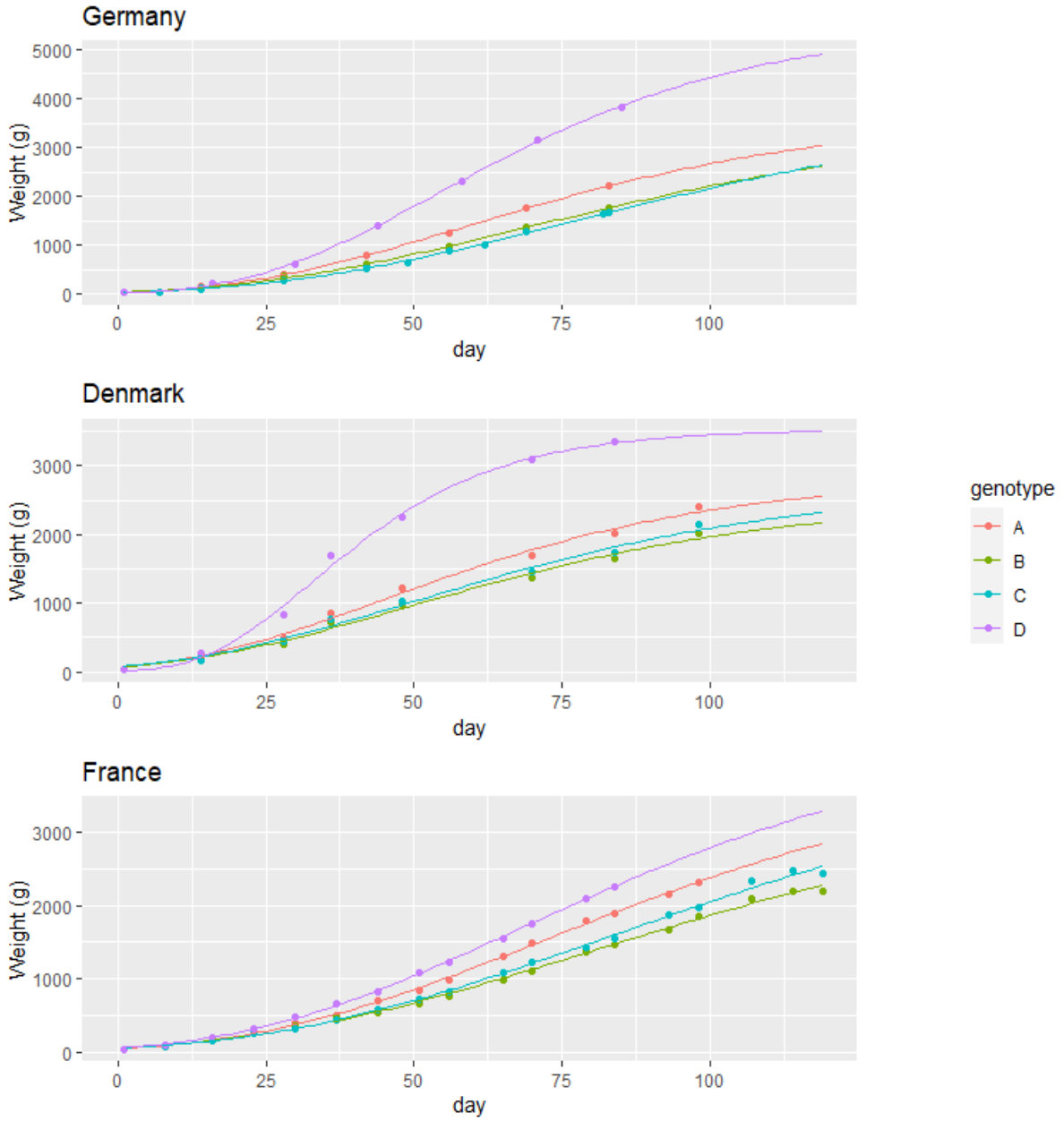
Body weight at 12 weeks of age

Genotype	Denmark	Germany	France
A	2019g	2203g	1931g
B	1645g	1763g	1521g
C	1732g	1634	1472g

Gain in body weight was a lot stronger for **control genotypes (D)** in each of the countries

Genotype A was consistently the second genotype displaying the highest performances

Genotypes C and B displayed almost similar performances with **genotype C** performing slightly better



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PPILOW – Dual purpose females

Results ♂

Feed concumption ratio (FCR)

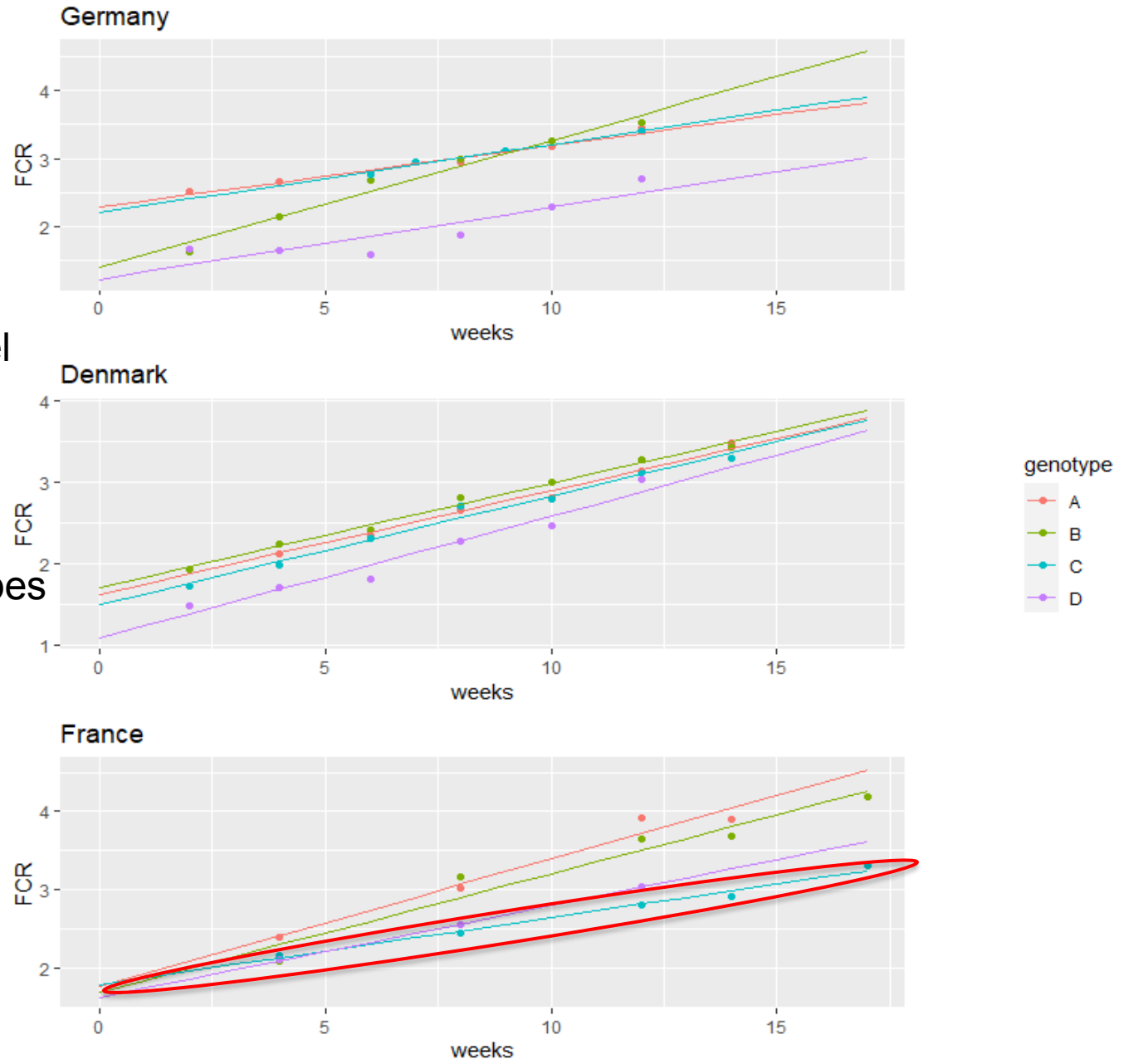
Feed consumption data were available at the flock level

We used a classical linear model to describe the relation between FCR and time.

Control genotypes (D) were the most efficient genotypes

In France, only **genotype C** displayed a lower feed consumption ratio

No clear hierarchy between the dual-purpose genotypes can be established as it varies depending on the country and the time at which we look at them



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Results

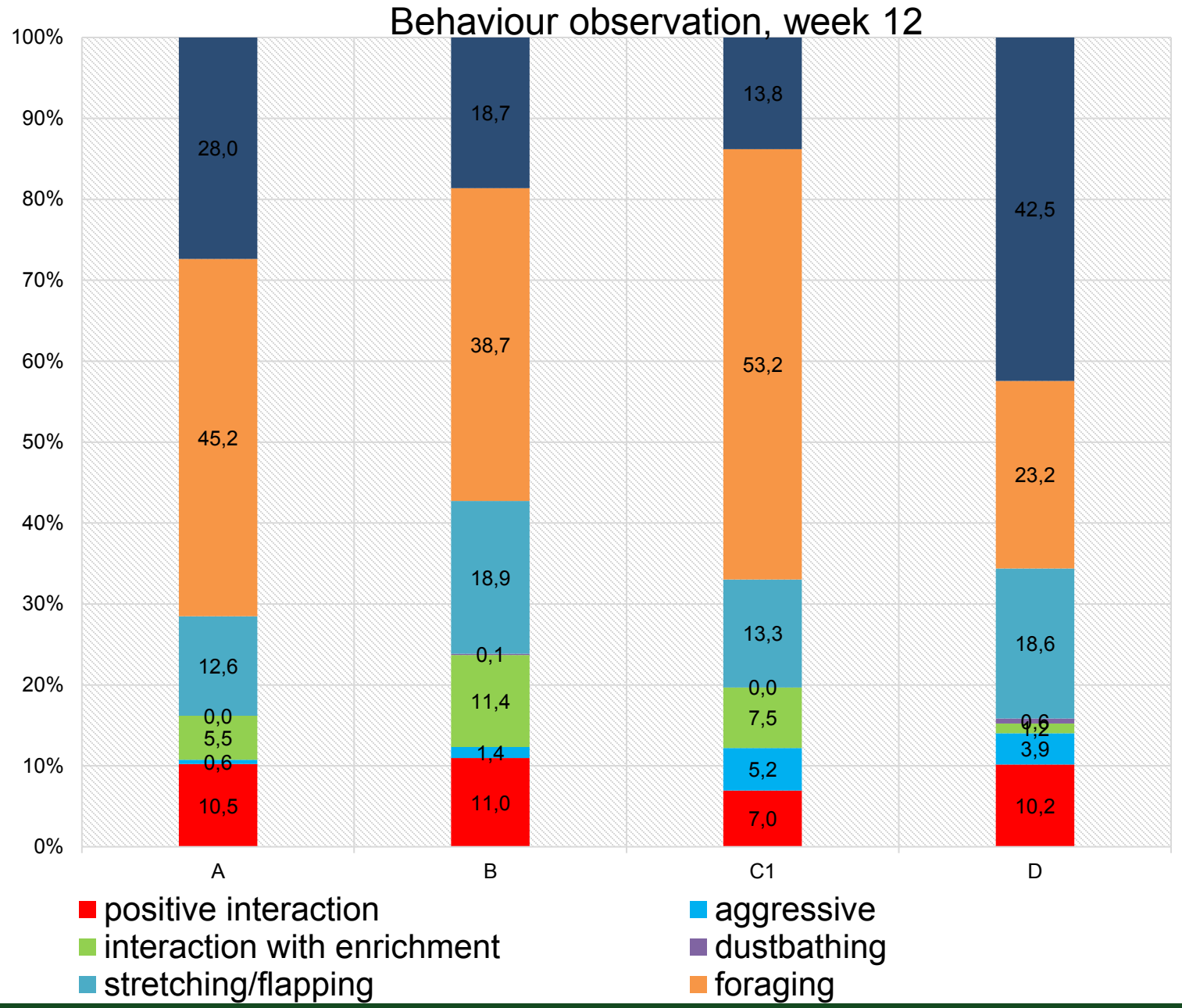
Behaviour ♂

Behaviour observations were carried out in the weeks before the three slaughter dates, resulting in two dates for data collection per genotype (weeks 10 and 12 for genotypes A and D, weeks 12 and 16 for genotypes B and C).

Foraging was the most frequently observed behaviour among the dual-purpose genotypes and significantly higher than in the control genotype D

2nd behaviour: Prenning

3rd behaviour: stretching/flapping



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Results ♀

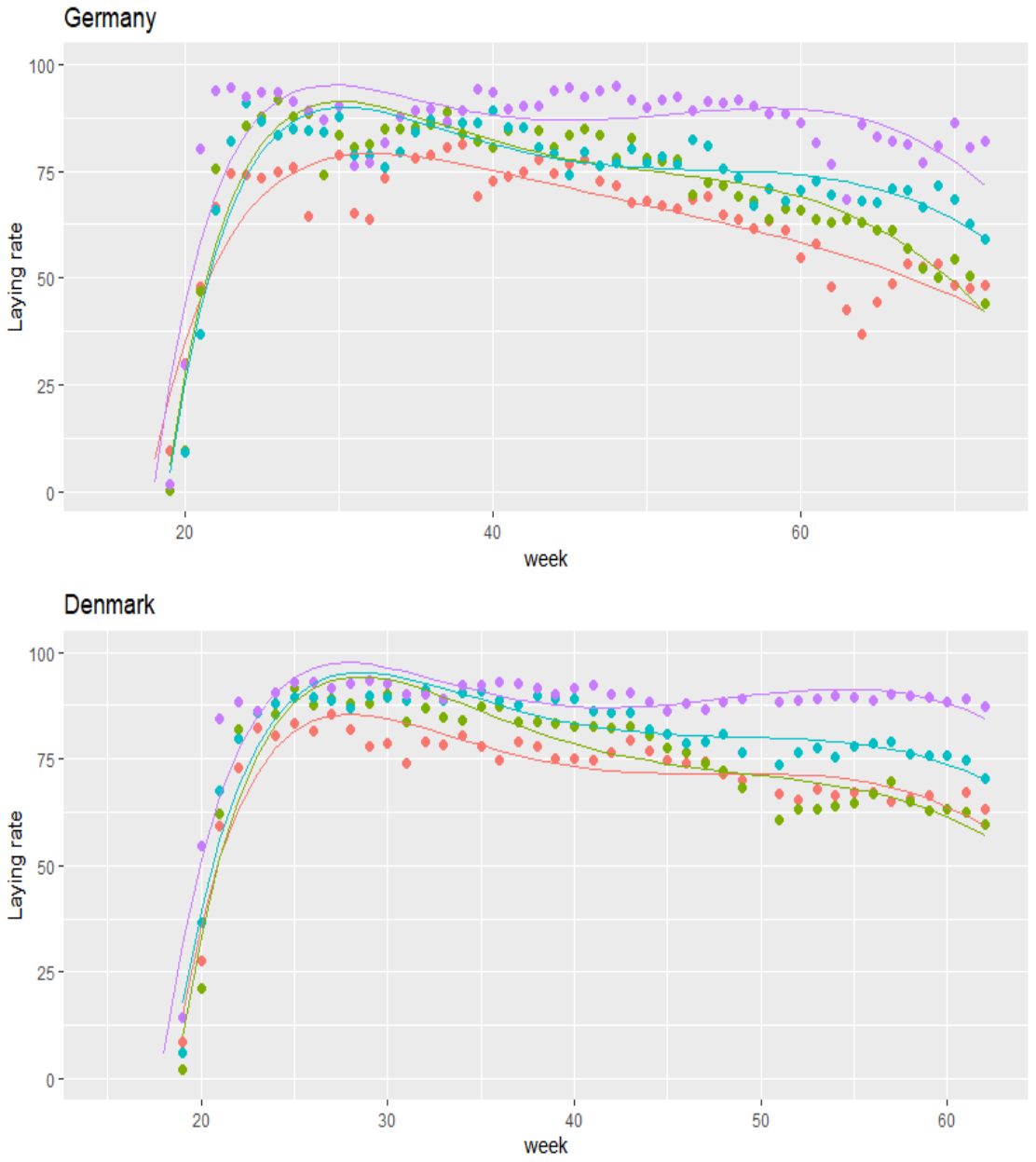
Evolution of the laying rate through time

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

Genotypes D laying peaks are higher than any of the dual-purpose lines and sustained for a longer period of time
Genotype A always showed the lowest laying peak

Difference between **genotype B and C** = sustainability of the laying rate over time

The interaction between country and genotype had no significant effect confirming that all genotypes are affected the same by the country effect



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PPILOW – Dual purpose females

Results ♀

Evolution of the egg related feed consumption ratio through time

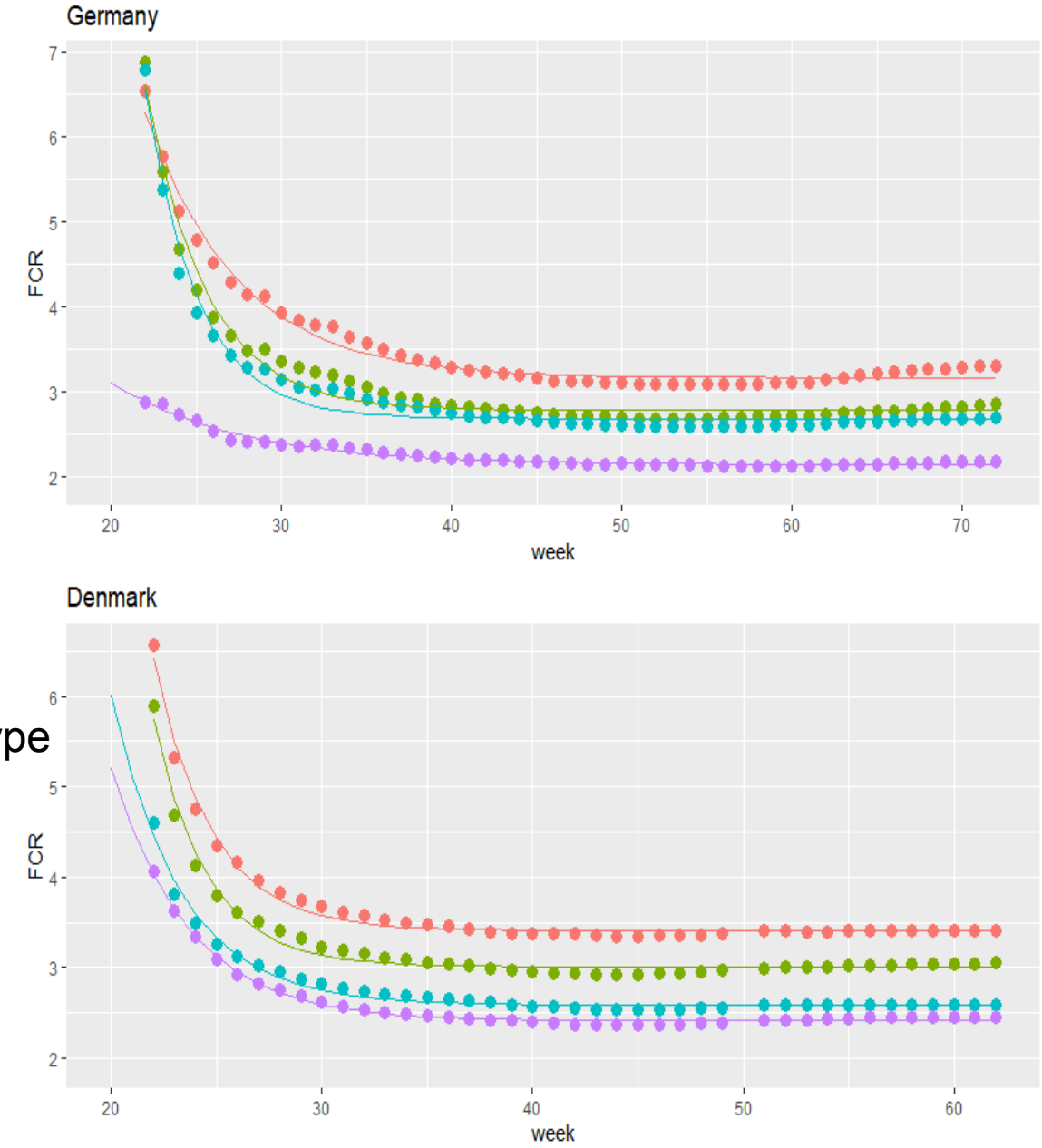
Total egg weight and feed consumption at the flock level was recorded every week.

Genotypes D are more efficient than any of the dual-purpose genotypes FCR between 2,1 in Germany and 2,4 in Denmark.

Genotype C is the most efficient dual purpose genotype

Interaction between genotype and country was found to be significant : genotypes didn't react the same to a change in country

gap between **genotype C and B** curves that tend to be wider in Denmark than in Germany



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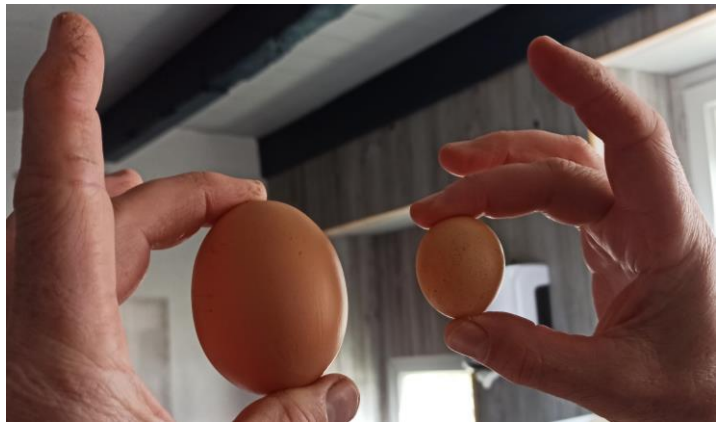
PPILOW – Dual purpose females

Results ♀

Eggs quality



→ **Publication in 2021**

Genotype A present the highest eggs quality

Open Access Article

Dual-Purpose Poultry in Organic Egg Production and Effects on Egg Quality Parameters

by Marianne Hammershøj [1,*], Gitte Hald Kristiansen [1] and Sanna Steenfeldt [2]

[1] Department of Food Science, Aarhus University, Agro Food Park 48, DK-8200 Aarhus, Denmark

[2] Department of Animal Science, Aarhus University, Blichers Alle 20, DK-8830 Tjele, Denmark

* Author to whom correspondence should be addressed.

Foods **2021**, *10*(4), 897; **https://doi.org/10.3390/foods10040897**

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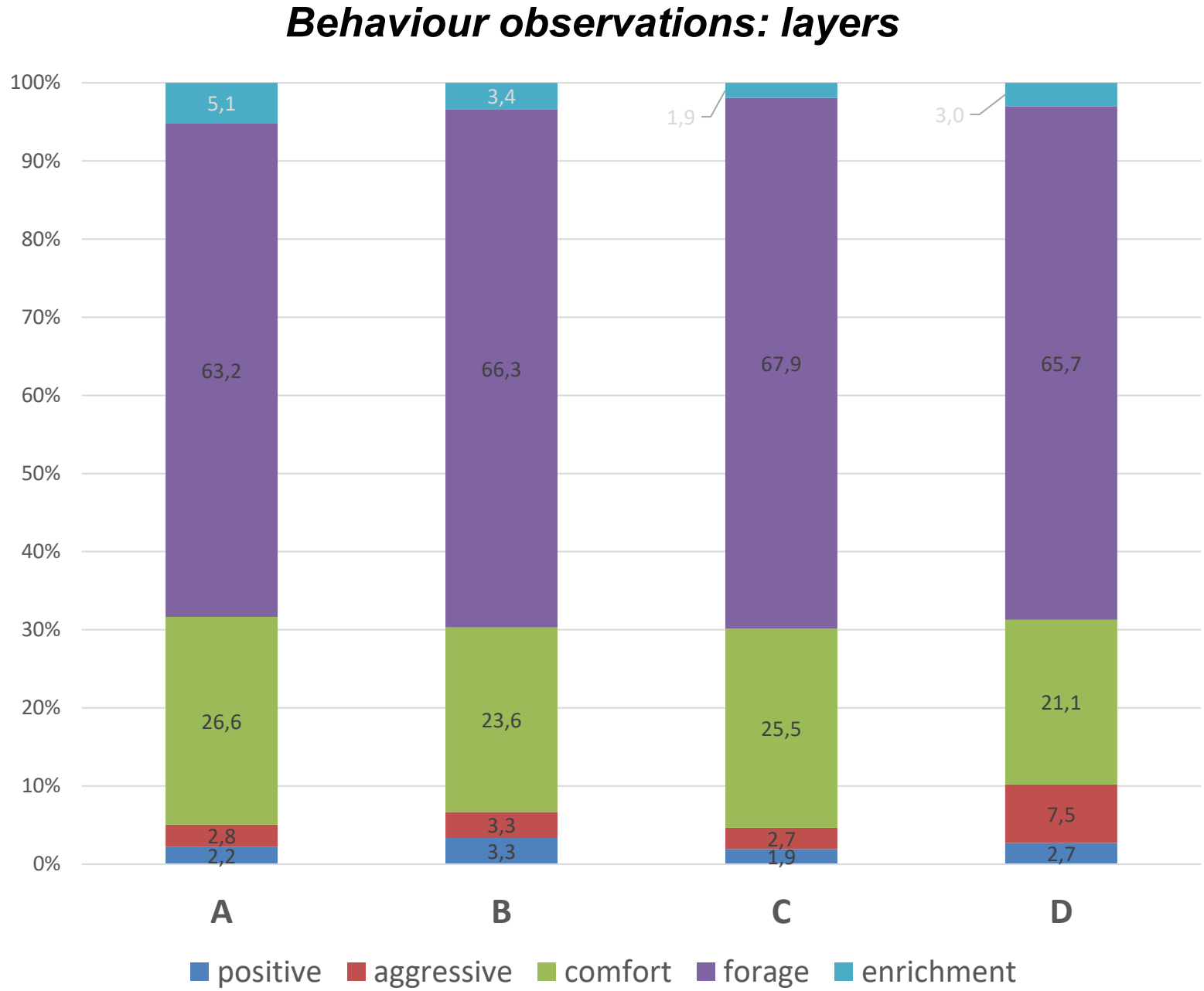
Results

Behaviour ♀

Behaviour observations were conducted inside the mobile housing and outside on pasture when hens were 30, 46 and 71 weeks of age

Main Behaviour : foraging

Comfort behaviour : “preening”, “dustbathing” and “wing flapping and stretching”



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Discussion - Conclusion

For any performance proxy investigated in this report, specialised genotypes (D in both cases) had a better performance than any of the dual-purpose genotypes.

♂ Genotype A present the best performance, followed by genotype C (13-14 to reach 2kg, FCR = 3-3,5)

♀ Genoype C is the one showing the best laying performances with the best egg related FCR

Following a presentation of the results and discussion with the NPGs, genotype C was chosen to be tested on farms in Germany, France and Denmark. Genotype A will also be tested in Denmark.

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Alternatives to the elimination of layer male chicks

On-farm trials with dual-purpose males

Thünen Institute of Organic Farming *(Helen Pluschke, Lisa Baldinger)*

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PPILOW WP5.2. On-farm trials with dual-purpose males

Different farm conditions in France and Germany

FR: Control genotype - S757N

	France	Germany
Number of birds	C' 220/F 220	C 220/D 520
Same hatch for C	✓	✓
Diet	Two phases	Three phases
Feed consumption	✓	✓
FCR	✓	✓
Behaviour observations	✗	✓
Welfare indicators	✗	✓
Mortality	✓	✓
Age at slaughter, wks	13 and 15	C 16 / D 13
Carcass weight	✓	✓
Valuable cuts	✓	✓

DE: Control genotype - JA757

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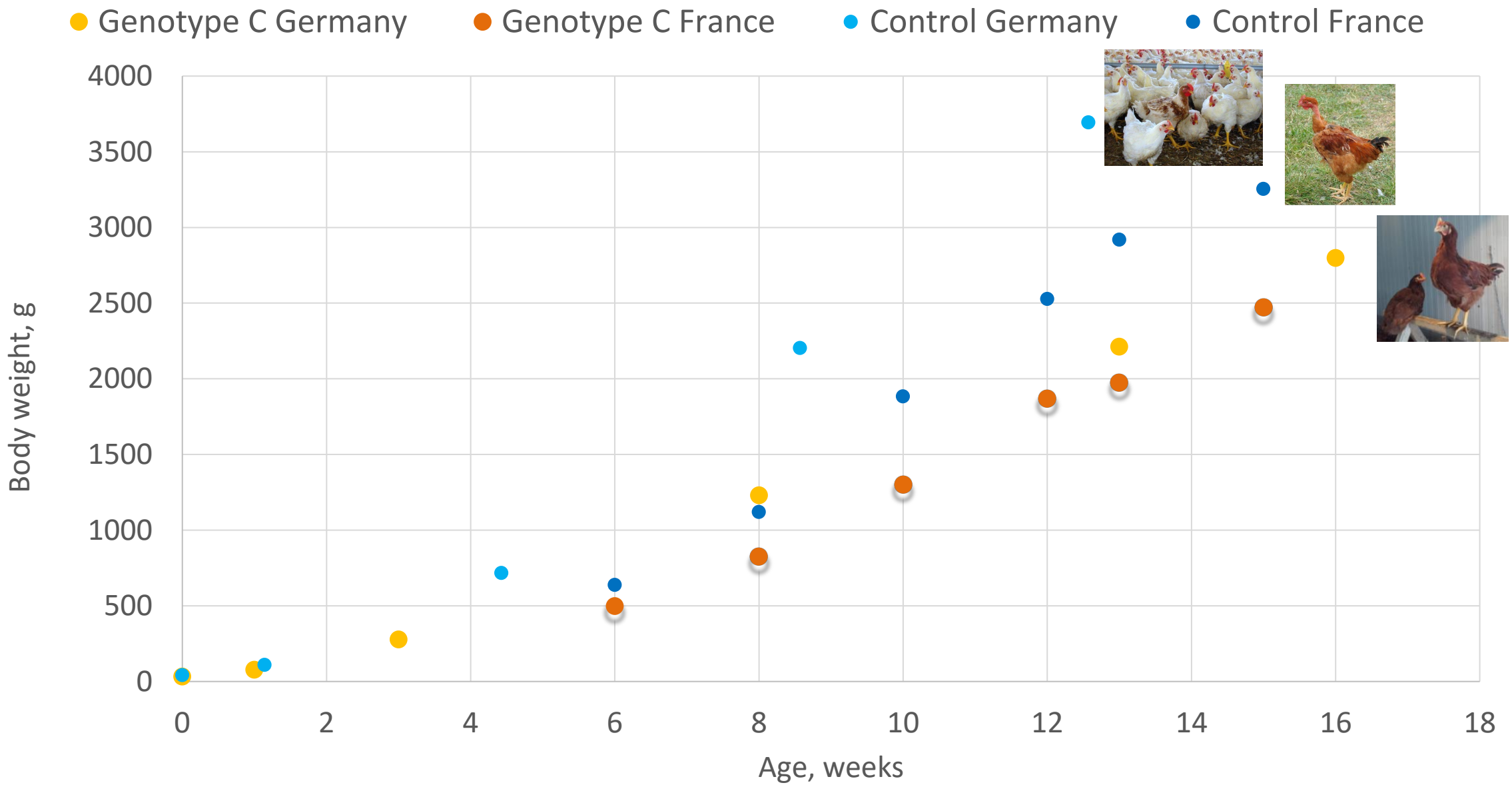
PPILOW Results – Growth curves of genotypes



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PPILOW Results – Technical data

	France		Germany	
	F	C‘	C	D
Mortality, %	1.36	4.57	11.0 (6.7)	1.20
FCR (13 wk)	2.65	3.74	3.79	3.09
Carcass weights at 13 wk, kg	1.94*	1.38*		2.42
Carcass weights at 15 wk, kg	2.41*	1.72*		
Carcass weights at 16 wk, kg			1.85	

* Including neck

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PPILOW Results – Carcass Characteristics in France

At week 13: Avg ± SE

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

Carcass conformation scores

	Genotype	Score 0	Score 1	Score 2
Wk 13	F	100%	0	0
	C’	0	0	100%
Wk 15	F	97%	3%	0
	C’	4%	39%	57%

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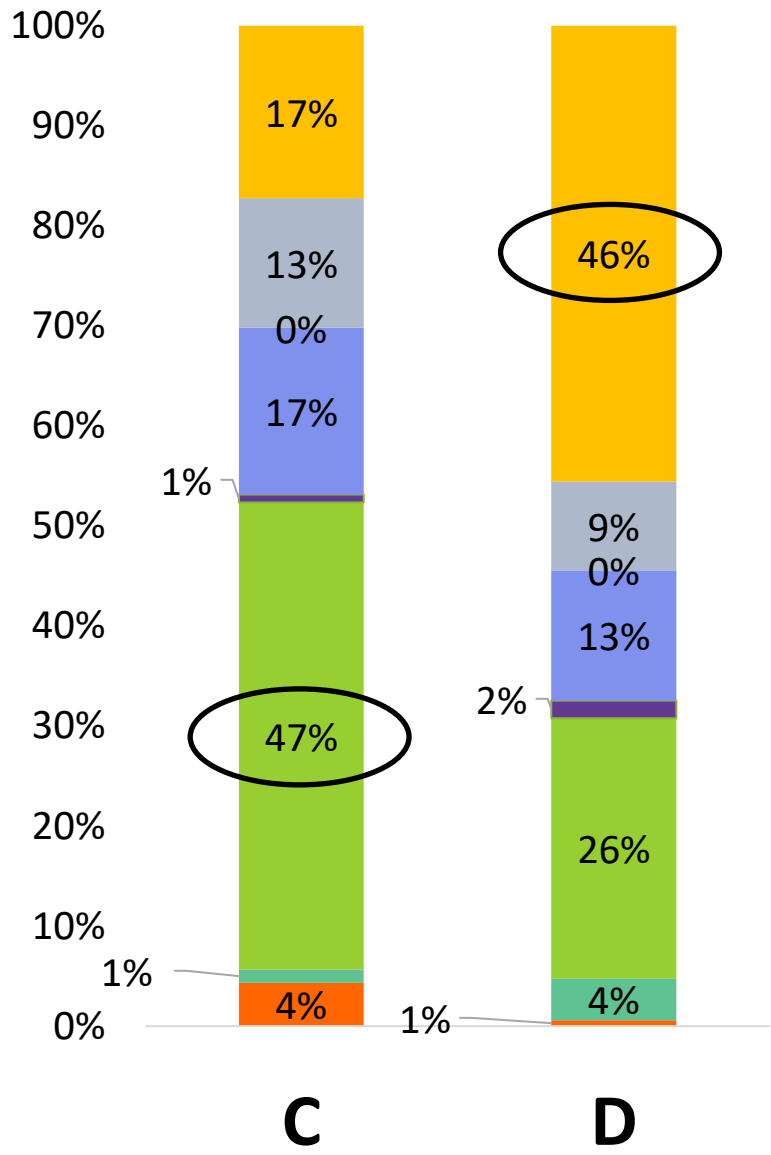
PPILOW Results – Behaviour Observations in Germany



- resting
- panting
- dustbathing
- positive interaction
- stretch/flapping
- preening
- foraging
- aggressive behaviour

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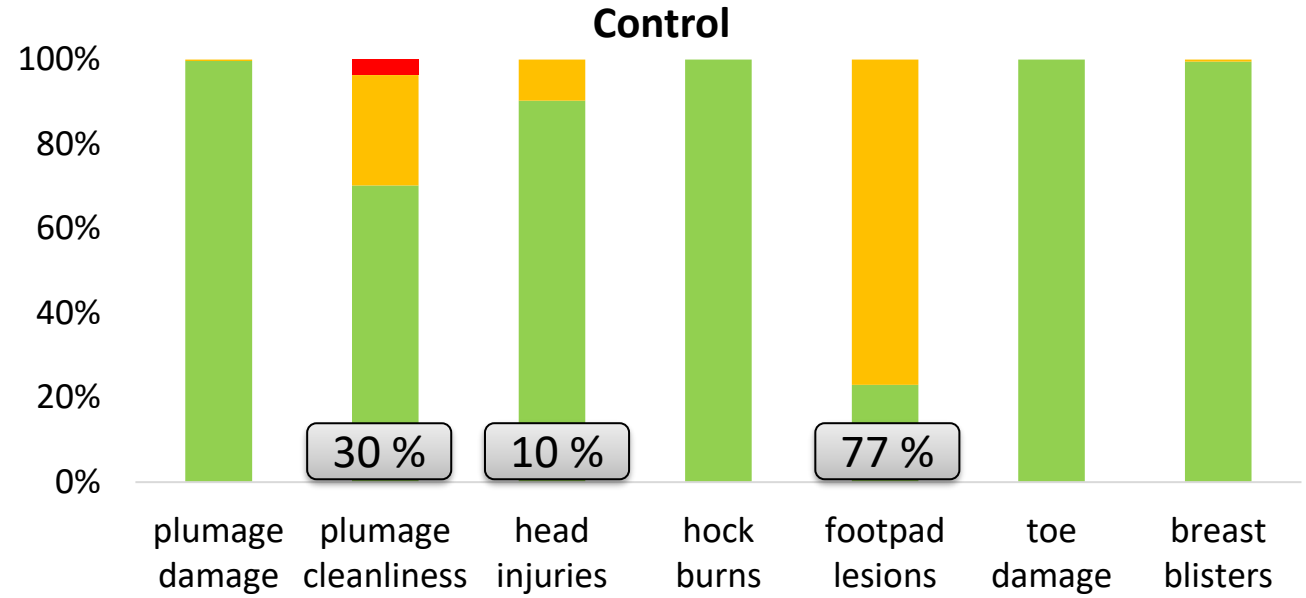
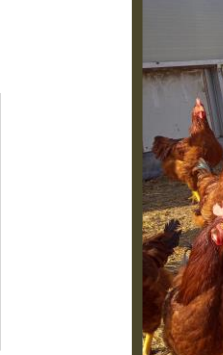
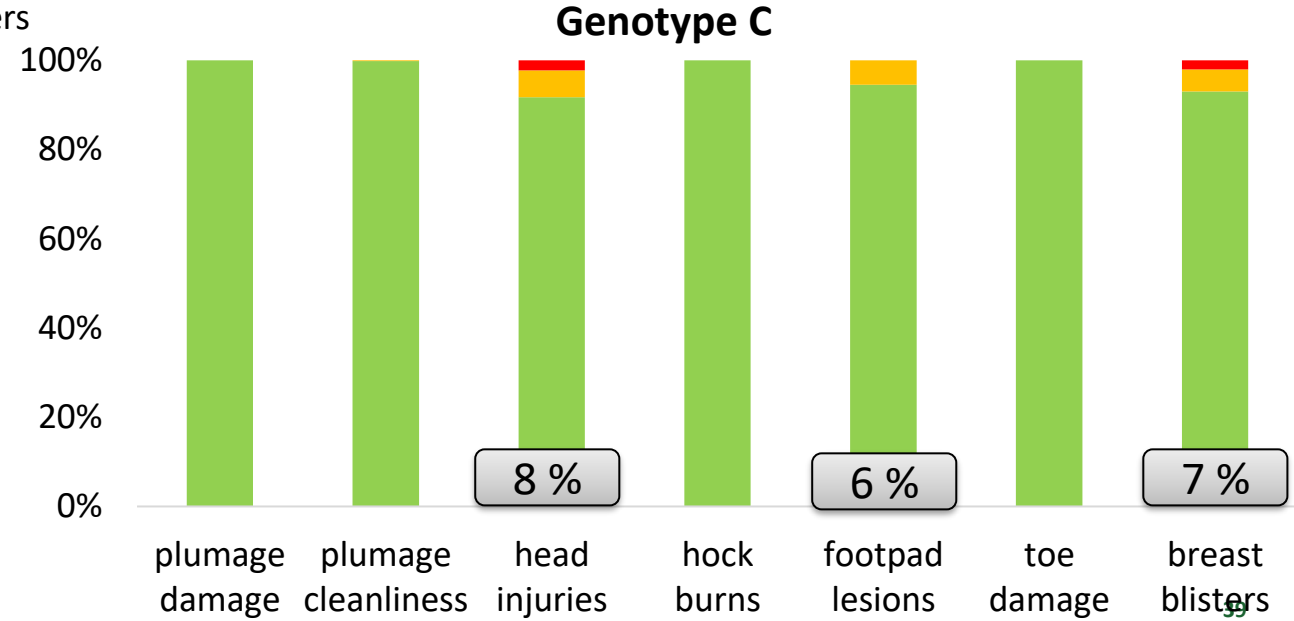
PPILOW Results – Welfare Indicators in Germany (n=200)







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PPILOW WP5.2. On-farm trials with dual-purpose males

Conclusion – genotype C males

- reared in two different environments (same hatch) up to 15/16 weeks of age → similar FCR & carcass weights in both countries
- Longer fattening period had positive effect on carcass conformation
- Very good welfare
- Very active birds

Farmers opinion & observations

German farm: The farmer started with providing enrichment (carrots) in the barn from day 1 since the birds were **very active**. The farmer did not observe much aggressive behaviour but described genotype C as very curious birds.

French farm: The farmer asked consumers for their feedback on genotype C meat: 58% said that there was no difference in **meat quality** between genotype C meat and the meat they were used to eating (= control). Of the consumers who did notice a difference in meat quality (23 people), 83% considered the meat from genotype C birds to be as good as the meat from the control genotype or even preferred the meat from genotype C.

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Alternatives to the elimination of layer male chicks

On-farm trials with dual-purpose females

Aarhus University *(Sanna Steenfeldt)*

Thünen Institute of Organic Farming *(Helen Pluschke, Lisa Baldinger, Daniela Werner)*

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PPILOW On-farm trials with dual-purpose females

Objective

Based on the results of the on-station evaluation of three dual-purpose genotypes, the most promising genotypes were used on commercial farms in order to evaluate their performance under real production conditions.

Genotypes selected

Results on performance, welfare and behavior from the on-station trials were communicated and discussed with the national practitioner groups (NPGs) in **France, Denmark and Germany**. Based on these discussions with the NPGs, it was decided to test females of **genotype C in all three countries**, and in addition to test females of **genotype A in Denmark**.

Genotype C on station

Genotype A on-station

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PPILOW On-farm trials with dual-purpose females

Rearing of genotype A and C pullets was carried out on a French farm from December 2021 to April 2022. Genotype C pullets for the German trial were reared on a German farm.

Due to management challenges, feather pecking started early in genotype C. Strategies to prevent further development of this behaviour were initiated from 8 weeks of age.

No feather pecking behaviour was observed in genotype A or the French control

At 18 weeks: genotype C pullets were transported to another French farm and pullets from genotype A and pullets from genotype C were transferred to Danish farm.

Genotype A

Genotype C

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Housing and feeding during laying period

Germany:

- Mobile barns on permanent pasture: 225 genotype C layers, 225 Lohmann classic as control
- Feed : no change of diet throughout the laying period
- Duration until 58 weeks

Mobile barn Germany

France:

- barn with access to a veranda and an outdoor run with trees (from week 25) : 196 genotype C layers, 249 Babock brown as control
- Feed : 2 different diets
- Duration until 67 weeks.

House system in France

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 816172

Housing and feeding during laying period

Denmark:

- Same barn separated in two parts for Genotype A (429) and genotype C (399) with access to an outdoor area
- Control group (Dekalb white) was placed on another and different farm)
- Feed : 2 different diets: egg-starter diet and phase 1 diet
- Duration until 60 weeks.

Permanent barn Denmark

Genotype A

Genotype C

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PPILOW On-farm trials with dual-purpose females

Results: performance

Indicators	France Genotype C	Germany Genotype C	Denmark Genotype C	Denmark Genotype A
Mortality at farm level (%)	27.6	2.2	25.5	18.2
Laying rate, %	74.1	60.6	72.1	66.8
Feed Conversion Ratio (FCR)	3.06	3.82	3.90	3.92
Live weight at 67/58/57 weeks (g)	2585 (67)	2154 (58)	2312 (57)	2744 (57)

A

C

C

Laying period: France 22-67 weeks; Germany 18-58 weeks; Denmark 23-60 weeks

Control genotypes in all countries had a better performance compared to genotype A and C

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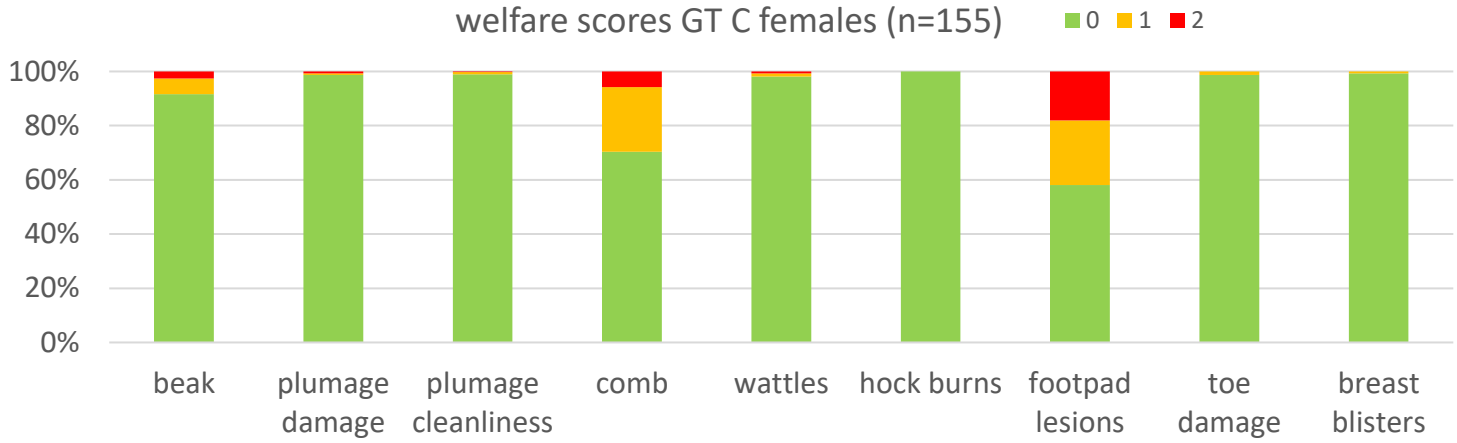
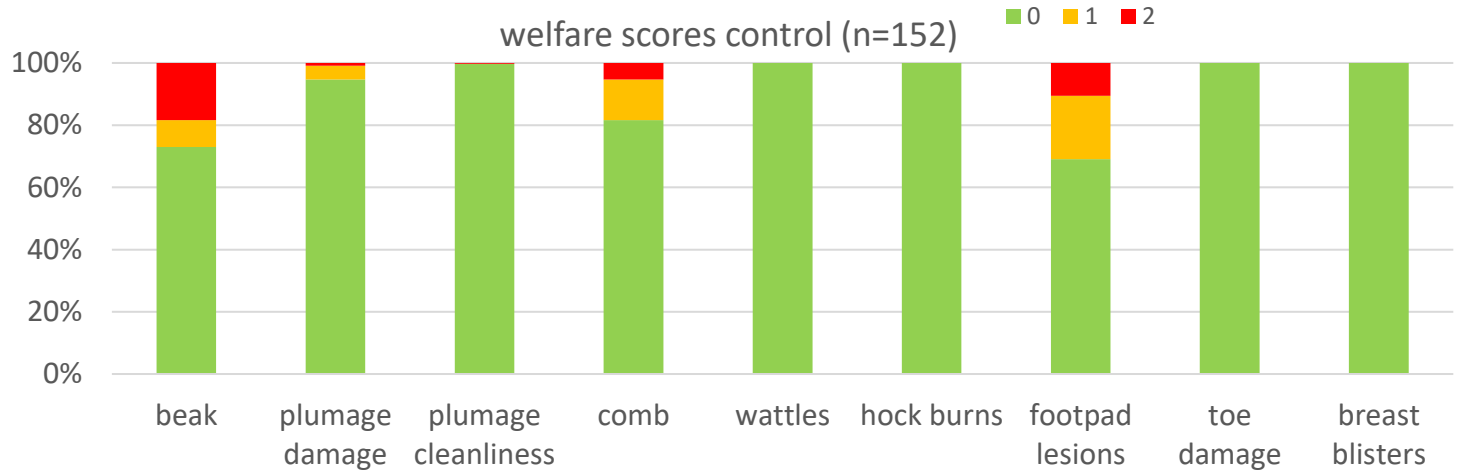
Results: Welfare Germany

- Excellent results were obtained in most categories (green), such as plumage
- Both genotypes had compromised footpad health, indicating that conditions were not optimal

- In both genotypes, injuries were seen in the head area (especially the comb), but this was slightly higher in genotype C females up to week 58
- No hock burns were observed in either genotype





Welfare indicator scores of genotype C and control group

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PPILOW On-farm trials with dual-purpose females

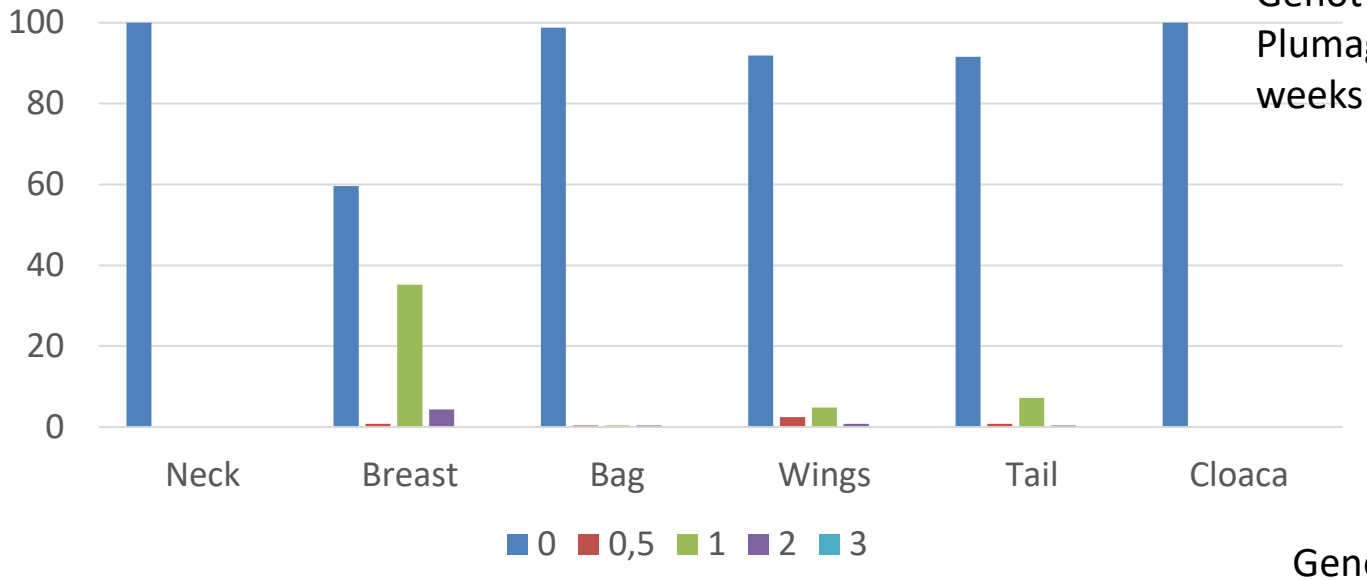
Results: Welfare Denmark

30 weeks of age:

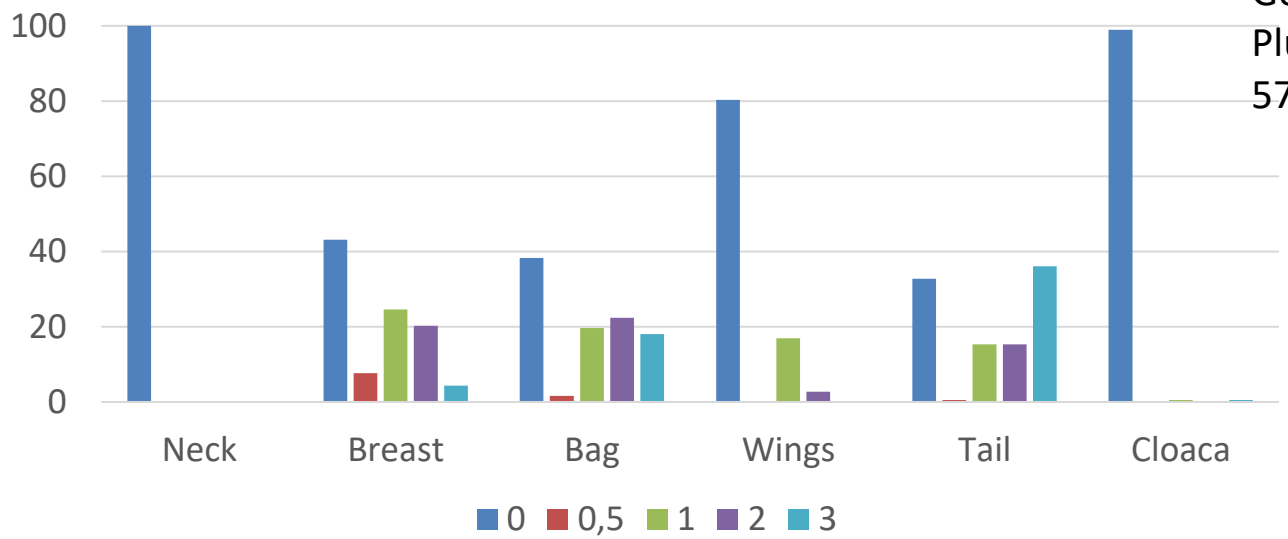
- Genotype A hens were fully feathered: 82,5% with a score 0
- Genotype C, 78% were feather pecked to some extent, whereas 22% were still fully feathered.

57 weeks of age:

- genotype A, 60% were fully feathered, though plumage appeared more worn, especially on the breast (35%)
- Genotype C, less than 10% were fully feathered.



Genotype A Plumage at 57 weeks



Genotype C Plumage at 57 weeks

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PPILOW On-farm trials with dual-purpose females

Results: Behaviour

- In all three countries, genotype C and genotype A used the outdoor area to a large extent and expressed normal positve behaviour such as foraging, preening, resting.
- In genotype C reared in France, the feather pecking behaviour (negative, aggressive) started during rearing and continued during the laying period. Genotype A never feather pecked during rearing or laying period
- Genotype C reared in Germany never developed feather pecking

Genotype A in- and outdoor in Denmark

Genotype C feather pecked – and new feathers

Genotype C outdoor and in mobile house in Germany

Genotype C fully feathered Denmark

Farmers opinion:

German farm: The farmer was surprised by the low mortality of the genotype C hens and assured that this type of robust bird was really needed for this type of system (free-range and mobile houses). The birds were calm and easy-to-handle. The farmer is generally keen to continue with dual-purpose chicken and would be happy to get this genotype again.

French farm: Genotype C birds were very active and explored their environment more than the control group. C females had a better body condition than control at end of lay. The farmer would accept lower egg production if the birds were more robust. He thinks that there is still a lot of work to be done on this genetic strain to improve pullet rearing and avoid feather pecking.

Danish farm: Both genotypes were very active and used the outdoor area to a large extent. Genotype C has potential as a dual-purpose layer, but work must be done to reduce the tendency to feather peck. The farmer did like the genotype A due to its very social behaviour and no feather pecking, but overall the egg production was too low, even though the A hens were very robust during the avian influenza continued to lay eggs at almost the same rate for a long time. However, robustness is an important factor, when choosing genotypes.

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Alternatives to the elimination of layer male chicks

Economic evaluation of dual-purpose strains

Thünen Institute of Farm Economics (Petra Thobe, Isam Almadani, Craig Chibanda)

ACTA (ITAVI) (Jonathan Hercule, Francois Cadudal, Simon Fourdin)

Thünen Institute of Organic Farming (Helen Pluschke, Lisa Baldinger, Daniela Werner)

ITAB (Brieuc Desaint, Sarah Lombard)

SYSAAF (Maxime Reverchon) Aarhus University (Sanna Steenfeldt)

PPILOW final conference – Africa Museum, Tervuren (Brussels)

June 11, 2024

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Which dual-purpose genotypes uses the least resources while producing the highest output to be economically viable?

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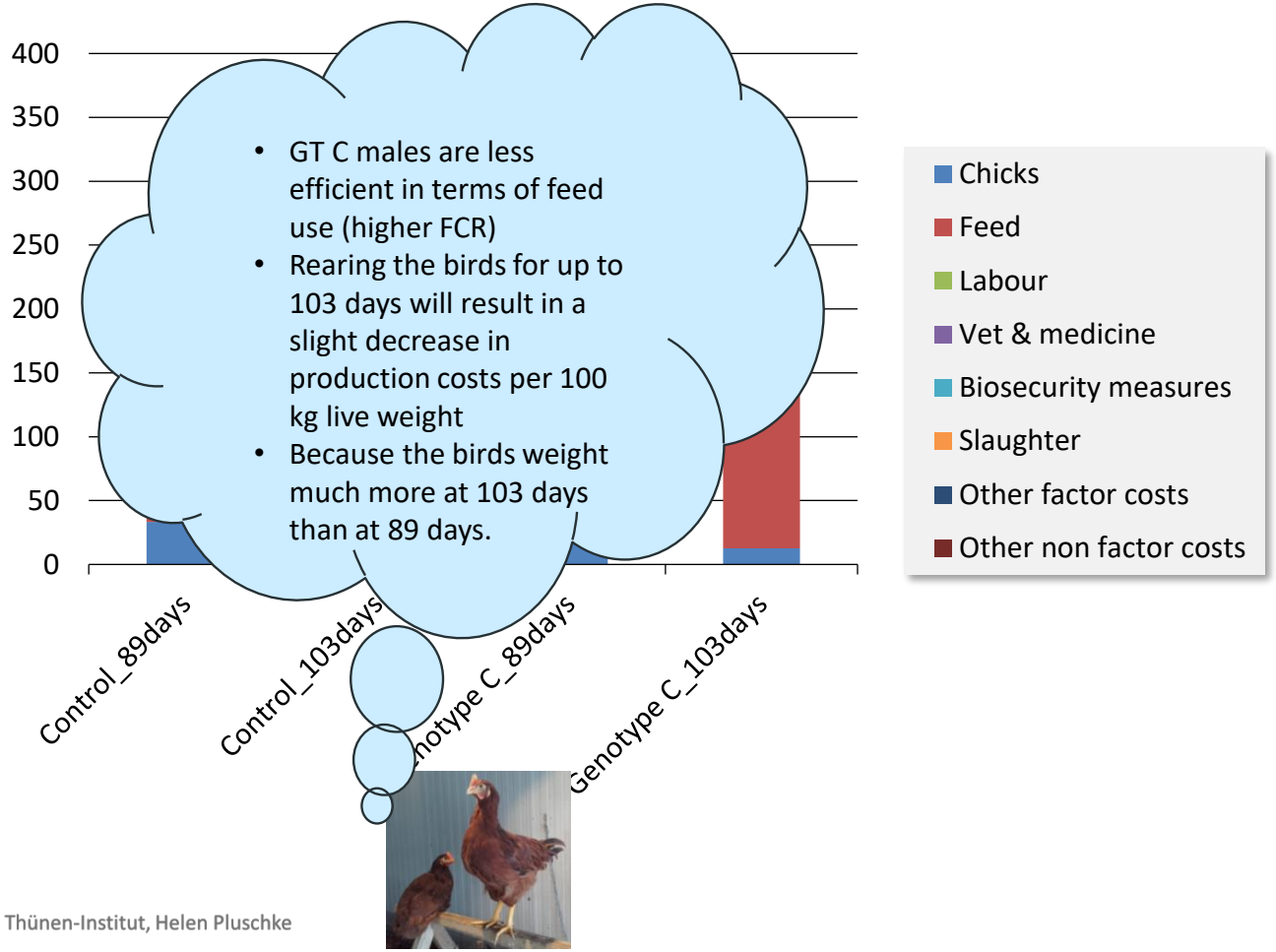
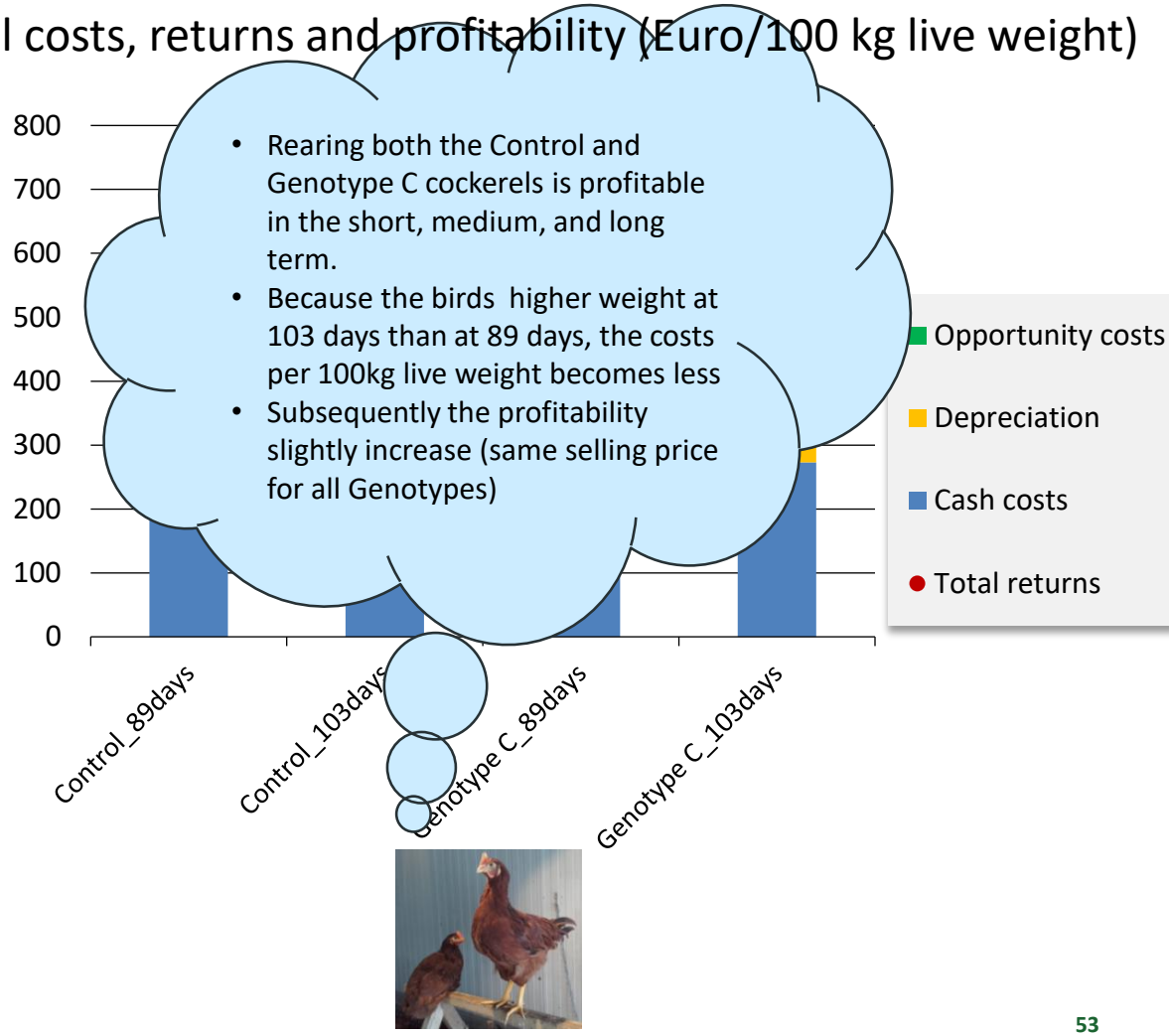
On-farm trials in France

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



- GT C males are less efficient in terms of feed use (higher FCR)
- Rearing the birds for up to 103 days will result in a slight decrease in production costs per 100 kg live weight
- Because the birds weight much more at 103 days than at 89 days.

Total costs, returns and profitability (Euro/100 kg live weight)



- Rearing both the Control and Genotype C cockerels is profitable in the short, medium, and long term.
- Because the birds higher weight at 103 days than at 89 days, the costs per 100kg live weight becomes less
- Subsequently the profitability slightly increase (same selling price for all Genotypes)

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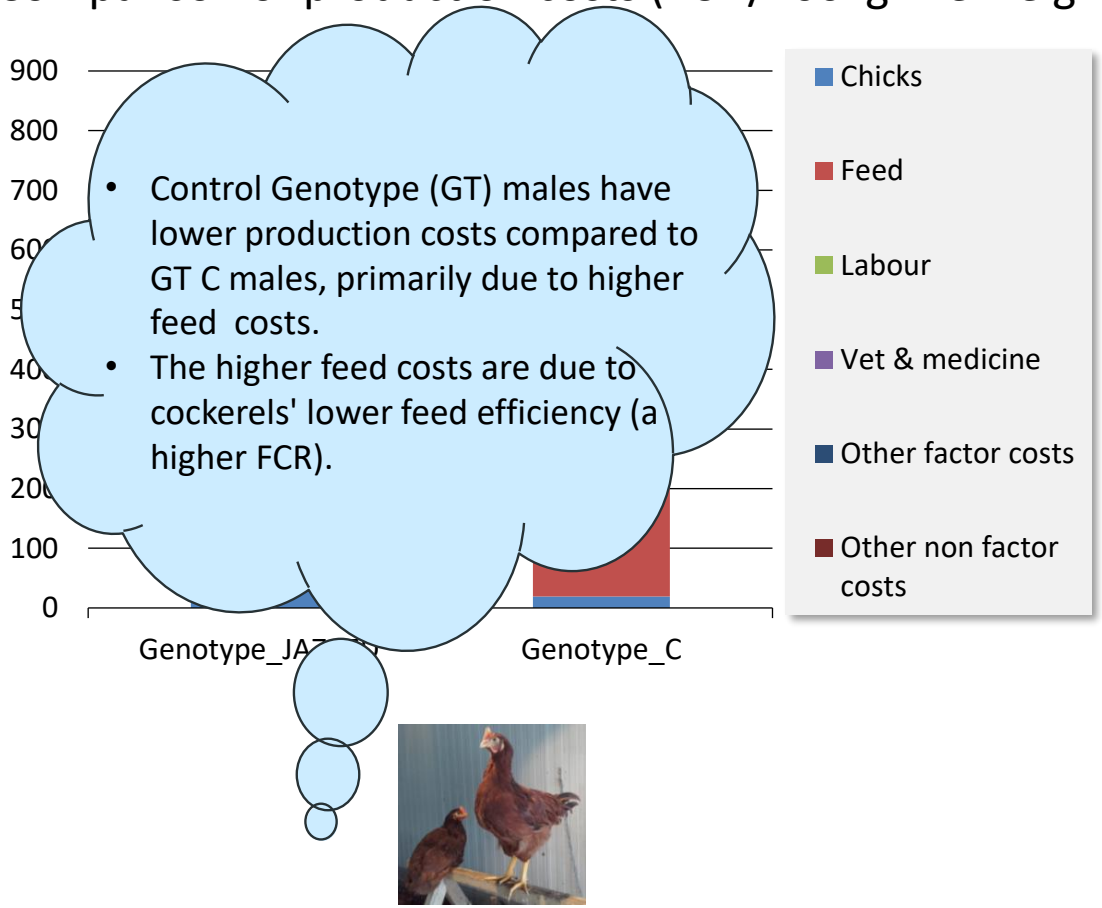
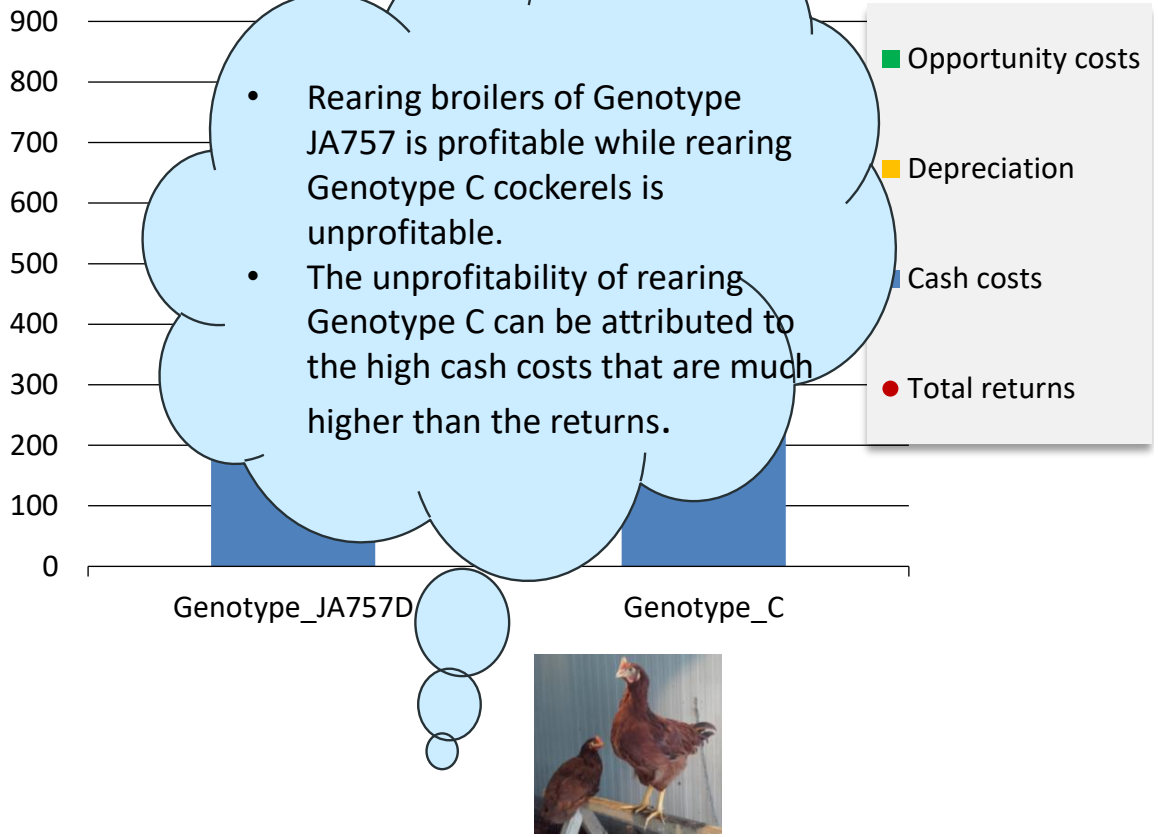
On-farm trials in Germany

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



- Control Genotype (GT) males have lower production costs compared to GT C males, primarily due to higher feed costs.
- The higher feed costs are due to cockerels' lower feed efficiency (a higher FCR).

Total costs, returns and profitability (Euro/100 kg live weight)



- Rearing broilers of Genotype JA757 is profitable while rearing Genotype C cockerels is unprofitable.
- The unprofitability of rearing Genotype C can be attributed to the high cash costs that are much higher than the returns.

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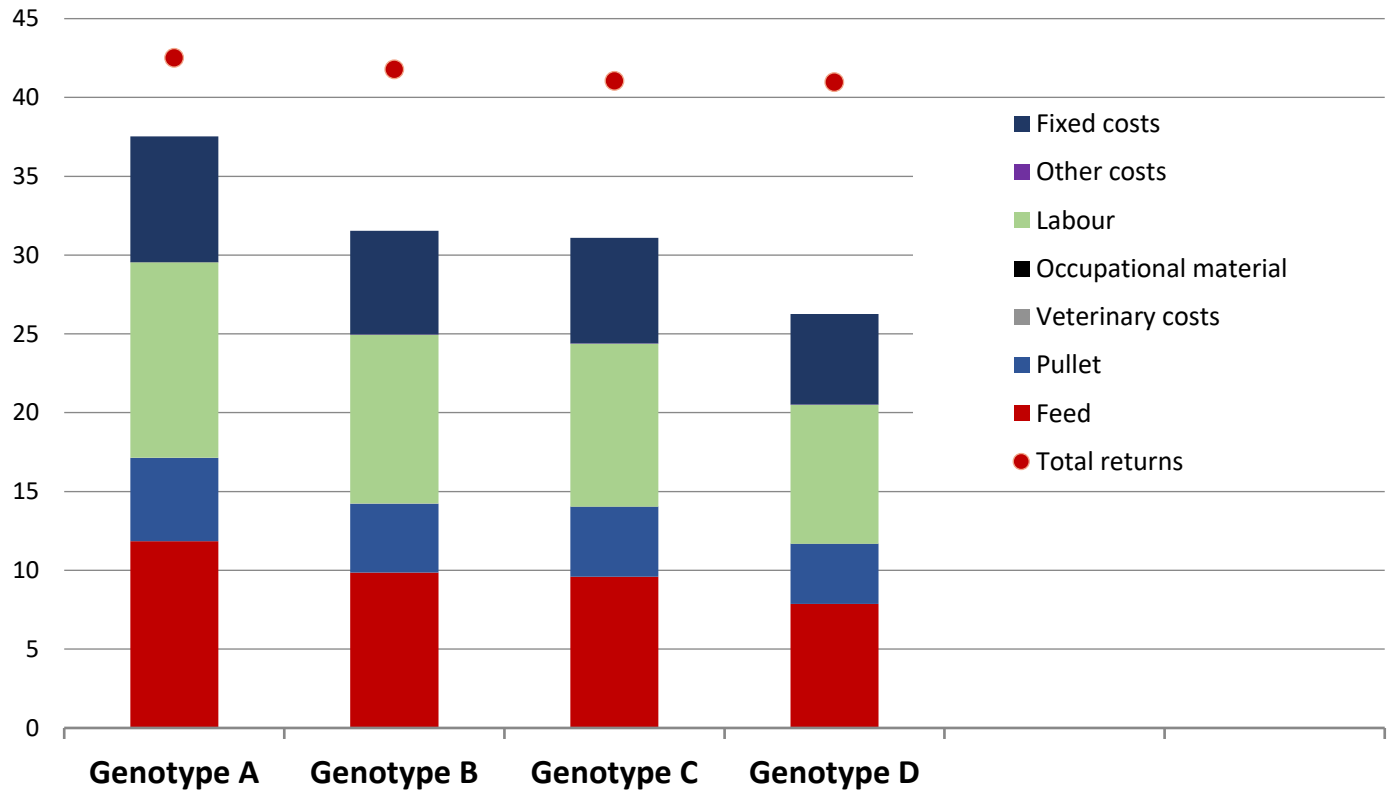
On-station trials of Females in Germany

Total costs, returns and profitability (Euro cent/egg)



- Egg price fix barn: 34 cent/egg
  Egg price mobile barn: 38 cents/egg
- Production costs 18-43% higher for dual-purpose hens compared to high performing layers.
- All genotypes are profitable under the given price assumptions.

Result confirmed by the multicriteria assessment

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PPILOW Conclusions

- The more the dual-purpose genetics are focused on laying eggs, such as GT C, the higher the feed conversion ratio and the higher the production costs for the males.
- Breeding of dual-purpose strains is only possible if selling prices are higher than for “usual" products.
- Promotion requires an appropriate communication strategy.
- The demands on a product or on animal husbandry are different, which has an impact on the development of business models that need to be taken into account when developing innovations.
- Only economically viable innovations will succeed in the market.
- For a full economic analysis of dual purpose genotypes, the productivity of males and females must be taken into account.

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Alternatives to the elimination of layer male chicks

Conclusions & perspectives

ITAB (Sarah Lombard, Brieuc Desaint, Antoine Roinsard)

Thünen Institute of Organic Farming (Helen Pluschke, Lisa Baldinger, Daniela Werner, Petra Thobe)

SYSAAF (Maxime Reverchon)

Aarhus University (Sanna Steenfeldt)

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In-ovo sexing methods

→ Identification of thousands of early sex biomarkers before day 8 of incubation

→ More research needed to improve sexing rate using a non-invasive method at 8 days of incubation

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Dual purpose strains

Males of genotype A

→ Interesting results for the males on-station, not tested on farm

Males of genotype C

→ Slower growth and higher FCR than control groups in France and Germany

→ Active birds, good welfare

→ Differ from the “organic standards” considering carcass conformation

→ More research is needed to optimize feeding regimes which might include by-products

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Dual purpose strains

Females from genotype A and C

→ Lower eggs production than the control groups and higher FCR for genotypes A and C

→ Performances not as good as on experimental farms, possibility to improve on this aspect by adapting rearing management

→ High sensibility of the genotype C females to feather pecking: crucial management during the rearing phase

→ Genotype A seems to adapt better to environmental challenges than genotype C

→ More research needed on feeding regimes

Genotype A female

Genotype C female

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Economics

Marketing strategies needed to compensate to be viable economically :

- increasing selling prices of the meat and / or the eggs to compensate the higher rearing costs
- policy measures and incentives can also be put in place (at national and EU level)

→ Educating consumers seems to be crucial for the development of dual-purpose breeds in Europe

Perspectives

- Studies conducted in various environments
- On small flocks
- On 3 dual purpose strains
- Restricted comparability of the results

→More research is needed on dual-purpose strains in general as many more strains could be tested

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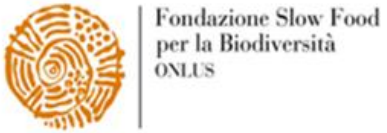
PPILOW **PARTNERS**



Huge thank you to all partners involved !

Thank you for your attention

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