Hatchery Talks

Lighting recipes for broilers before and after hatching

Hatchery Talks

PHILIPS Lighting signify once iLOX

1891
Philips founded and first to commercialize light bulbs on mass scale

2001
iLOX founded as product brand

2007
iLOX becomes independent business entity

2008
First commercial LED retrofit lamp launched

2008
ONCE founded and first to introduce spectrum lighting to ag industry

2012
Philips CityTouch and Philips Hue systems launched

2012
ONCE launches first species-specific LED in the world

2016
Philips Lighting separates from Philips and lists on Amsterdam Stock Exchange

2017
ONCE files application for 125th patent

March 2018
Interact IoT platform and LiFi launched

June 2018
ONCE announces Germany-based Ilox and Polish subsidiary acquisition

May 16, 2018
Philips Lighting becomes Signify

May 2019
Signify acquires Minnesota-based ONCE and iLOX entities

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Once applies science to agricultural lighting

Layer light recipe:

- Improving circadian rhythm
- Increase egg production up to 2%
- Improved longevity of layers

Salmon lighting:

- Reduce Maturation to 0%
- Increase growth by 12.8%
- Lower sealice infestations

Broiler light recipe:

- Reducing stress with broilers
- Increased growth up to 4%
- Improved FCR with 2%

Tomato lighting:

- Reduction of 50% in energy
- Boost quality and crop yield by 30% in dark winter times

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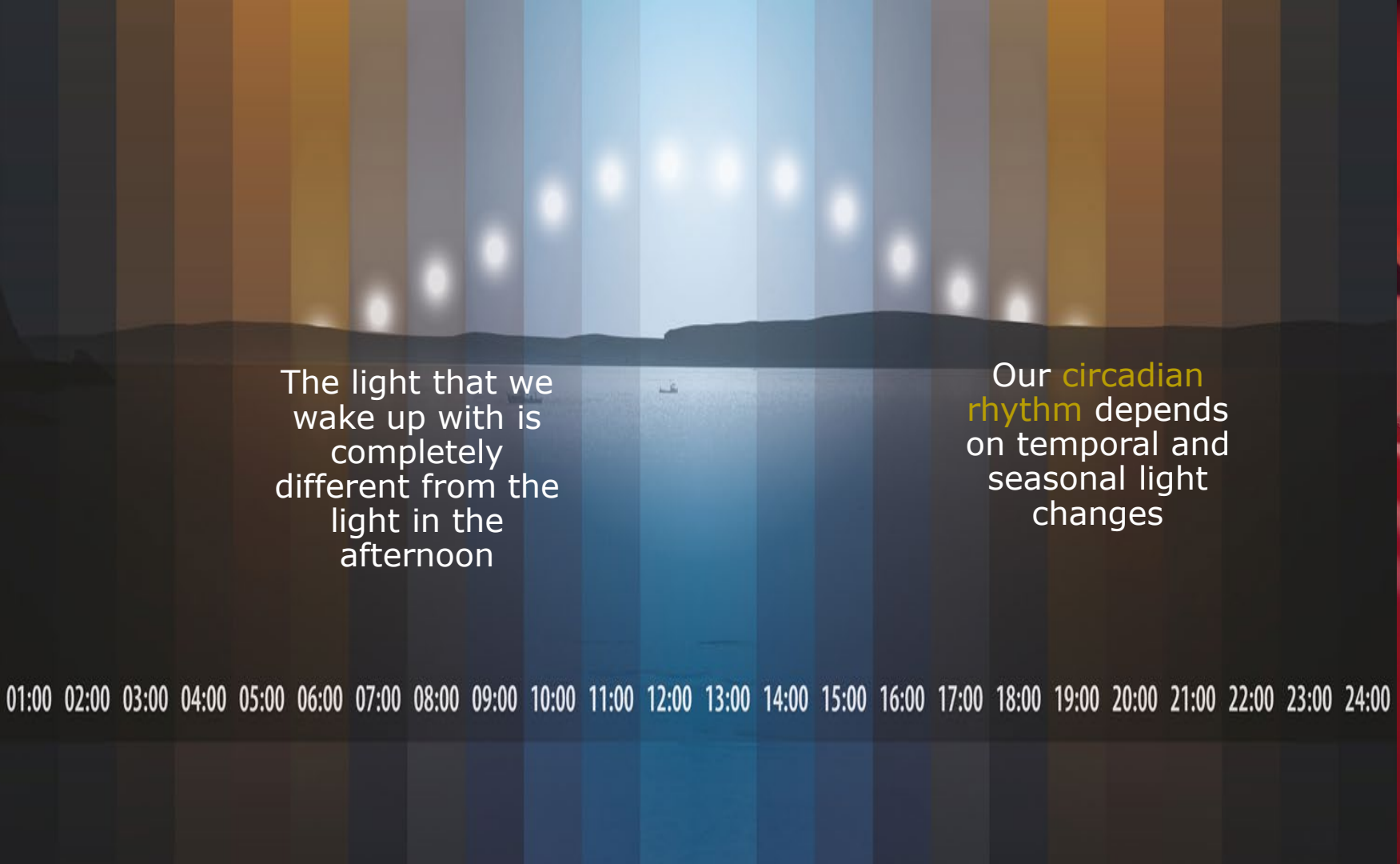
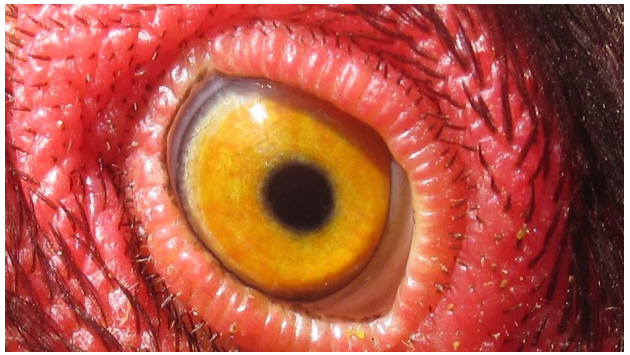
Nature is different everyday


The light that we wake up with is completely different from the light in the afternoon
Our circadian rhythm depends on temporal and seasonal light changes
01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 24:00

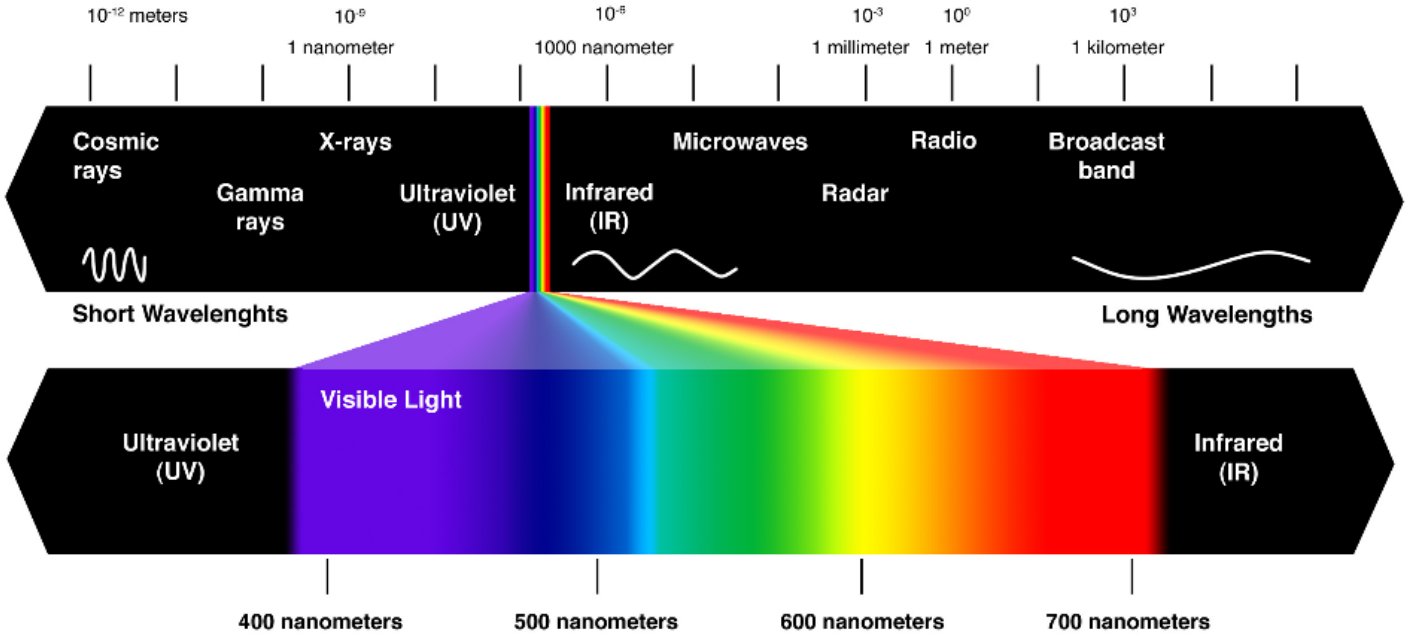
Birds and human perceive light differently

- The emotions, tendencies and habits of animals are similarly affected by natural light

- Just like us, animals also produce melatonin which regulates their internal clock

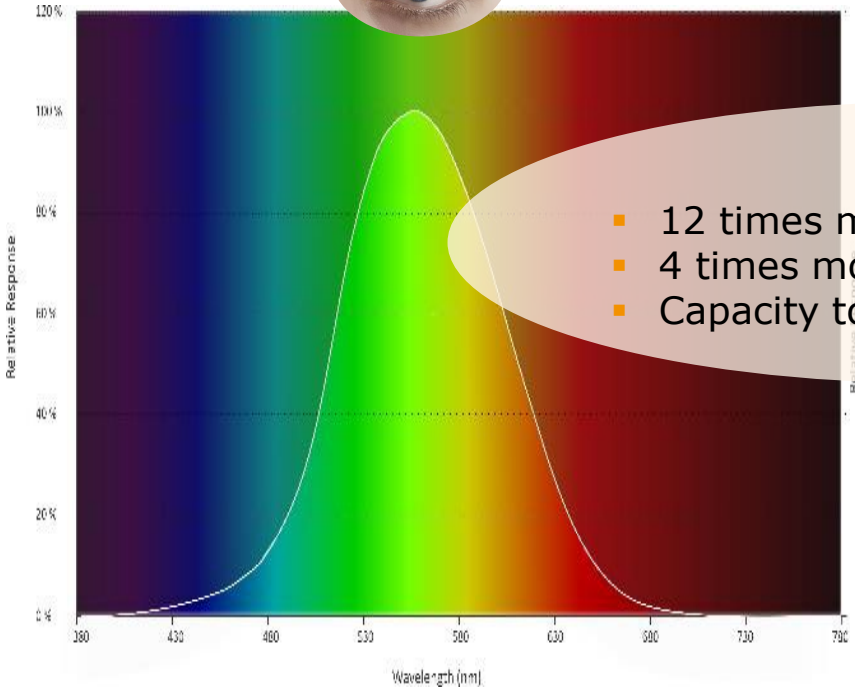


What is light?

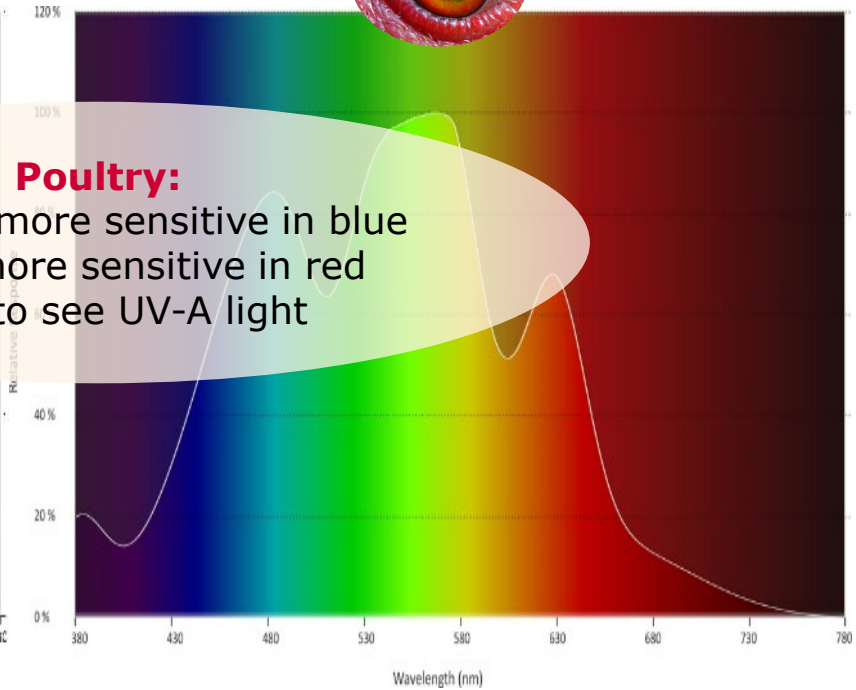


Light sensitivity

Human



Poultry



Poultry:

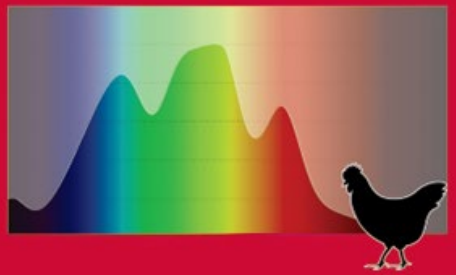
- 12 times more sensitive in blue
- 4 times more sensitive in red
- Capacity to see UV-A light

Data source: »Spectral sensitivity of the domestic fowl (Gallus g. domesticus)« N. B. PRESCOTT AND C. M. (1999)

What is a light recipe?

Leverage these key aspects of lighting to experience optimal success and animal welfare.

Spectrum



- Applies photo-biology
- Meet animal needs at all stages of growth

Intensity

- Optimal light output during animal production cycle

Schedule

- Natural sunrise and sunset simulation
- Proven photoperiod

Hatchery Talks

Focus on broilers

ONCE Junglite recipe development

Years of R&D from academics and industry professionals

Establishment of ONCE internal research farm with over 2.5 years of trials (11 total Junglite trials)

ONCE Research Team has reviewed >2,000 peer-reviewed publications

Dozens of research collaborations with universities

Spectral preference of broilers changes depending on age

- Younger (brooding) birds prefer warm-white or red-enhanced white light
- Older (growing) broilers prefer cool white or blue-enhanced white light

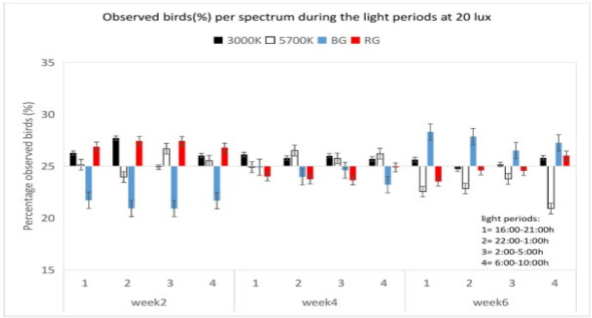


Figure 3.3 Relative percentage of observed birds per light spectrum (3000K, 5700K, BG, RG) and sd during the four light periods (16.00-21.00, 22.00-1.00, 2.00-5.00, 6.00-11.00) at 20 lux.

Older birds (left: blue enhanced, right: red enhanced)

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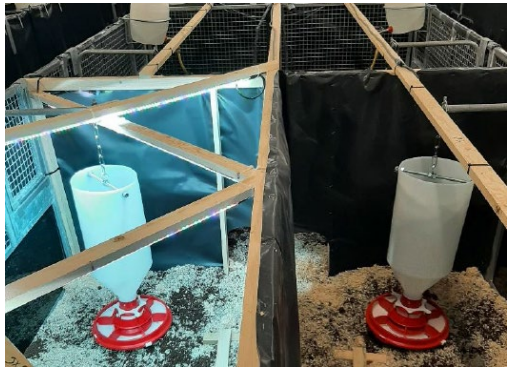
Intensity preference for broilers

- Trial conducted by Wageningen University allowed chicks to choose light intensity
- 4 zones: 0.2 lux, 20 lux, 50 lux and 1000 lux
- Young chicks preferred to remain under high intensities
- At older age, this preference shifted to the darker zones



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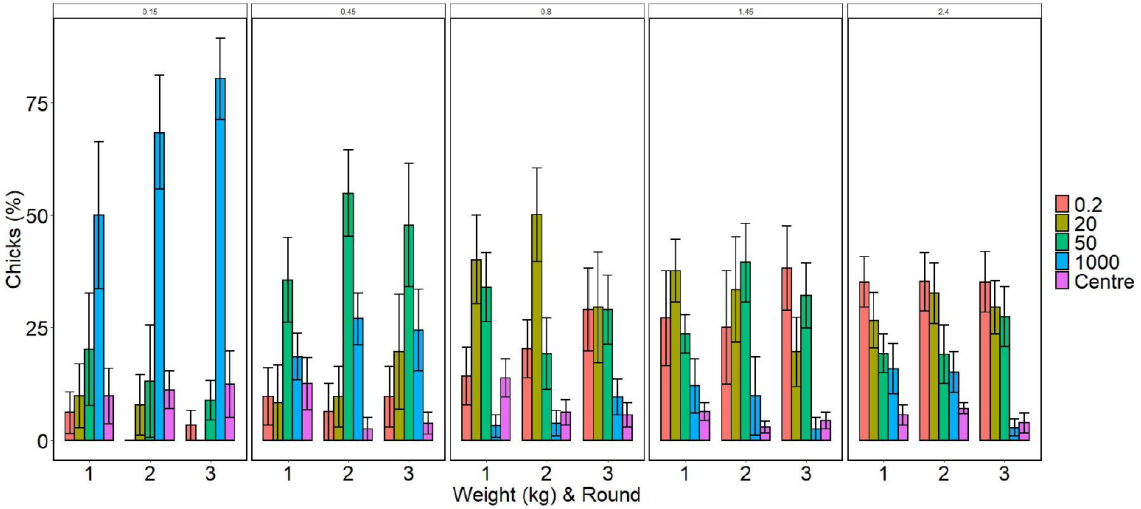
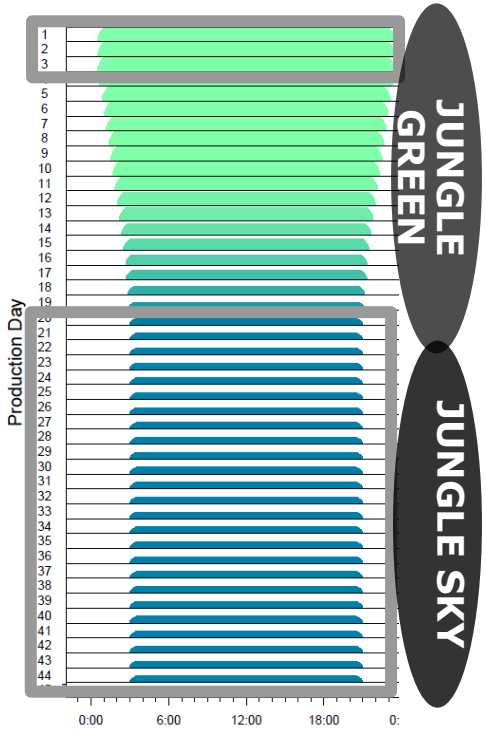


Recipe for improved performance and welfare: Junglite



Jungle green spectrum (brooding phase)

- Encourage bird **movement and feeding/drinking** behaviors
- Establish sound **musculoskeletal system**

Jungle sky spectrum (grow out phase)

- **Reduce bird activity, piling, and stress** with blue/green spectrum
- Improve **FCR** and **welfare**
- Improve **uniformity** and **growth**
- Monochromatic blue spectrum for **bird catching**

Note: utilizing the enhanced color spectrum is a patented concept by Once Innovations®

The Junglite recipe has two distinct phases

Brooding phase (first 10 days of production)

- Full spectrum green-enhanced light activates young birds
- This ensures an optimum start for healthy birds

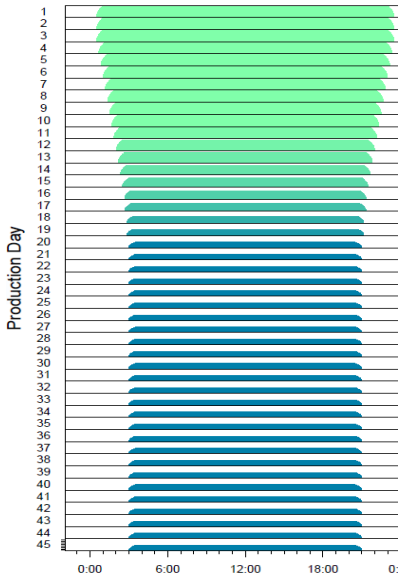
Grow-out phase (after 10 days of production)

- Blue-enriched light at dimmed levels reduce stress.
- This enhances feed conversion ratio (2% improvement)

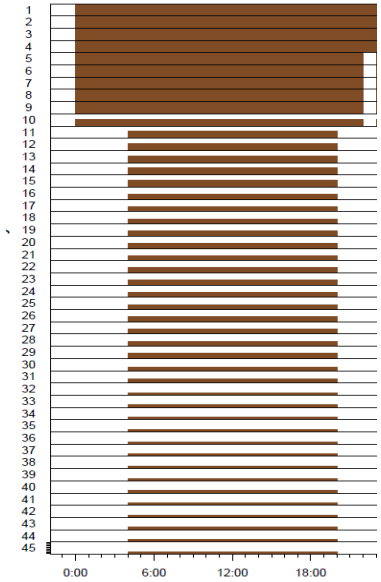
Commercial trials

Tested Junglite recipe vs white

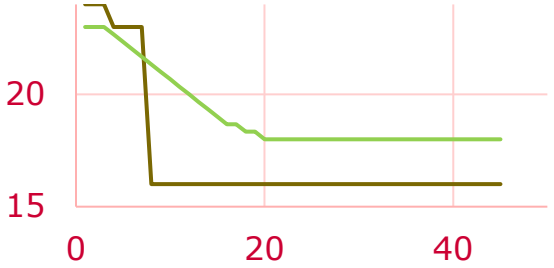
Junglite



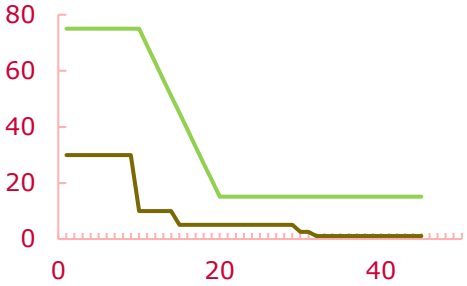
Control



Photoperiod

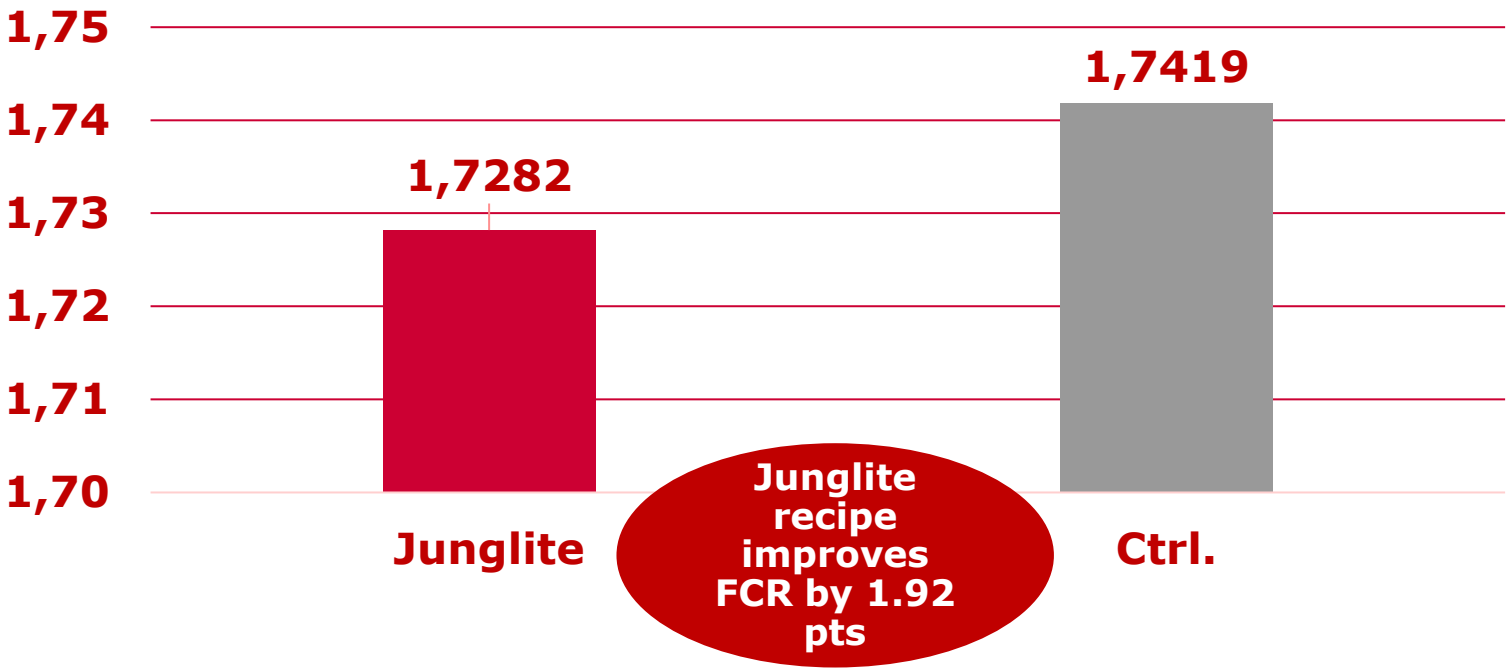


Intensity



38 global broiler field trials

Average FCR for 38 global trials



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7 welfare-centric field trials

Junglite vs. white LED	Reduced physiological indicators of stress (2 tests)	Reduced fear (5 tests)	Enhanced human/animal relationship (1 test)
Trial 1	✓	✓	✓
Trial 2	✓	✓	✓
Trial 3	✓	✓	✓
Trial 4a + 4b	—	✓	✓
Trial 5a + 5b	✓	✓	✓

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Hatchery trial results

Hatchery trial results

Photoperiodic lighting positively influences

- Hatchability
- Chick quality
- Post-hatch welfare metrics

Challenge with photoperiodic lighting during egg incubation

- **Early feeding in the Pas Reform SmartStart™ system requires that the birds see the feed.**

- **If photoperiodic lighting is used, any chicks hatched during the night phase will not see the food.**

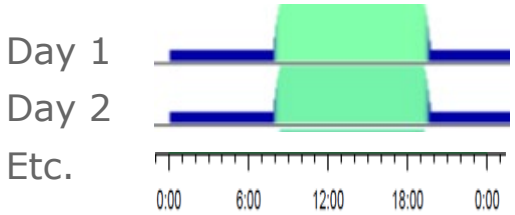
Incubation lighting recipes tested

- **Trial consist of 2 stages**
    1. hatchery trial with 2 different recipes
    2. grow out trial with 2 different recipes

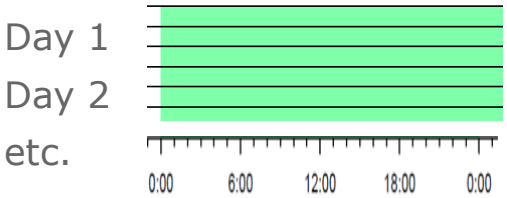
- **Total 980 eggs received**
- **500 chicks in the grow out phase**

Incubation lighting recipes tested

ND Dome – Junglite 12L:12Blue



24h Light



Incubation location

ONCE Biological Research and Development Lab

940 eggs received and placed in small scale incubator

558 – Incubator 1 – 12L:12Blue

382 - Incubator 2 – 24L

E21 Hatch Day

Incubator 1: 455 hatched (2 euthanized)

Incubator 2: 260 hatched (2 euthanized)

Hatching statistics

Incubator 1
12L:12Blue
558 Eggs set
57 Clear

501 To hatch basket
453 Hatched (2 euthanized)

Fertility rate
501/558 = 89.8%

Hatch of fertile
453/501 = 90.8%

Incubator 2
24L
382 Eggs set
49 Clear

333 To hatch basket
258 Hatched (2 euthanized)

Fertility rate
333/382 = 87.2%

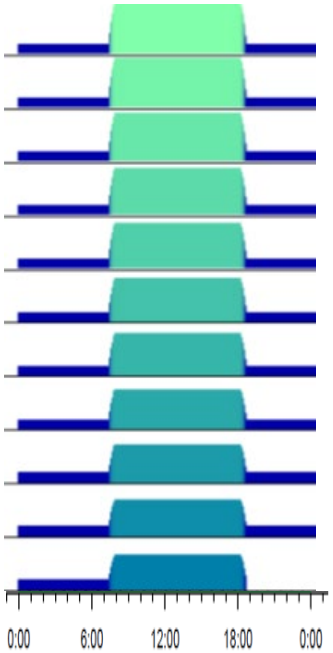
Hatch of fertile
258/333 = 78.1%

More repetitions needed to confirm results

Post-hatch lighting recipes tested

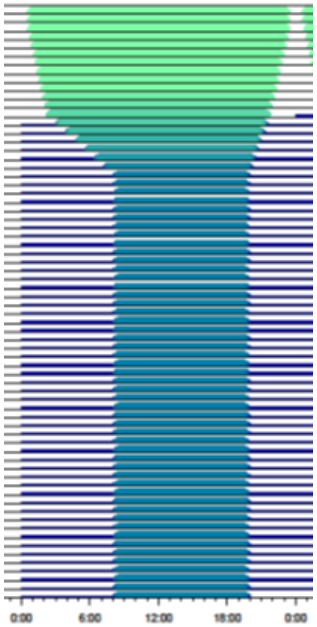
ND Dome
Junglite 12L:12Blue Day 0

Day 1
Day 2
Day 3
etc.



ND Dome
Junglite 12L:12Blue Day 14

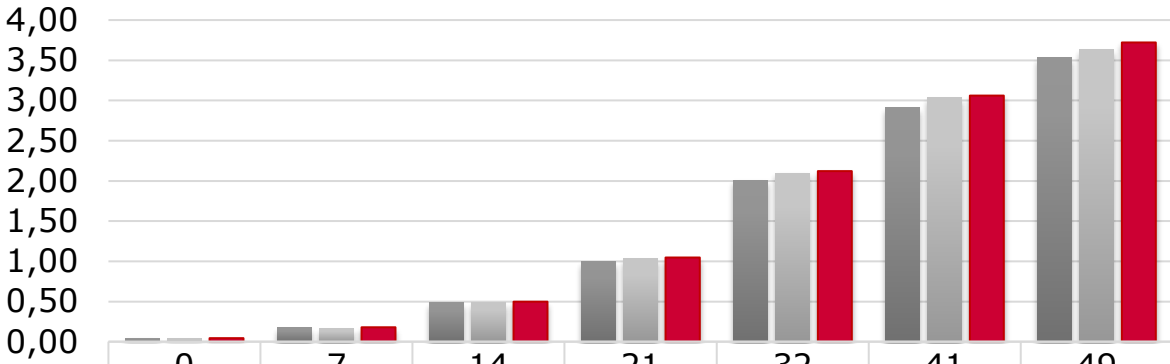
Day 1
Day 2
Day 3
etc.



Data collected

- Feed consumption is measured daily (kg).
- Mortality monitored daily.
- Birds are weighed periodically throughout the grow out
- Average weights and feed conversion rate calculated as of each day of weighing.

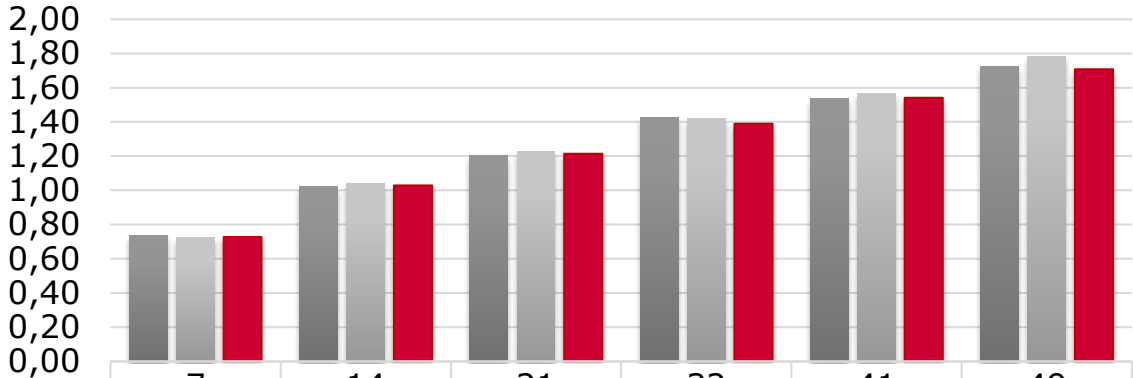
Results - Weight data



	0	7	14	21	32	41	49
24L / 12L:12Blue Day 14	0,05	0,17	0,48	1,00	2,01	2,91	3,53
12L:12Blue / 12L:12Blue Day 0	0,04	0,17	0,49	1,04	2,10	3,04	3,64
12L:12Blue / 12L:12Blue Day 14	0,04	0,18	0,50	1,05	2,12	3,06	3,72

24L / 12L:12Blue Day 14 12L:12Blue / 12L:12Blue Day 0 12L:12Blue / 12L:12Blue Day 14

Results - Feed conversion data



	7	14	21	32	41	49
24L / 12L:12Blue Day 14	0,74	1,02	1,20	1,42	1,54	1,73
12L:12Blue / 12L:12Blue Day 0	0,73	1,04	1,23	1,42	1,57	1,78
12L:12Blue / 12L:12Blue Day 14	0,73	1,03	1,21	1,39	1,54	1,71

Preliminary conclusions

Incubation

- Large improvement in hatch of fertile under 12L:12Blue incubation vs. 24L (90.8% vs. 78.1%) with similar fertility rates (89.8% vs. 87.2%)
- Higher weights for bird incubated under 12L:12Blue

Grow Out

- Increased weight seen in those birds getting Junglite for first 14 days then 12L:12Blue

12L:12Blue Incubation + 12L:12Blue starting at day 14 of grow out =

➡ **The best weights and FCR.**