Make lights great for animals!

Special LED Lighting for Poultry Production: Study and Extension

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2018
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1. About LightTalk®

Zhejiang University, Prof. Pan,
One of the most authoritative teams on animal light in the world

*LightTalk®* devotes to offering the most economical and special LED light for animal, to promote their production as well as health.

*LightTalk®* has been undertaking national science and technology support project, special fund, natural science foundation, such researches on LED light and animals.

The product has been applied in more than 400 companies in China.
2. Light for birds

How does light work on birds

The efficiency of different wavelength light passing through the optic nerve to the hypothalamus or reaching the hypothalamus through the skull and intracranial organization **is different**!
2. Light for birds

- Birds are more sensitive to light than human
- Birds can see the flickering at lower frequency (<130 Hz)
- The terrible flickering makes birds feel the press from the shadow which like eagle coming. It will influence the intake as well as growth of birds.

The flickering of different bulbs under AC 220V
3. Lighting for Breeder/layer Production

Long wavelength could promote sexual maturity significantly than short wavelength

<table>
<thead>
<tr>
<th>Age/Wk</th>
<th>I</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<tr>
<td>23-29</td>
<td>53.48</td>
<td>49.08</td>
<td>54.58</td>
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<td>30-56</td>
<td>51.27</td>
<td>51.50</td>
<td>50.11</td>
<td>50.93</td>
<td>50.01</td>
<td>51.86</td>
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</table>

Research of spectrum on sexual maturity and laying with breeder
3. Lighting for Breeder/layer Production

- Total egg number per bird
- Total egg mass per bird
- Highest laying rate

Abnormal egg production
Fertility
Hatchability
Red light easily results in high-yield syndrome

- Longwave promotes hormone secretion of birds to achieve high yield
- Shortwave promotes calcium absorption to ensure high quality eggshell
- Only reasonable proportion could reach cooperative improvement

SPF breeder house

Red LED in layer house

Spotted egg and soft-shelled egg
3. Lighting for Breeder/layer Production

Special spectrum for layer /breeder

- Proportion wavelength & Mild spectrum:
- Red (promote eggs) + Blue (promotes calcium absorption) = More eggs with good quality
- Decrease pecking behavior = Lower mortality

Perfect design
3. Lighting for Breeder/layer Production

Optimizing the layout of lamps:
Poultry lighting standards
Irritation angle of lamps, cage size and layout

Uniform light /Uniform group
Stable laying rate

Common uneven illumination design
(Bright and dark zones on ground)

Professional design, Uniform illumination
(Peak Laying rate improved from 95% to 97.5% and maintained for 2 months)
3. Lighting for Breeder/layer Production

- Cold white energy-saving lamps (fluorescent): high blue light component, low red light composition
- Ban of IL and promotion of FL reduced production of layer and breeder
- Symptom: Obesity, abdominal fattiness, late mature, low laying peak rate

Special LEDs could successfully replace incandescent bulbs.

Laying rate could only maintain at 80% for 3 to 5 weeks by using normal lamps. Laying rate maintains at 80% for 10 weeks and then decreases slowly by using special LEDs.

Data source: Wens Group, the biggest animal husbandry company in China
3. Lighting for Breeder/layer Production

Beijing DQY Agriculture Technology Co., Ltd
House: 93924 layers/house, 8-tiers caged
Date: Reared to 80 weeks, laying rate 90% last 40 weeks, a total of 378 eggs/bird
3. Lighting for Breeder/layer Production

CP Group in China
Broiler Breeder House
Applied LightTalk®
Special LED system
4. Lighting for Broiler Production

Spectrum optimization

Blue & green advantage at early stage

Yellow & red advantage at later stage

Cumulative growth rate (%) vs. Age (days)

PLoS One, 2015,10 (8): e0135330
4. Lighting for Broiler Production

Blue-green mixture

Uncomfortable problem of eyes may caused by green and blue

Body weight

Food conversion

Invention patents (201410012863.0) / Application PCT / PLoS One, 2014: e113595
4. Lighting for Broiler Production

Invention patents (201410012863.0) / Application PCT
4. Lighting for Broiler Production

Yellow-white mixture

Body weight

Food conversion

Invention patents (201410013075.3) / International Patent Application PCT
4. Lighting for Broiler Production

Light period

Feed intake at early stage

\[ FI = 17.487t + 1248.2 \]
\[ R^2 = 0.9029 \]

Feed intake at later stage

\[ BW = 3.7982t + 471.12 \]
\[ R^2 = 0.9874 \]
### 4. Lighting for Broiler Production

![Graphs showing the effects of light exposure on P, Ca, K, and Na concentrations.](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>P</th>
<th>Ca</th>
<th>K</th>
<th>Na</th>
<th>TC</th>
<th>TG</th>
<th>GLU</th>
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<td>-0.534*</td>
<td>0.454</td>
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<td>0.175</td>
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<td>-0.534*</td>
<td>0.190</td>
<td>0.006</td>
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<td>0.033</td>
<td>0.703*</td>
<td>0.025</td>
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<td>0.278</td>
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<td>-0.262</td>
<td>1</td>
<td>-0.111</td>
<td>0.281</td>
<td>-0.066</td>
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</tbody>
</table>

**Scientific Reports, 2016, 6: 24808**
Two houses, 1680 m² per house
Started from October, 2012
200,000 AA+ broilers
15 Batches
CFL as control

- Lower mortality: 2.17%
  (During an occasional disease, mortality was 44.4% lower compared to control)
- Higher feed conversion: 0.75%
- Reduced power consumption: 75.0%
- Longer working life: at least 3 times
4. Lighting for Broiler Production

Jinan Jiuben

Fuxi subsidiary

Special spectrum + lower intensity (later stage) = Lower mortality & Higher uniformity
5. LightTalk® Product

Breeding Environment
- High humidity: disinfectant spray and humidification
- High dust: feed and feather
- Corrosive gases: ammonia and hydrogen sulfide

Poultry Demand
- Continuous lighting everyday
- Long breeding period
- Spectrum demand for different varieties
- Light intensity demand for different ages
- Sensitive to light switch on or off
- Sensitive to stroboscopic light

- Waterproof
- Dustproof
- Anti-corrosion

- Fast Cooling
- Slow Attenuation
- Specific Spectrum
- Changeable Control
- Dimmable
- Gradual Change
- Low Strobe
5. LightTalk® Product

Special LED bulbs (AC)

Special LED pipes (DC)

Tri-proof LED lamp

Controller for LED bulbs (AC)

Controller for LED pipes (DC)

IP65 Integration wire
5. LightTalk® Product

Whole System Design

- Wire Waterproof
- Easier installation  Easier replacement
Gradual display of intelligent control system
(Silicon controlled mode, 190-300V alternating current)

Phased light intensities to simulate the sun
Gradually brightening or dimming
5. LightTalk® Product

Low voltage direct current LED system

- Higher safety
- Higher line loss and thicker wires/cables
- The brightness of front and rear LED lamps is not consistent
- Higher risk of darkness of the whole house because of the power supply

AC is better in aisles while DC better in cages.
### 6. LightTalk® cases: Layers and Breeders

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>北京市华都峪口禽业有限公司</td>
<td>World's top three egg breeding companies</td>
</tr>
<tr>
<td>华裕农业科技有限公司</td>
<td>Vice President unit of China animal husbandry association</td>
</tr>
<tr>
<td>四川圣迪乐村生态食品有限公司</td>
<td>BFA (Boao Forum for Asia) nominated supplier for egg products.</td>
</tr>
<tr>
<td>四川正鑫农业科技有限公司</td>
<td>China laying hens breeding base</td>
</tr>
<tr>
<td>沈阳华美畜禽有限公司</td>
<td>Strategic cooperative enterprise of Hy-line international</td>
</tr>
<tr>
<td>北京德青源农牧科技有限公司</td>
<td>2008 Beijing Olympic Games nominated supplier for egg products.</td>
</tr>
<tr>
<td>山西晋龙集团</td>
<td>Biggest Laying hens company in Shanxi Province of China (3 millions)</td>
</tr>
<tr>
<td>荣达食品有限公司</td>
<td>Biggest Laying hens company in Anhui Province of China (3 millions)</td>
</tr>
<tr>
<td>鸿轩农业</td>
<td>China's first egg products enterprise approved by SGS safety certification</td>
</tr>
<tr>
<td>宁夏顺宝现代农业</td>
<td>Biggest Laying hens company in Western of China (1 million)</td>
</tr>
</tbody>
</table>
6. LightTalk® cases: Layers

- 廣東綠楊農業股份有限公司
- 河南省暖洋洋現代農牧業有限公司
- 河南滿意禽業有限公司
- 河南益源生物技術有限公司
- 河南長垣縣東蒲養殖有限公司
- 河南中州牧業有限公司
- 河北金凱牧業有限公司
- 河北萬雉園農牧科技有限公司
- 河北宏興郞农牧發展有限公司
- 河北唐山豐南區惠福園養殖有限公司
- 河北楊華智
- 河北涿州正晟農業科技有限公司
- 湖南大山農業開發有限公司
- 湖南縣藍鳳凰農業
- 湖南永州市冷水灘永成合養殖專業合作社
- 湖北恩施州新旺牧業
- 浙江江山科皇蛋雞養殖公司
- 浙江江山市穗豐牧業有限公司
- 山東濟寧聚匯禽業有限公司
- 福建光陽蛋業
- 重庆市合川區海林禽業責任公司
- 江西南門生態農業
- 天津威龍禽業有限公司
- 天津市百勝蛋雞養殖專業合作社
- 云南富民縣壟業畜禽有限公司
- 云南開遠市永華種雞場
- 陝西邁信德源
- 湖南文昌潭牛嘉源蛋鸡場
- 湖南蘭州農業開發有限公司
- 甘肅張掖市建華禽業有限公司
- 甘肅烏海市鑫宏養殖場
- 山西長治縣威杰禽業有限公司
- 山西晉城市旭勝綠色養殖專業合作社
- 黑龍江溝海蛋雞養殖
- 浙江湖州科皇蛋雞養殖公司
- 浙江江山市穗豐牧業有限公司
- 山東濟寧聚匯禽業有限公司
- …
6. LightTalk® cases: Broiler and Breesders

- 北京家禽育、南通正大、黑龙江正大、湖北正大
  CP Group
- 河南省陈州华英禽业有限公司
  Huaying group subsidiary, 40 million chickens per year
- 沈阳树新畜牧有限公司/铁岭营盈牧业有限公司
  Biggest poultry breeding companies in Liaoning Province
- 山东福喜（威海）农牧发展有限公司
  Fuxi subsidiary, largest KFC chicken suppliers of China
- 威海合鑫农业科技有限公司
  Weihai City breeding demonstration base
- 安徽省固镇县亿只肉鸡产业化项目
  Key agriculture project, hundreds of millions meat chicken
- 烟台牟平某肉鸡场
- 济南九本
- 开封市兴达禽业有限责任公司
- 北京康达种鸡场
6. LightTalk® cases: Yellow-Feather Broiler Breeders

温氏集团
China's largest animal husbandry enterprise

江苏立华牧业股份有限公司
One of China's largest yellow feather chicken breeding, aquaculture enterprises

- 广西凤翔集团
- 广西金陵农牧有限公司
- 广西富凤农牧有限公司
- 广西园丰牧业有限公司
- 广西鸿光农牧有限公司
- 广西贵港市港丰农牧有限公司
- 河南粤禽农牧有限公司
- 山东南山龙凤特禽繁育基地
- 吴川市粤凤农牧有限公司
- 浙江群大畜牧有限公司
- 浙江光大种禽业有限公司
- 江西抚州市临川龙鑫生态养殖有限公司
6. LightTalk® cases: Other animals

- 安徽黄山强英鸭业有限公司
  East China's largest cherry valley SM3 (large) generation and parents breed ducks breeding enterprise
  Agricultural industrialization national key leading enterprise

- 山东荣达农业发展有限公司
  Agricultural industrialization key leading enterprise (Breeding, slaughtering, processing industrial chain for breed and meat ducks)

- 江苏南京长沃农业科技有限公司
  East China's largest Haldor Baghi geese enterprise
6. LightTalk® cases: Poultry house
6. LightTalk® qualification: Funding

- National science and technology support project
- National public interest research special fund
- Natural science foundation
- National small and mid-sized enterprise technology innovation fund
- Hundred Talents highest level support entrepreneurship program in Jianggan District of Hangzhou
- The blue plan of hangzhou start-ups
- Interdisciplinary frontier exploration project in Zhejiang university
6. LightTalk® qualification: Patents

- Intelligent light system and light control method for laying hens (PCT)
- Hen or chicken coop ladder scale LED lamp lighting method and system
- Intelligent parent stock breeding illumination system and illumination control method
- Artificial lighting method and system applied in breeding of breeder cock
- Method and device fill sheds natural daylight and night with artificial light
- Broiler mixed type LED lighting system and method (PCT)
- The human friendly green – blue mixed LED illumination method and system (PCT application)
- Alternate lighting method and system arrangement sheds green and blue LED lights
- Monitoring device for self selection characteristics of light intensity of poultry breeding
- Monitoring method and system for daily routine and activity degree of chicken
- Light source control system for livestock breeding

Two PCT patent and 13 national invention patents
A new method to manipulate broiler chicken growth and metabolism: Response to mixed LED light system. Scientific Reports, 6, 25972

Physiological responses to daily light exposure. Scientific Reports, 2016, 6: 24808

Changes in pigment, spectral transmission and element content of pink chicken eggshells with different pigment intensity during incubation. PeerJ, 2016, 4:e1825

The relationship of spectral sensitivity with growth and reproductive response in avian breeders (Gallus gallus). Scientific Reports, 2016, 6: 19291

Human-Friendly Light-Emitting Diode Source Stimulates Broiler Growth. PLoS ONE, 2015, 10(8): e0135330


The behavioral preferences and performance of female broilers under unevenly distributed yellow led lights with various intensities. Transactions of the ASABE, 2014, 57(4): 1245-1254

Effect of natural daylight intensity, overnight artificial LED light colors and duration on growth performance of female broilers, 2013, ASABE Annual International Meeting, Paper Number: 131595210 , Kansas City, Missouri, USA

Behavior preference and performance of female broilers under different yellow LED lighting intensities, 2013, ASABE Annual International Meeting, Paper Number: 131619449, Kansas City, Missouri, USA1.


6. LightTalk® qualification: Award

TOP100 of Global LED lighting showcase (2013, Broiler case)

TOP100 of Global LED lighting showcase (2018, Layer case)
6. LightTalk® qualification: International reports

9/2018, Hanoi, Vietnam
4/2018, Sao Paulo, Brazil
12/2017, Beijing, China
8/2017, Vienna, Austria

5/2017, Hangzhou, China
1/2017, Atlanta, America
11/2016, Beijing, China
10/2016, New Delhi, India