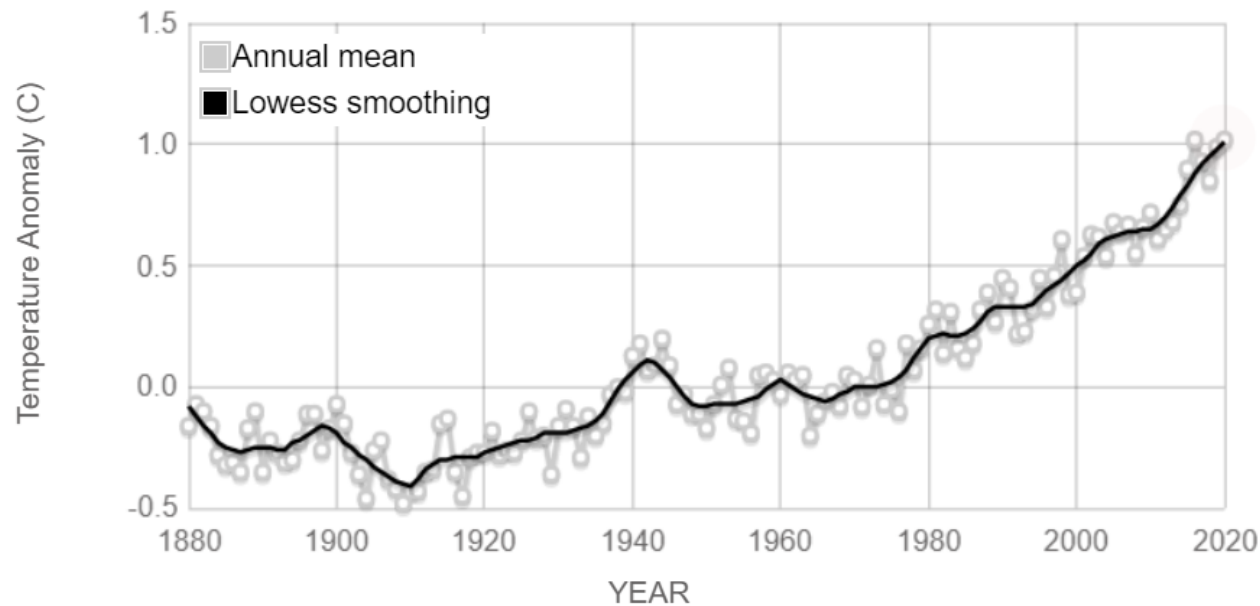
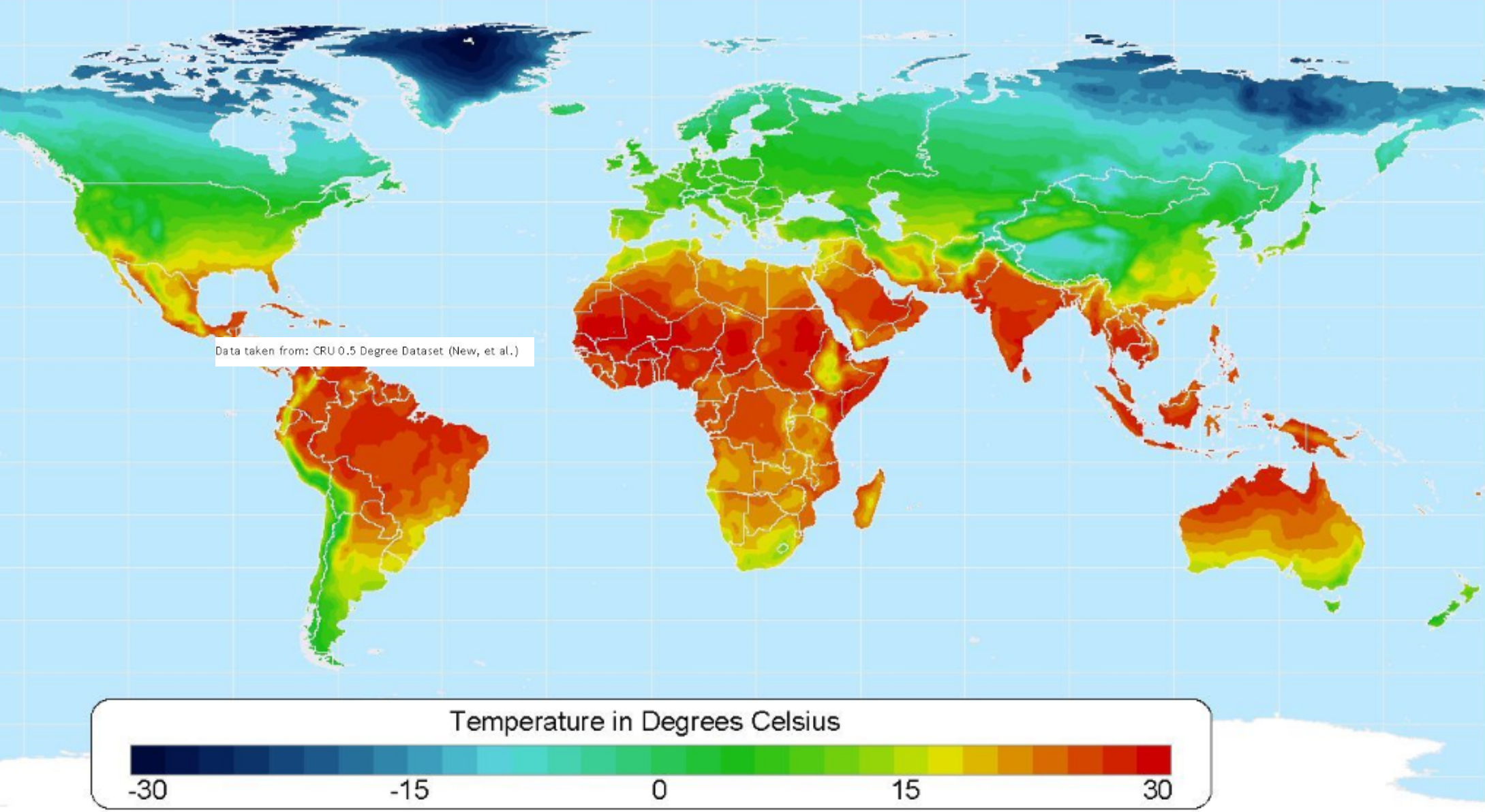


Annual change in temperature



Data source: NASA's Goddard Institute for Space Studies (GISS). Credit: NASA/GISS

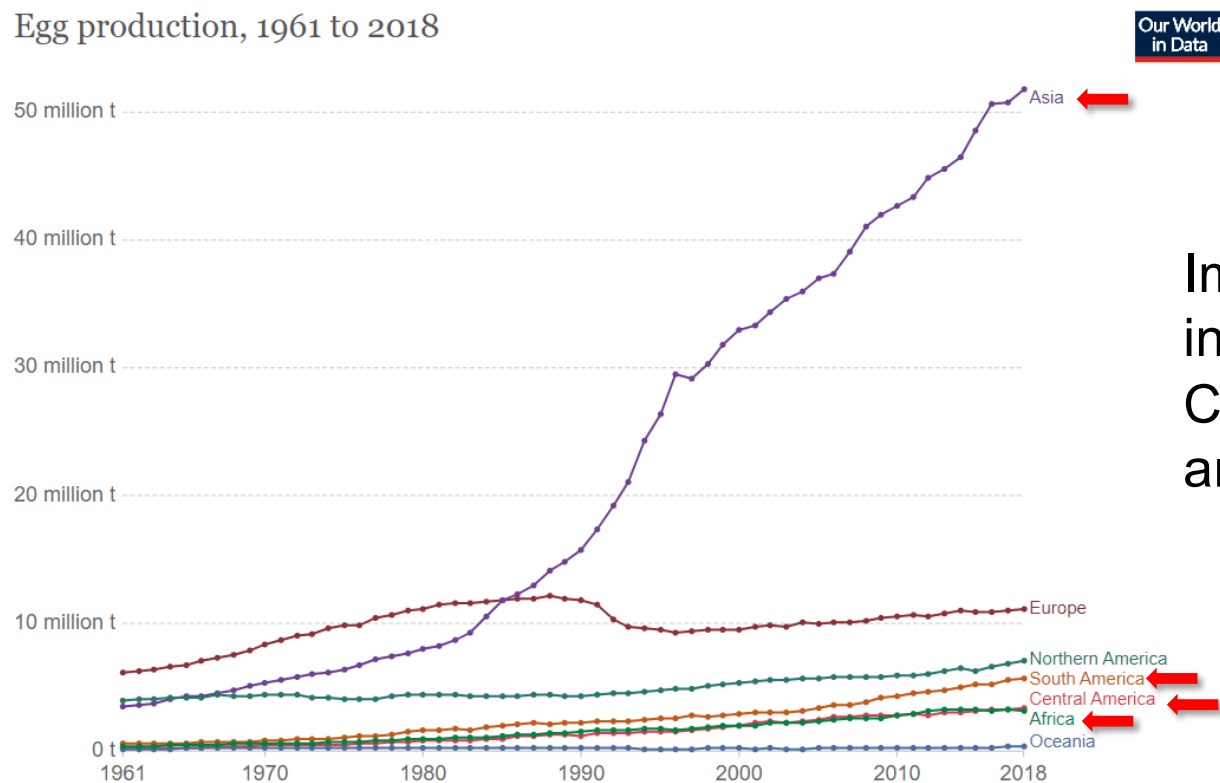
<https://climate.nasa.gov/vital-signs/global-temperature/>



CRU 0.5 Degree Dataset (New, et al.)

Egg production evolution since 1961

Egg production, 1961 to 2018



Our World
in Data

Important growth
in Asia, South and
Central America
and Africa

Source: UN Food and Agricultural Organization (FAO)
Note: Figures include eggs derived from all domesticated or farmed birds.

OurWorldInData.org/meat-production • CC BY



INTERNATIONAL

The key to your profit!



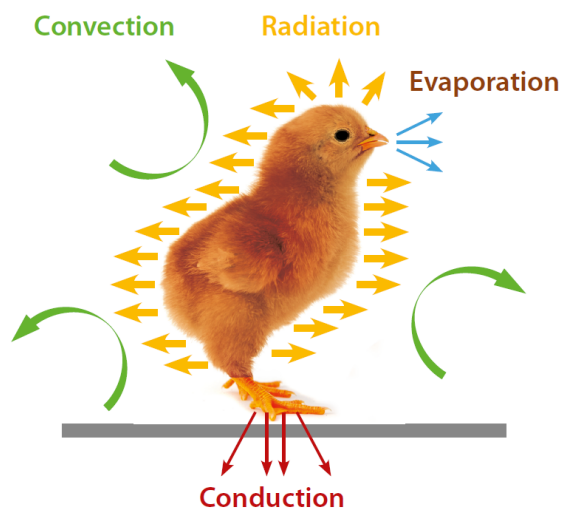
Tips to solve heat stress

Academy Asia H&N 2021

Maurice Raccoursier MV MSc

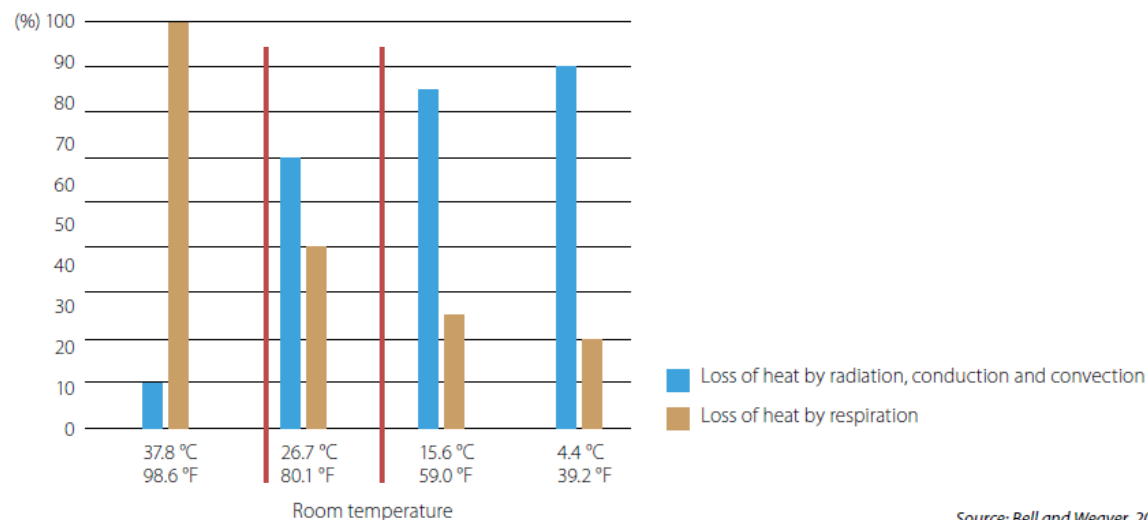
Global Technical Service

How birds lose heat?



H&N Management Guide, 2019

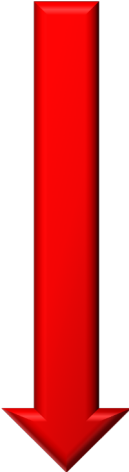
Effect of the room temperature on the different ways of losing heat



Source: Bell and Weaver, 2002

- Temperature increases, loss of heat by evaporation increases.
- Humidity increases, the moisture that can be evaporated decreases.
- Key is a high-speed movement of air.

Temperature and its effects



Temperature		Effects
°C	°F	
< 20 °C	< 51.8 °F	Increased feed conversion
20–27 °C	51.8–77 °F	Ideal temperature for good performance and feed conversion.
27–31 °C	77–87.8 °F	Slightly reduced feed intake.
32–36 °C	89.6–96.8 °F	Further reduction of feed intake. Reduced activity and drop in egg production, egg weight and shell quality.
37–39 °C	98.6–102.2 °F	Severe reduction of feed intake. Increase in cracked eggs. Mortality of heavier hens or those in full production.
40–42 °C	104–107.6 °F	Severe panting and respiratory alkalosis. Increased mortality due to heat prostration.
> 42 °C	> 107.6 °F	Emergency measures are needed to cool down hens for survival.

- Not only very warm countries suffer of heat stress.
- At temperature above 32 °C (89.6 °F) decline in performance occurs.
- It's critical the hot weather management

Effect of High Temperatures on Different Productive Traits

Productive Trait	Effect of High Temperatures
Egg Production	Decreases when the temperature reaches 30 °C (86 °F)
Egg Weight	Decreases: 0.4 % per 1 °C/33.8 °F between 23 - 27 °C/73.4 - 80.6 °F 0.8 % per 1 °C/33.8 °F above 27 °C/80.6 °F
Feed Intake	Decreases: 1.4 % per 1 °C/33.8 °F between 20 - 25 °C/68 - 77 °F 1.6 % per 1 °C/33.8 °F between 25 - 30 °C/77 - 86 °F 2.3 % per 1 °C/33.8 °F between 30 - 35 °C/86 - 95 °F 4.8 % per 1 °C/33.8 °F above 35 °C/95 °F

H&N - Hot Climate Management Guide, 2011

- Decreases
 1. Egg production
 2. Egg weight and shell quality
 3. Feed intake

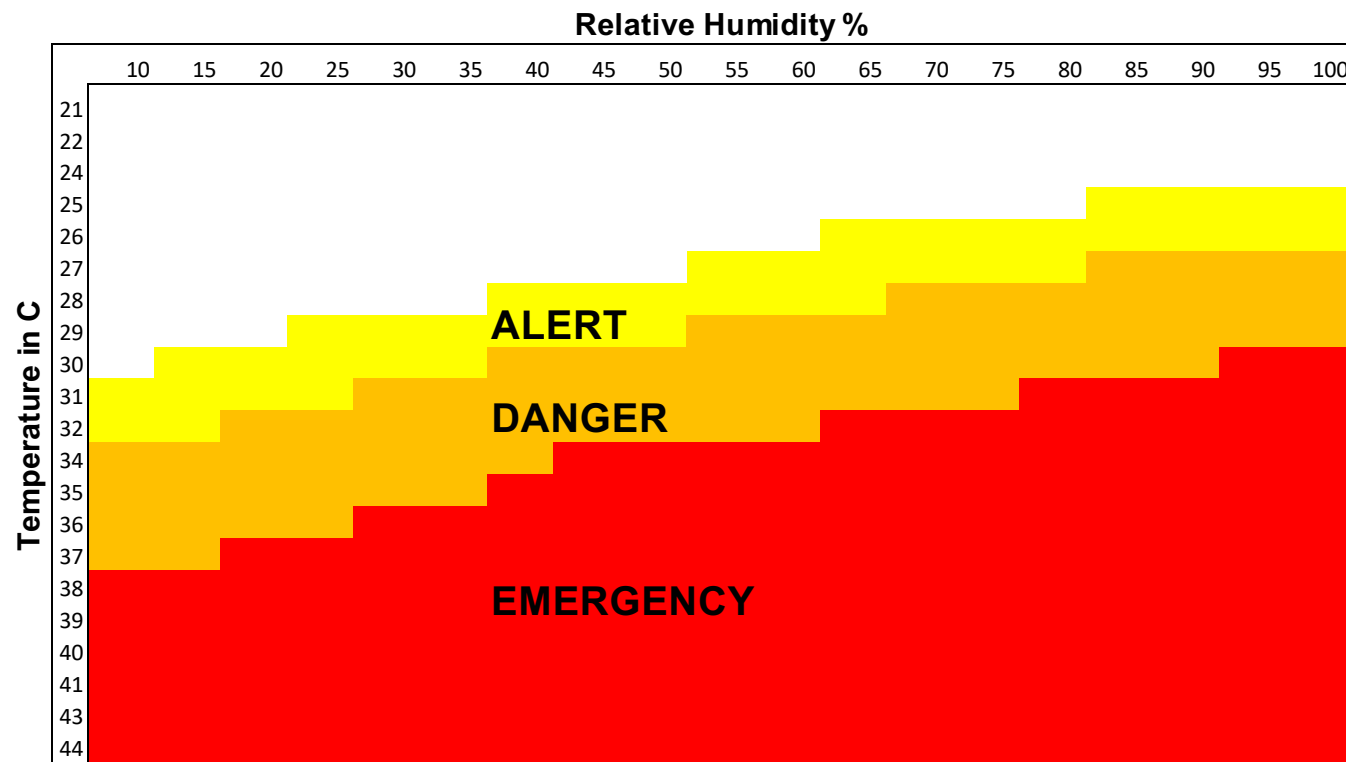
- Impact depends on:
 1. Max. temperature
 2. Duration of high temp.
 3. Rate of temp change.
 4. Relative humidity.

Temperature + relative humidity of air = effective temperature.

- Increase of RH increases bird's discomfort.
 1. Low RH = evaporative cooling and air speed.
 2. High RH = air speed.

Heat stress index

Temperature and Humidity Stress Index for Laying Hens



Adapted from Hongwei and Harmon, 1998.

Strategies to prevent/reduce heat stress problems



Management strategies



- All managements must be done during night or early morning hours.
- Work schedules and lighting program adjusted to be done during early morning or at night.
- Do not run feeders during the hot time of the day.
- Maximize cooling conditions during night.
- Lower stocking density.

Feeding strategies during hot weather



- Always closely monitor the daily feed intake.
- Reformulate the critical nutrients (aa, Ca, P, etc.) according to feed intake and bird's egg mass production.
- Formulate to digestible amino acids to reduce the crude protein.
- Increase % use of highly digestible lipids to provide energy rather than carbs.
- Increase Phosphorus.
- Do not feed during the hot periods of day.
- Stimulate feed intake during the fresher periods (morning and evening).



Feeding strategies during hot weather: keep a balanced diet depending on feed intake

Egg mass of 60 to 58 g/hen/day

		mg / hen / day	105	110	115	120
Lysine	%	941	0.941	0.896	0.856	0.818
Dig. Lysine	%	800	0.800	0.762	0.727	0.696
Methionine	%	471	0.471	0.448	0.428	0.409
Dig. Methionine	%	400	0.400	0.381	0.364	0.348
Met. + Cysteine	%	847	0.847	0.807	0.770	0.737
Dig. Met + Cys	%	720	0.720	0.686	0.655	0.626
Threonine	%	659	0.659	0.627	0.599	0.573
Dig. Threonine	%	560	0.560	0.533	0.509	0.487
Tryptophane	%	207	0.207	0.197	0.188	0.180
Dig. Tryptophane	%	176	0.176	0.168	0.160	0.153
Isoleucine	%	753	0.753	0.717	0.684	0.655
Dig. Isoleucine	%	640	0.640	0.610	0.582	0.557
Valine	%	824	0.824	0.784	0.749	0.716
Dig. Valine	%	700	0.700	0.667	0.636	0.609
Argenine	%	980	0.980	0.934	0.891	0.853
Dig. Argenine	%	833	0.833	0.794	0.758	0.725
Sodium	%	180	0.180	0.171	0.164	0.157
Potassium	%	500	0.500	0.476	0.455	0.435
Chloride minimum	%	180	0.180	0.171	0.164	0.157
Chloride maximum	%	325	0.325	0.310	0.295	0.283
Linoleic acid	%	1550	1.550	1.476	1.409	1.348

- Management guide
- Egg mass production

*The energy needs are calculated for a body weight of 1600 g. Every 50 g of change will have an impact of +/- 4 kcal / bird / day

Feeding strategies during hot weather

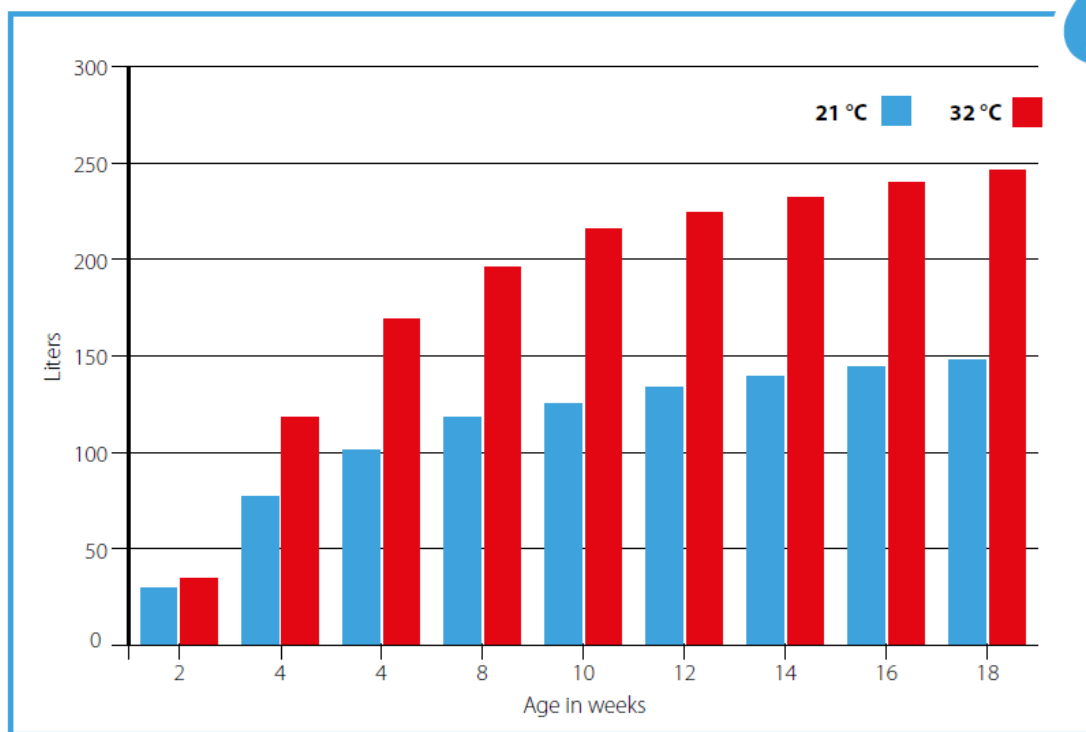


- Make hens to clean out the feeders one time per day (during the hot time).
- If possible, alter the particle size (75% - 0,5 to 3mm) or crumble feed.
- Supplementary Ca source is recommended. Large particle.
- Keep an adequate electrolyte balance (250 mEq/kg).
- Increase % of vitamin and trace minerals (reduced feed intake).
- Use of organic minerals.
- Vitamin C in feed (200-300 mg/kg).
- Add Sodium bicarbonate, potassium chloride or ammonium chloride to the feed. Help improve eggshell quality.

Water strategies during hot weather



Water consumed / 1000 birds / day

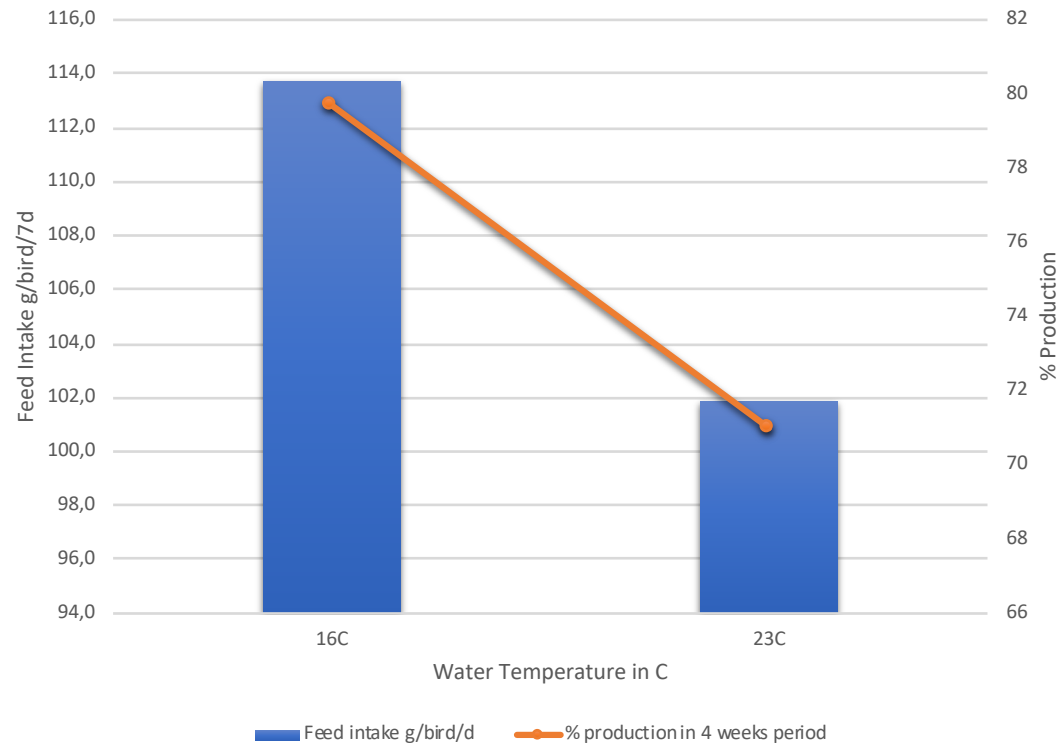


- Effect of water temperature on feed consumption.

H&N International Management guide, 2019.



Effect of water temperature in feed intake and production at 30C and 50% RH.



- Higher feed intake
- Better production.

Chang et al, 2009



Water strategies during hot weather

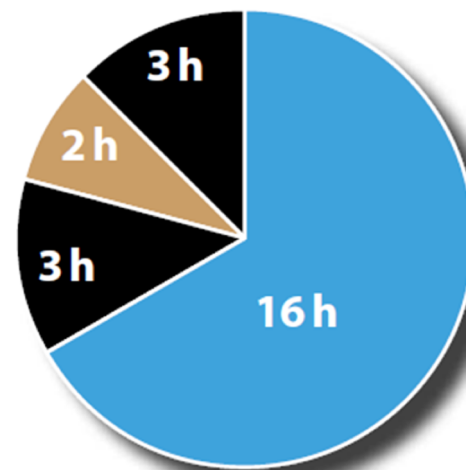
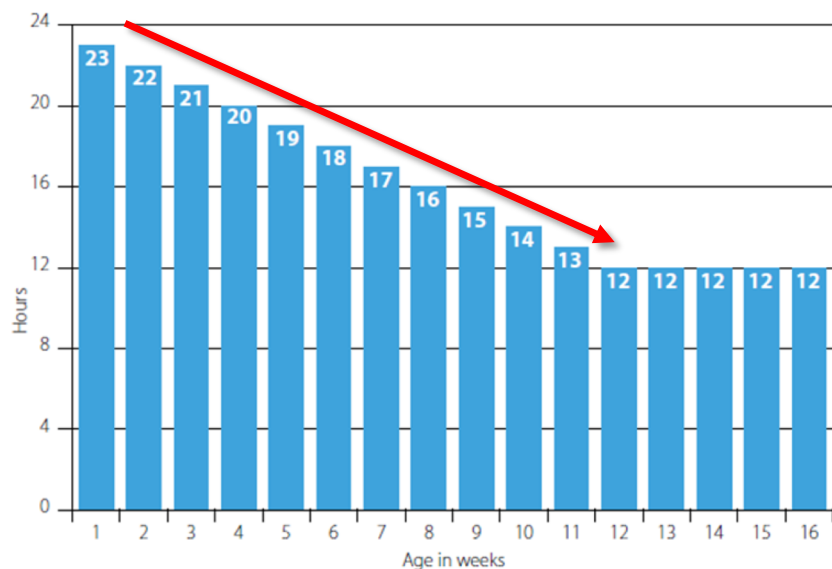
- Higher demand of water (water to feed ratio) up to 6-8:1
- Water flow must be enough to satisfy the demand.
- Sufficient drinker space (6 nipples / bird)
- Frequently flush the water lines, keep the water temperature as cold as possible (<math><25^{\circ}\text{C}</math>). Hot time of the day.
- Vitamin and electrolyte in drinking water.
- Do not exposed water tank to direct sunlight.
- Keep water filters clean to prevent water flow issues.

Lighting program in hot weather



- Slow step-down program in rearing during hot weather season.
- Midnight snack (1 to 2 hours) to increase feed intake + run the feeders.

1. Eat during cooler hours of the day.
2. Increase feed intake and bird's growth.
3. Egg shell quality



Midnight snack

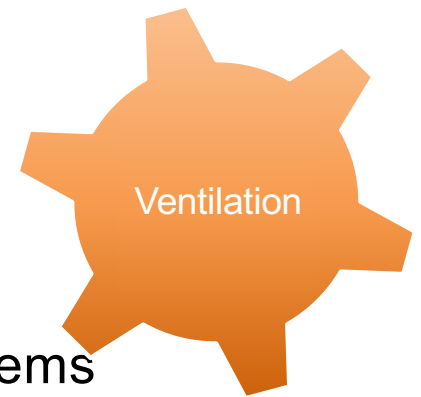
Lighting program in hot weather



- When start stimulation, add hours in the morning when temperature is cooler.
- Helps to increase feed intake and prevent drop in production.

Ventilation and housing recommendations

- Presented by Leon Schouren in his presentation “Housing systems options in hot climate”.



Summary

Time	Management
20:00	Lights off
21:00	Lights off
22:00	Lights off
23:00	Midnight Feeding
0:00	Midnight Feeding
1:00	Lights off
2:00	Lights off
3:00	Lights off
4:00	Feeding
5:00	Feeding
6:00	Feeding
7:00	Feeding
8:00	Feeding
9:00	Feeding
10:00	Feeding
11:00	Feeding
12:00	Feeding
13:00	No feeding
14:00	No feeding
15:00	No feeding
16:00	Feeding
17:00	Feeding
18:00	Feeding
19:00	Feeding
20:00	Lights off

Flush water lines (12:00-15:00)

Empty feeders (13:00-15:00)

No major disturbances (13:00-15:00)

- Midnight Feeding
- Hottest time of the day

Conclusions

- The approach to control the effects of heat stress are:
 1. Density (stocking, feeder and drinkers)
 2. Feeding
 3. Water
 4. Lighting
 5. Ventilation.

- More important tip is to have a standard operation procedure plan and begin implementing before the predicted increase of temperature.



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Thank you, questions?