Early life management solutions to improve resilience in slow-growing broilers

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Early life management to improve resilience

Different studies performed in the incubation
and early post-hatch period of slower-growing broilers:

- Thermal manipulation during incubation

- On-farm hatching (=providing early feed and water)
  in organic and low input outdoor farms

Why thermal manipulation during incubation?

- Epigenetics = Thermal programming for later life possible
  - Improved resistance to temperature/pathogens
    (Tzschentke, 2007, Loyau et al., 2015, Al-Zghoul et al., 2023)

- BUT also positive or negative effects possible on:
  - Survival & Chick quality (reviewed by Tainika et al., 2022)
  - Performance later life (Yahav et al., 2004; Yalçin et al., 2010; Piestun et al., 2017)
  - Behaviour later life (Bertin et al., 2018; Verlinden et al., 2022)

Can thermal manipulation during incubation increase resilience & adaptive capacity of slow-growing broilers?

Study 1 - Early life consequences of TM

Study 2 - Later life consequences of TM

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Experimental design

Study 1 – Early life consequences

3 eggshell temperature treatment

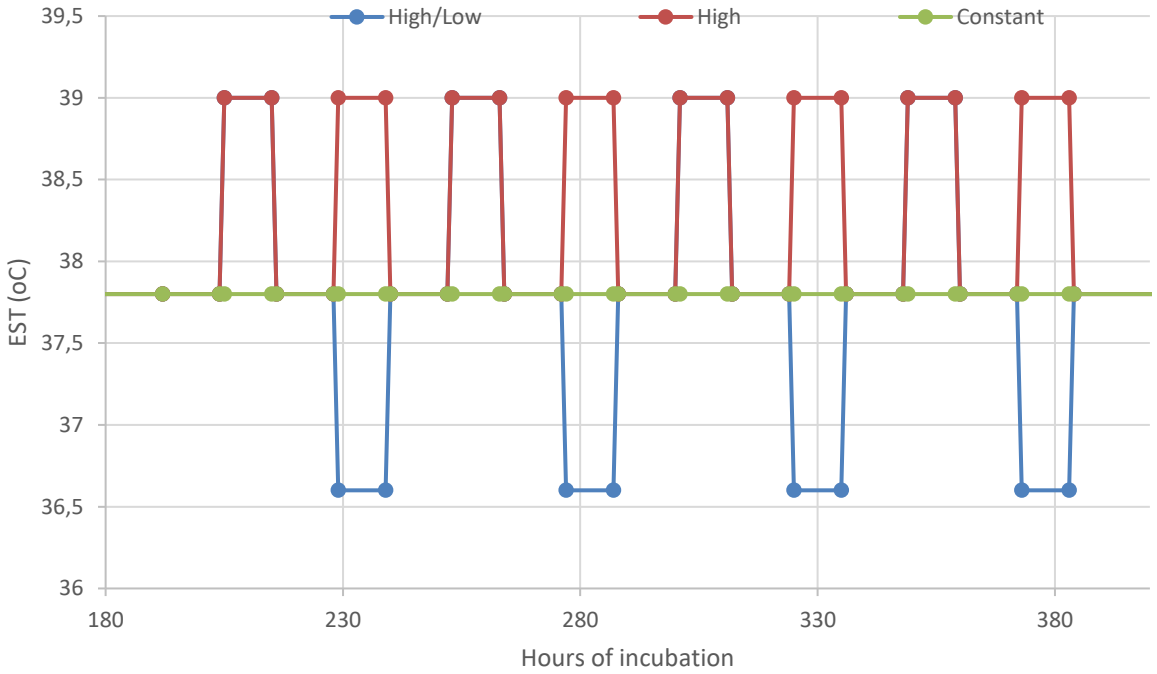
1. Control (C):
Constant eggshell temperature of **37.8°C**

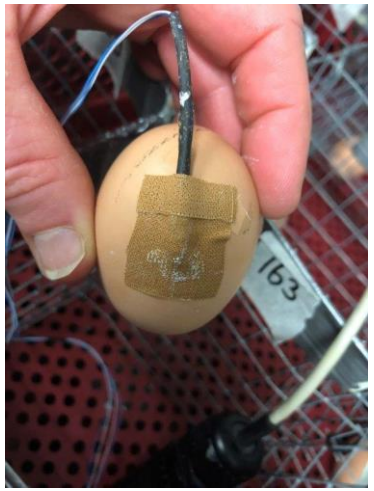
Thermal treatment (TM): from embryonic day 9-16 temperature changed every 12 h

2. High/Low (HL)
37.8°C – 38.9°C – 37.8°C – 36.7°C

3. High (H)

37.8°C – 38.9°C

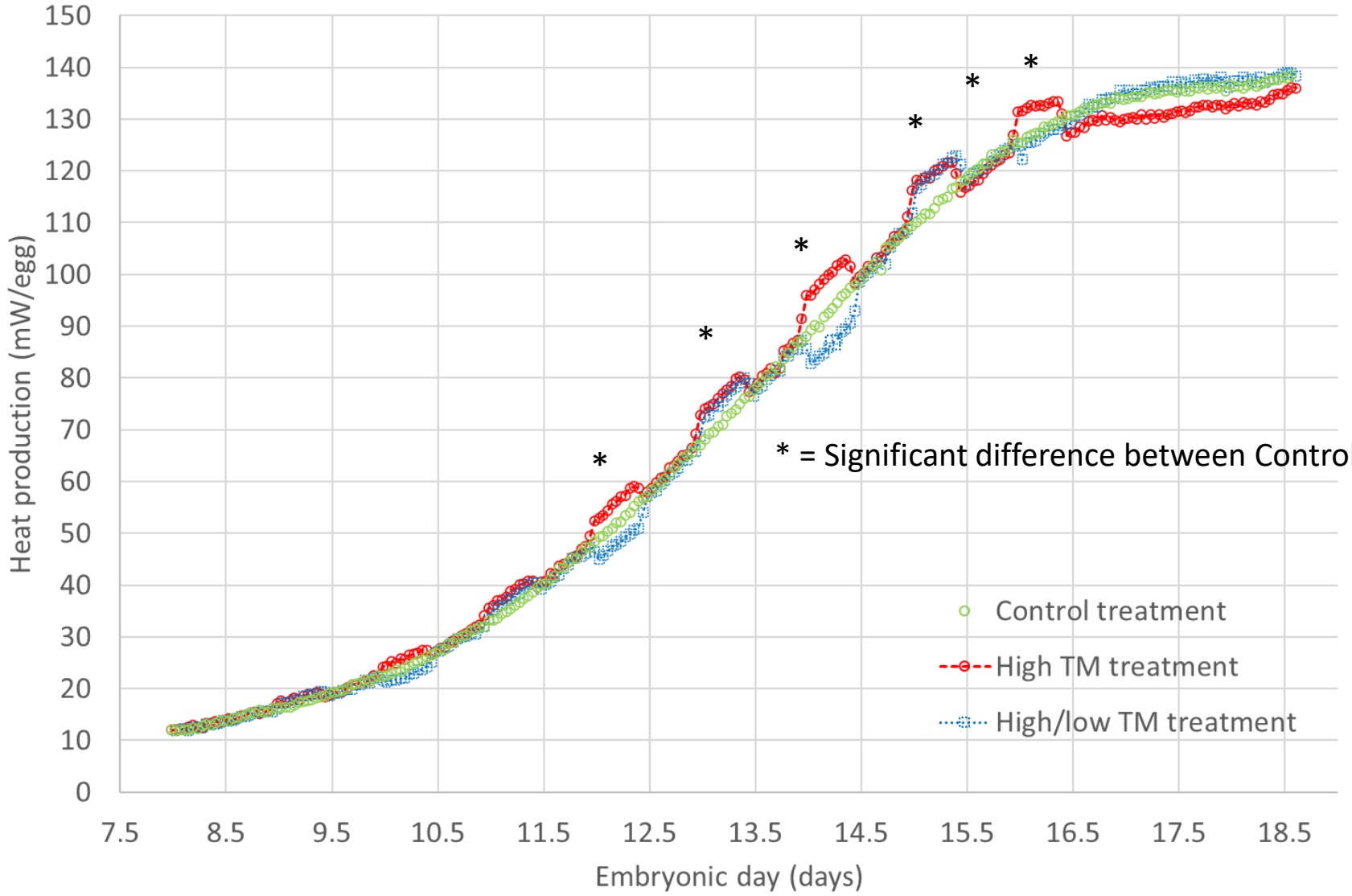




Study 2 – Later life consequences

Treatment Control (C) and High/Low (HL) applied

Study 1 – Results - Heat production

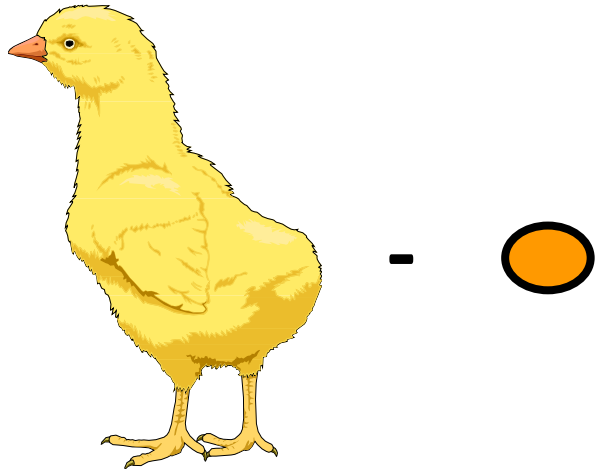


* = Significant difference between Control and TM treatment

Study 1 – Results - Chick quality

Parameter	Control	High	High/ Low	SEM	P-value
Hatch time (hrs)	498	493	497	2	0.44
Body weight (g)	40.8	40.7	40.8	0.18	0.95
YFBM (g)	36.4	35.9	36.3	0.21	0.42
Residual yolk (g)	4.50	4.80	4.52	0.13	0.32
Heart (% of YFBM)	0.77	0.70	0.75	0.03	0.34
n	52	54	59		

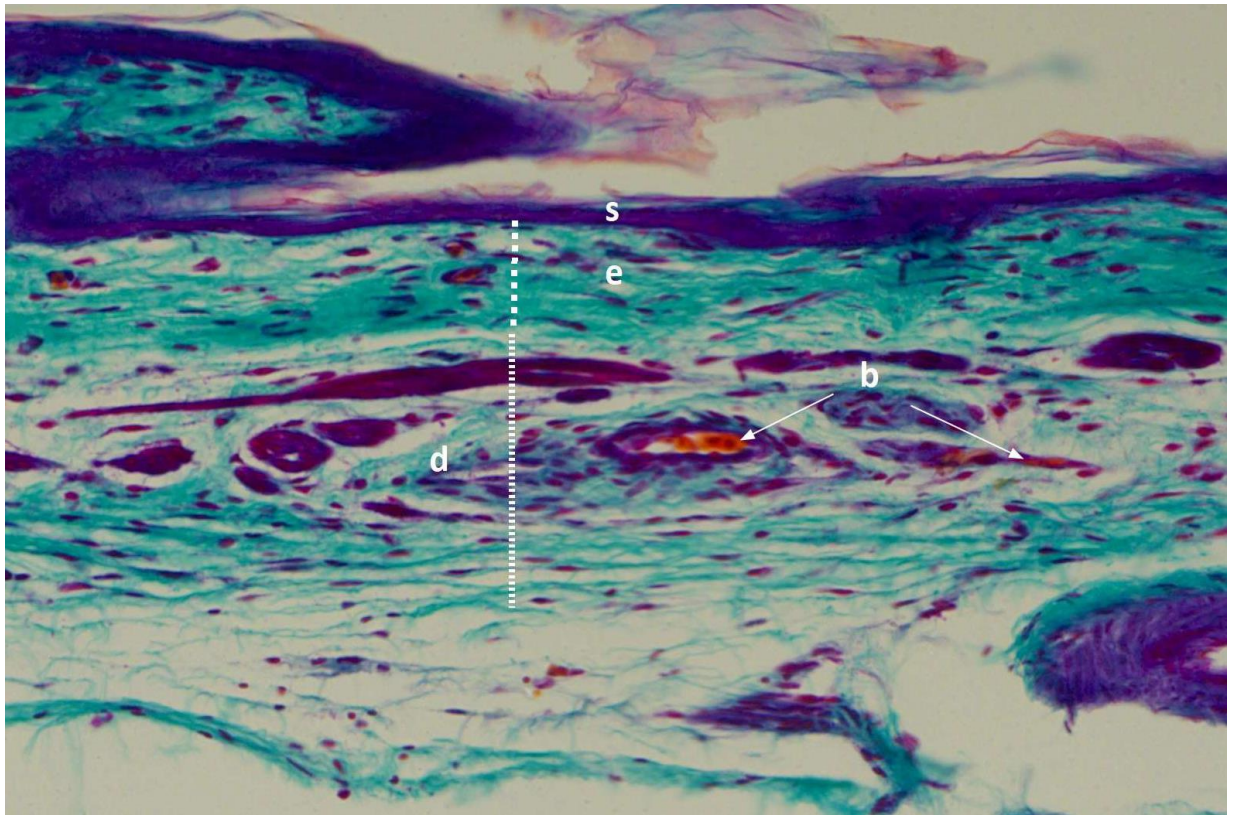
Yolk-free body mass
Body weight minus Residual yolk weight



No difference in chick quality between treatment groups

Study 1 – Results - Skin development

Parameter	Control	High	High/ Low	SEM	P-value treatment
Skin					
Str corneum (µm)	10	10	9	0.7	0.88
Epidermis (µm)	35	38	39	2.6	0.58
Dermis (µm)	74	75	85	7.1	0.57
Blood vessel ratio	9.0	8.6	8.9	0.54	0.91
Vessel perim (µm)	18	17	18	2.2	0.94
n	13	11	13		



No difference in skin development between treatment groups

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Study 2- Later life consequences

2x2 groups of 100 chickens

Stable compartment:

- 9.6 m^2
- 3 feeders
- 3 drinkers
- Perches

Winter garden:

- 72 m^2
- Enriched with operant larvae feeders

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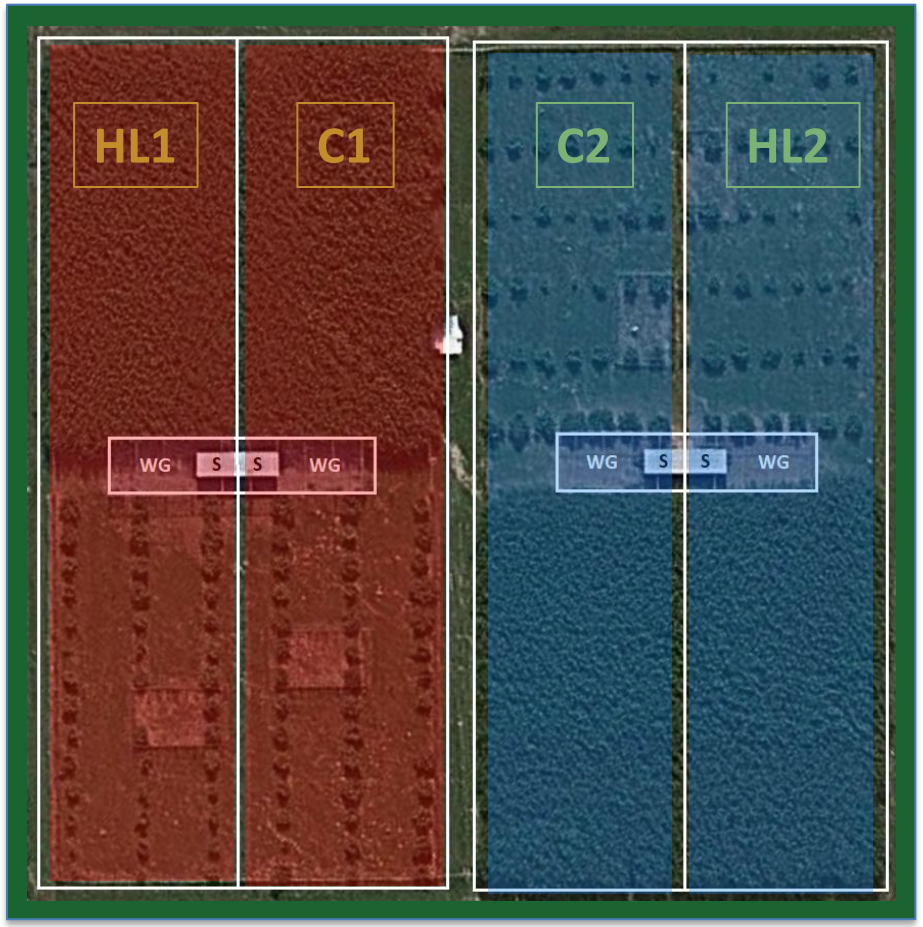
Study 2 – Performance - Results

	Feed intake (g/chicken/day)	Growth (g/chicken/day)	Feed conversion ratio
High/low	**79.57**	**33.12**	**2.40**
Control	**78.94**	**33.45**	**2.36**
I657 Hubbard Company	71.89	28.2	2.53

No clear difference between treatments

Study 2 - Thermal challenge – Experimental design

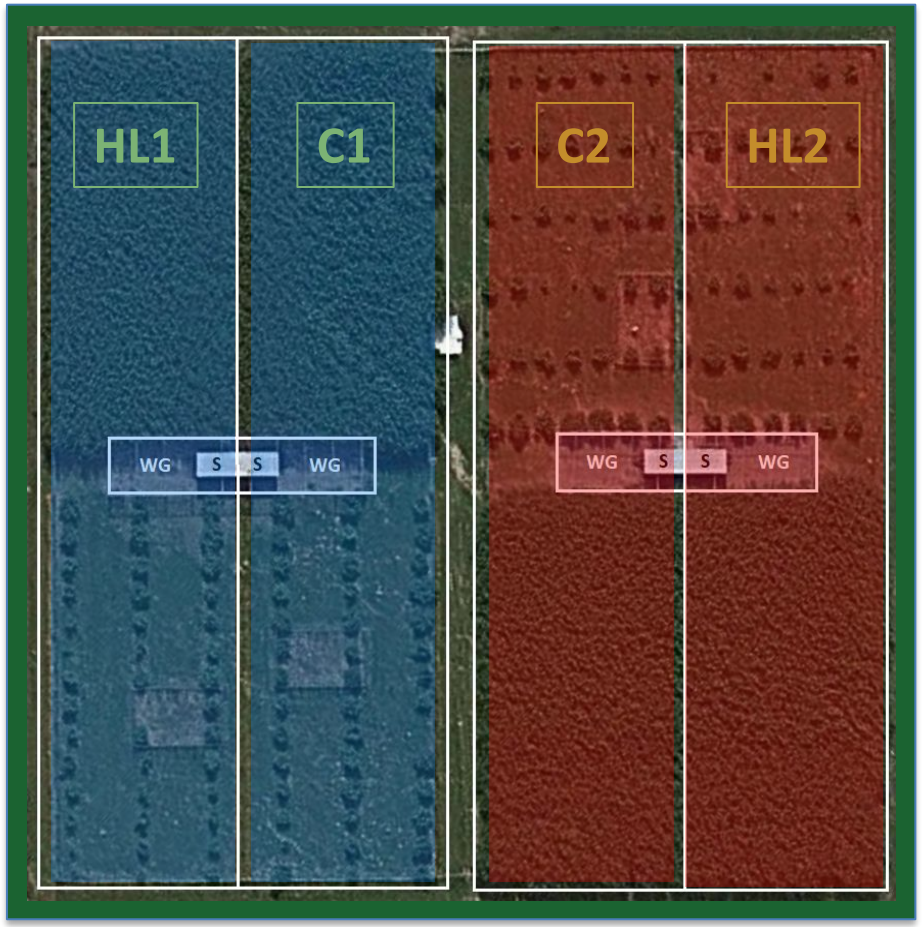


Thermal challenge (day 48 or 49): 3 hours at 30°C ± 2°C

Day 48: Thermal challenge HL1 and C1 + Control day HL2 and C2

n=9

Study 2 - Thermal challenge – Experimental design



Thermal challenge (day 48 or 49): 3 hours at 30°C ± 2°C

Day 48: Thermal challenge HL1 and C1 + Control day HL2 and C2

Day 49: Thermal challenge HL2 and C2 + Control day HL1 and C1

Compare thermal challenge and control day per group

Behavioural observations on group level:

- During 3 hours of the challenge
- Behavioural scan every 3 minutes
- Visual comparison of group level data

n=9

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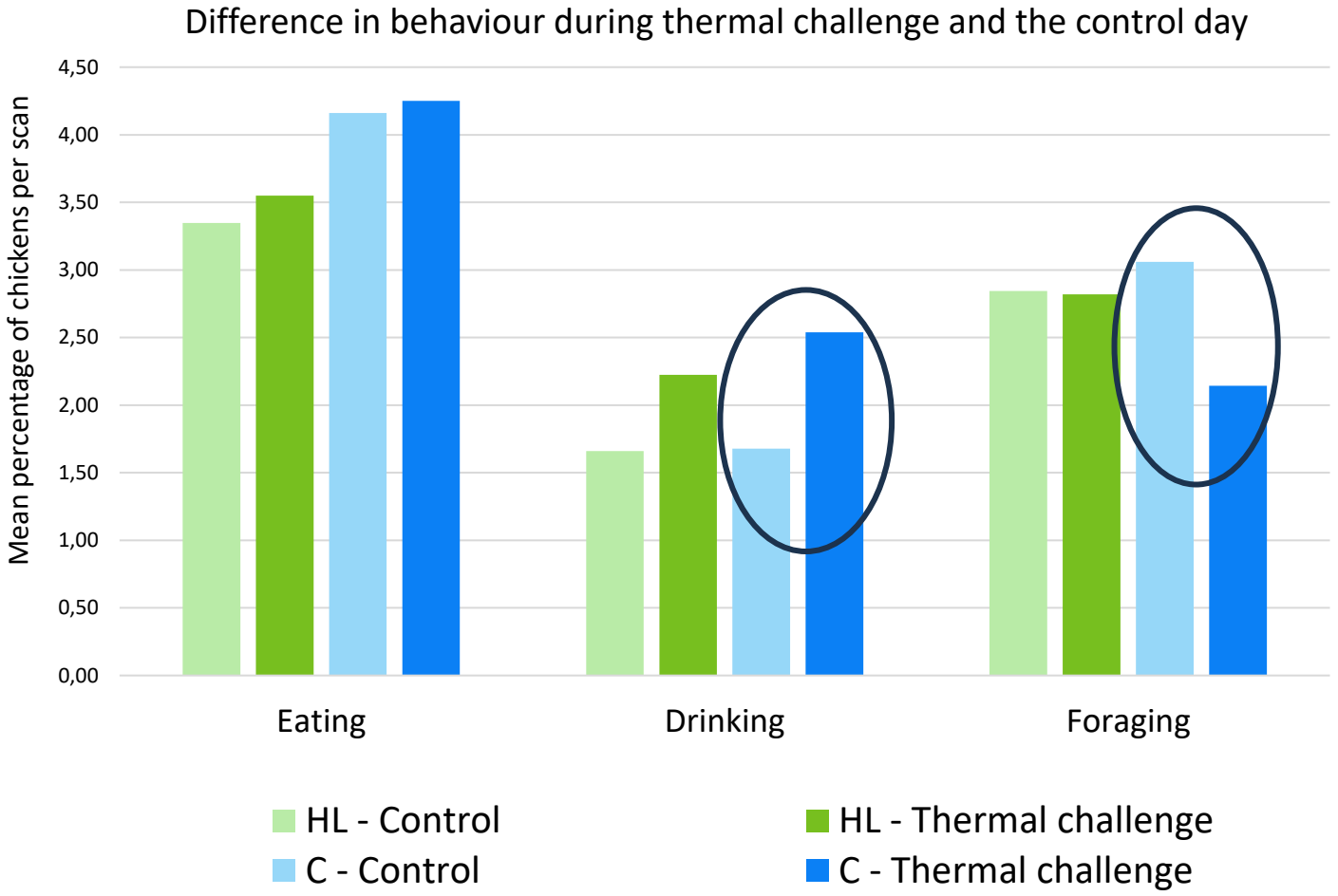
Study 2 - Thermal challenge – Results

"Drinking" increased more for the control group

"Foraging" decreased for the control group



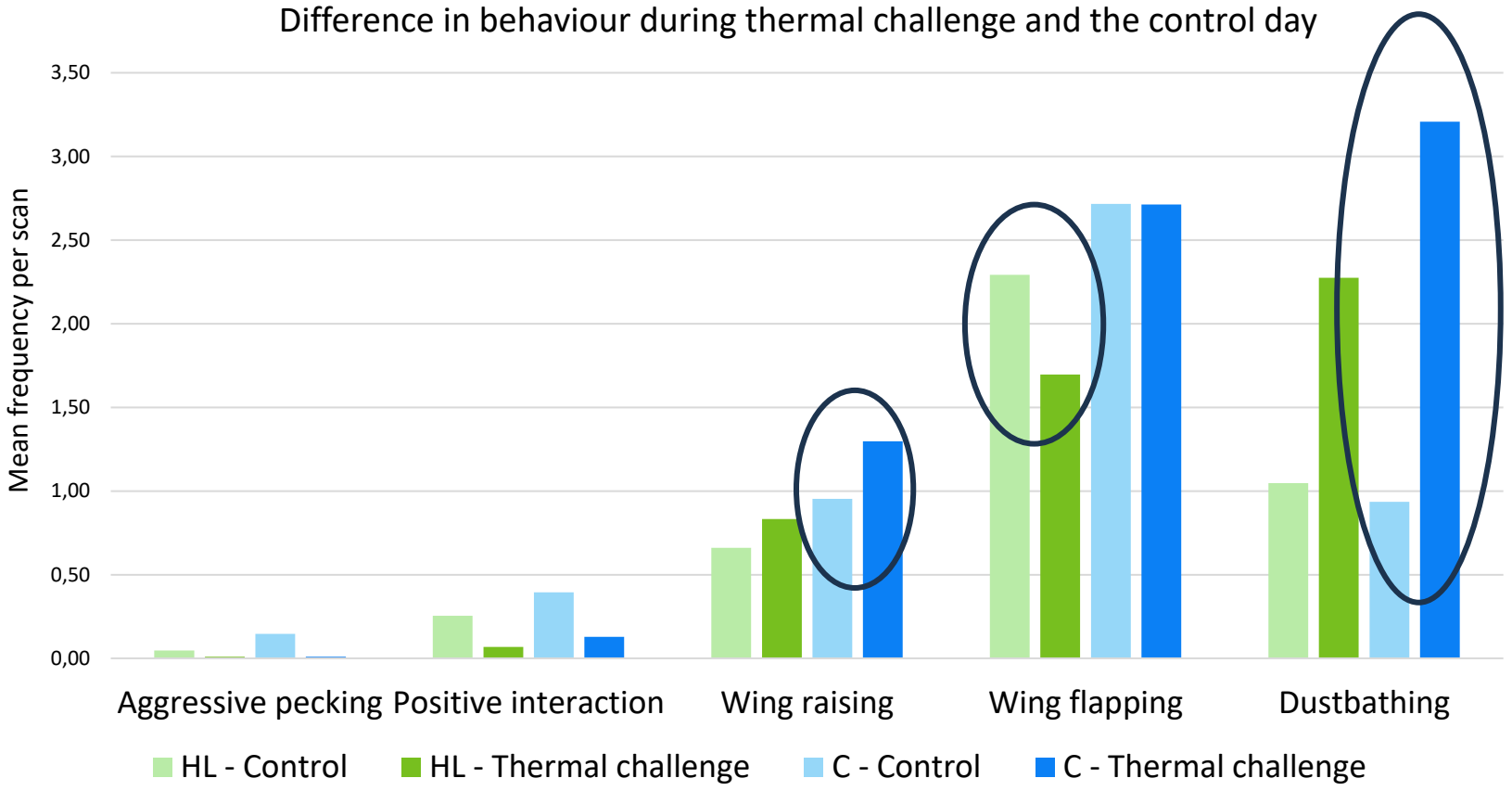
HL: n = 2; 198 chickens C: n = 2; 195 chickens

Study 2 - Thermal challenge – Results

High Low (HL) treatment observation:

- “Wing raising” increased less
- “Wing flapping” decreased
- “Dustbathing” increased less

Possible indications of coping better with high temperature



HL: n = 2; 198 chickens C: n = 2; 195 chickens

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Summary of effect Thermal Manipulation (TM) in slower-growing broilers

Early life consequences (Study 1)

- Heat production was instantly affected by TM
  - TM treatment changed metabolic rate
- No effect of TM treatment on chick quality or skin development at hatch
  - No indications of negative effects nor adaptations in skin

Later life consequences (Study 2)

- TM does not seem to affect performance in later life
- There were some indications that the behaviour of TM chickens was less affected by high temperatures

- Follow-up research needed to assess effectiveness of TM in later life
  - Fine tuning of amplitude, timing and frequency of temperature manipulation procedure important to improve later life resilience and adaptive capacity

On-farm hatching in low-input outdoor and organic broiler farms

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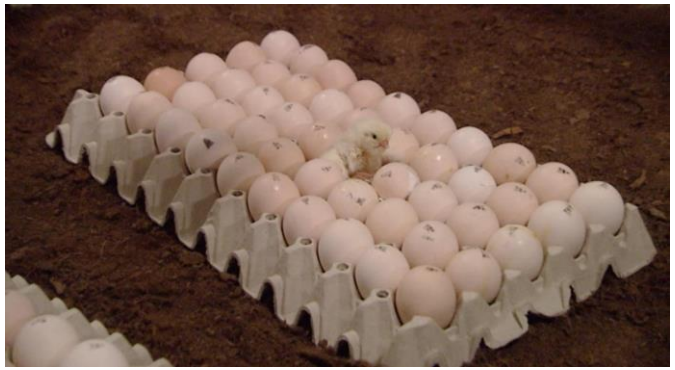
Small batches of chicks of specific slow-growing genotypes

Farms far from the hatchery: long transport

Different hatching times + delay before delivery on farm: Risk of dehydration

Means for limiting chick perturbation and stimulating adaptive capacities in slow growing chickens?

Impacts on welfare, chick quality, physiology, health, performance and resilience



https://www.one2born.com/en/product/

On-farm hatching 18-day incubated eggs

Industrial set-ups or simple designs described

Van de Ven et al., 2009; De Jong et al., 2018; Giersberg et al., 2020; Molenaar et al., 2023 ; Guilloteau et al., 2024

The chicks have directly access to feed and water when ready

Good hatchability and performance in fast-growing chickens

Lower use of antibiotics

Slow-growing lines, alternative systems?

Jessen et al., 2021

Hatching Organic farm: http://www.ferme-moonriver.com/

Chick houses 3 x 2 x 0.6 m^3 in mobile poultry houses 42 m^2
2 poultry houses (2 repetitions) – 300 km from hatchery, 2 x 550 eggs G657N

Refinment of conditions: 2 powerful electric radiants -> heating pad
+ small ventilating radiant (34 to 35°C ambient temperature)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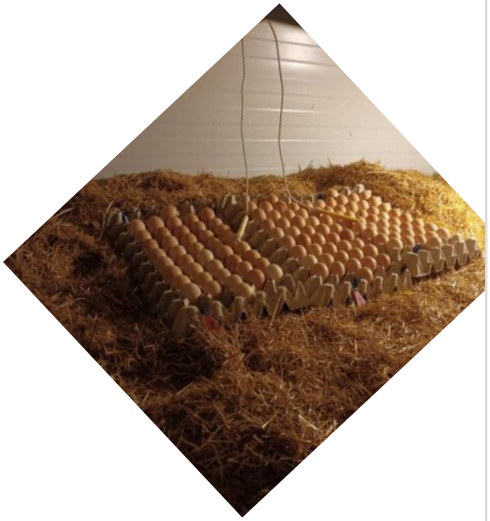
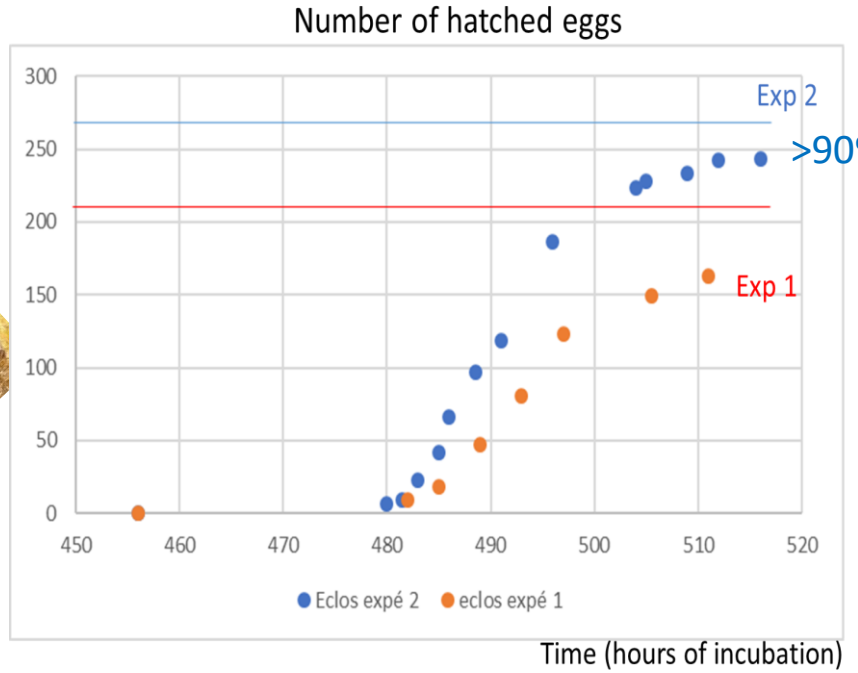
One2Born
53 x 29 cm





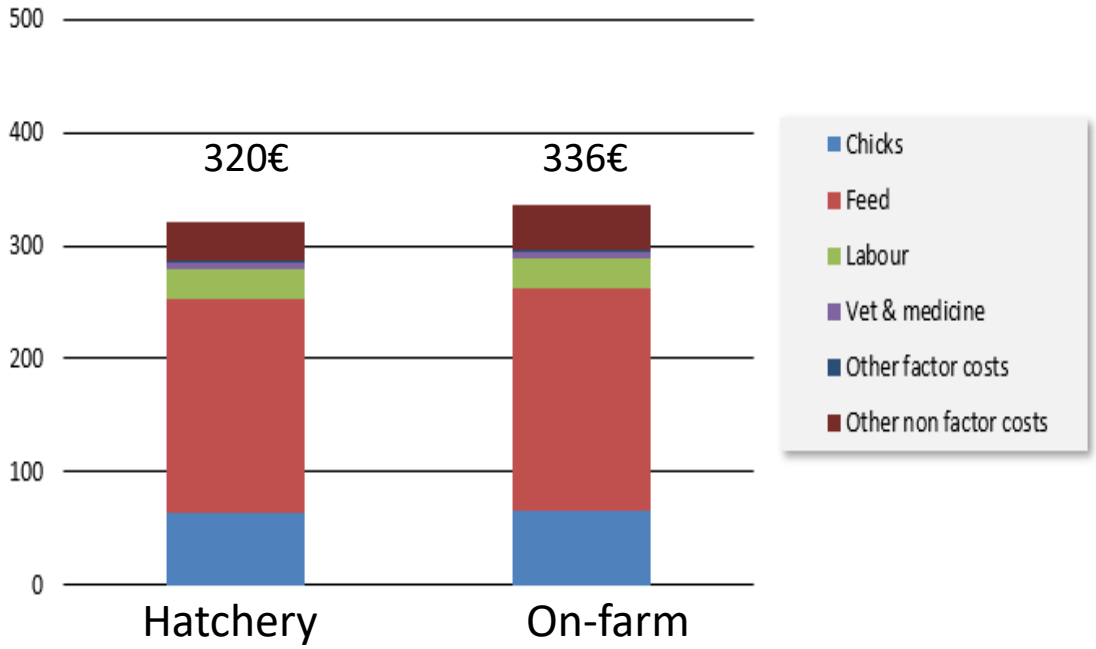
>90% vs. 94% hatchery

- Better AW indicators (EBENE®)
- Difficulty to control egg temperature (semi-experimental)
- Marek Vaccination + Infectious bronchitis on-farm
- Rewarding but more time and monitoring needed
- More energy consumed

Body weight + 3g at day 1; Slightly lower feed efficiency, slightly higher mortality

Economic evaluation

Production costs, €/100 kg Body Weight (BW)

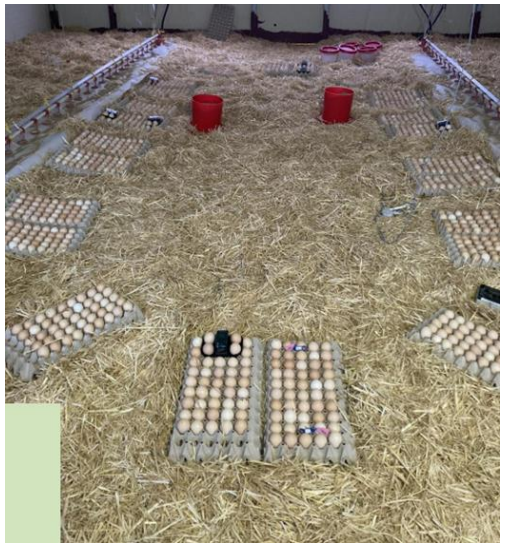


- Lower feed efficiency, body weight and animal numbers : +4.9% costs
- Direct sale : costs stay far below than returns (around 630€/100 kg BW)

Difficulty to obtain eggs of 18 days of incubation in small batches of this strain
On-farm vaccination

Season to be considered for lower heating costs?
Necessary adjustments in ambient T° in small-scale farms
Rewarding and interest for the consumer in direct sale?

Label-type farm

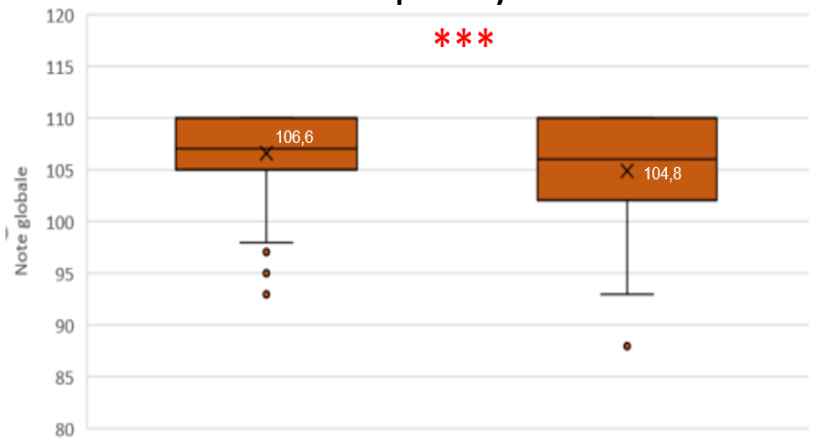


Gas radiants, One2Born system, eggshell monitoring 36-37°C
2 poultry houses with vaccinated eggs of 18 d of incubation
vs. 6 control poultry houses

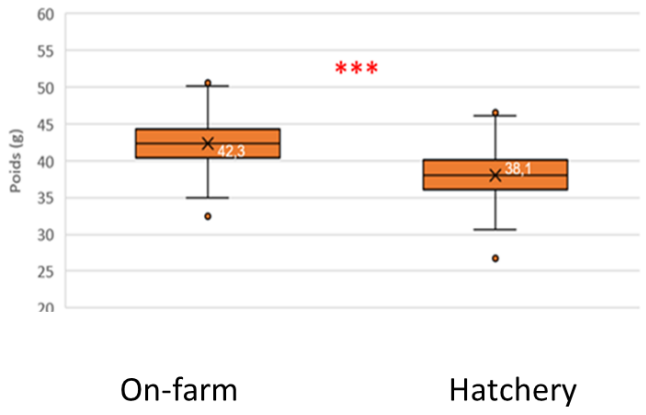
Very good results on-farm

	On-farm hatching	Hatchery
Hatching rate	96.73 %	95.20 %

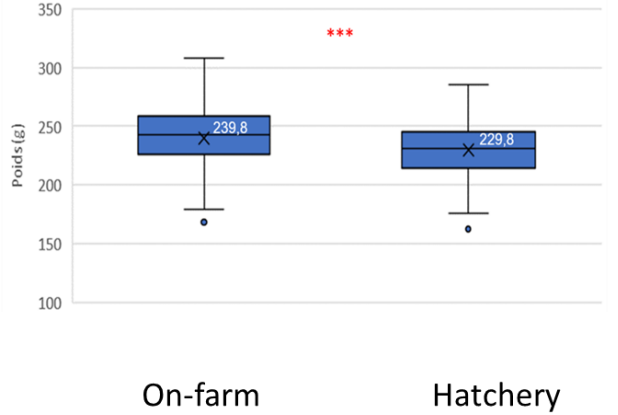
Chick quality scores



BW at d1 (g)



BW at d17 (g)



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+ 37 g at slaughter age (81d): 1d of rearing gained!

- Mortality <1%; catching process: lower stress mentioned by catchers
- Carcasses with less skin lesions
- For the Farmer: greater time for monitoring and stressful at first time, but **rewarding, ready to apply it again, *but with technical support***
- <u>Economic evaluation</u>:

  Performance gain that, depending on the context, may not compensate the cost of eggs + heating + time

 *Difficulty to control animal density within the poultry house (mandatory max.densities)*

Conclusions

- Very interesting in label-type farm with controlled gas radiants

- In low-input independent organic farm with small batches

More difficulty to maintain an homogeneous temperature with 4 pt lower hatching rates

More difficult to obtain I18 vaccinated eggs, no control on the sex ratio and chicken density

-> Also consider on-farm incubation (+ on-farm hatching?)

- Interest of German organic farmers to test on-farm hatching from these results

PPILOW **PARTNERS**

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