TOOL BOX by LOHMANN

ENG

PRE-WARMING

Pre-warming of eggs prior to incubation is a common practice of most hatcheries in the world, either running single or multistage machines. It allows the embryos to achieve a homogeneous temperature before the incubation starts, which promotes a more uniform development in the beginning.

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What is the correct pre-incubation time and condition?

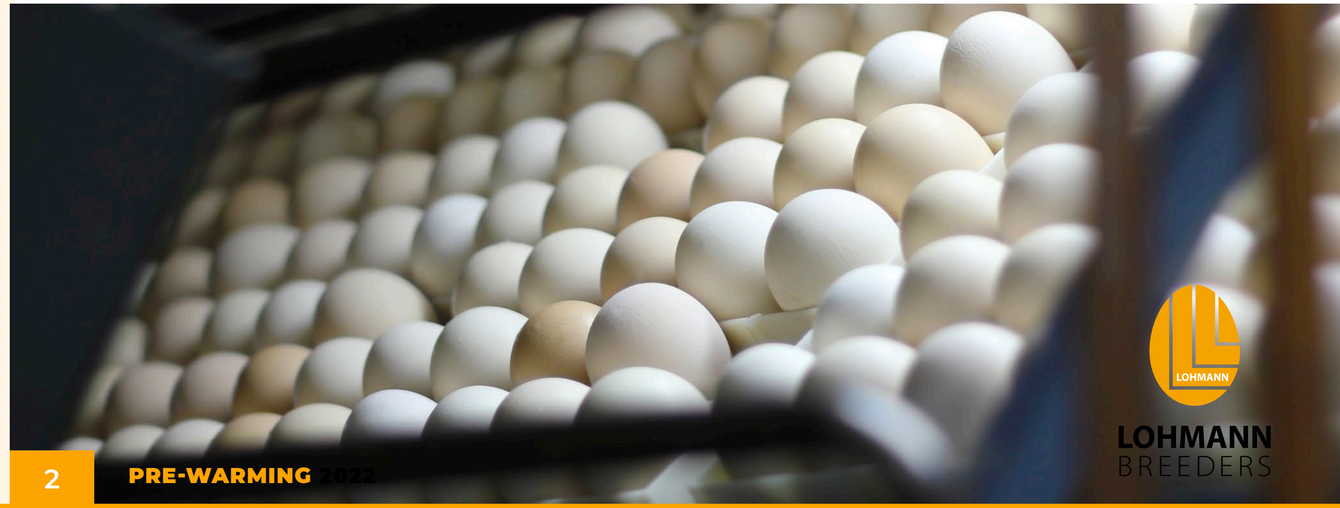
We must consider some real important points: On the egg storage, whether they were SPIDES (“Short Period Incubation During Storage”) or not, the temperature set point during storage are the main drivers for a good pre-warming program. An extra challenge is the air velocity through the eggs during the process of heating them up.

Important to remember that the right pre-warming time is easy to test and prove, with the early candling test. The primary effect for the perfect embryos’ development is the livability and achievement of perfect benchmarks. In this case, if something is wrong, the mortality of embryos in the primary step is high and does not respect the LOHMANN BREEDERS dedicate benchmarks.

When embryos start off uniformly in the beginning, it is very likely they will later show a shortened hatch window, which delivers a better hydration level of the chicks as well more weight uniformity.

Pre-warming not only provides chicks with uniform development speed, but also, it is the most important tool to prevent condensation, especially in multistage systems when eggs are loaded with other batches of eggs in different stage of development.

Moreover, pre-warming of eggs can be even more beneficial for the eggs already in the incubators (in case of multistage system) than it is for pre-warmed eggs themselves.



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INCUBATION

Initially, let´s discuss condensation as it is the first challenge to overcome when we think about pre-warming. Why does an egg condensate or sweat? It is for the same reason a beer condensates when we take it from the fridge. Water drops we see on the can or on the egg surface do not come from inside as some may think. So, condensation does not mean dehydration for the eggs.

1 Condensation takes place whenever the content of water vapor is higher than air holding capacity. The colder the air, the less able it is to hold water in the form of vapor (less water vapor "fits in the air").

2 Therefore, when we take a batch of eggs from the cold store and move to a warmer room, it is expected that warmer room is holding more water vapor. When this water vapor reaches the surface of the eggs (or the beer can!), the air on its immediate surroundings is colder and, thus, has less capacity to hold the amount of water vapor present.

3 Once the cold air around the egg cannot hold that water, it will "drop off the air". This is what is called "reaching the dew point". In other words, this water will condensate, leaving the air in vapor form by dripping on the surface of the egg in liquid form.

The higher the difference of temperature between the cold store and the pre-warming room/machine, the more and the longer water will condensate.

Likewise, the higher the relative humidity on the pre-warming room, the more and the longer water will condensate, ranging from a mildly wet surface to an easily seen real water dripping off the eggs.

When we do the opposite movement, e.g. eggs from a warmer to a colder environment, then condensation does not occur.

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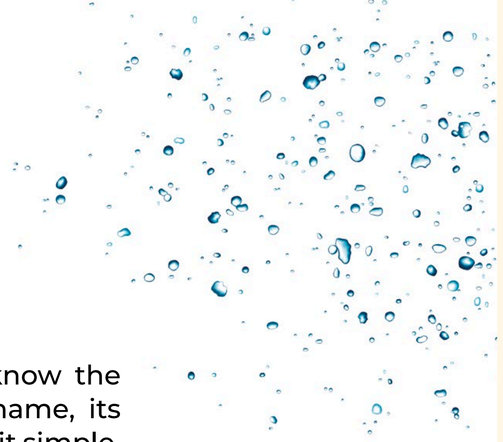

And how to avoid it? Hatchery managers should know the basics of psychometrics. Although a complicated name, its principles are easy to understand and apply. To make it simple, we have made the table below from a psychrometric chart or Mollier diagram.

Temperature (°C) after cold store

RH (%) after cold store	23	24	25	28	30	33	37,5
75	19	20	21	24	26	29	33
70	18	19	20	23	25	26	32
65	17	17	19	21	24	26	31
60	16	16	18	20	22	25	29
55	14	15	16	19	21	24	28
50	13	14	15	17	19	22	27
45	11	12	13	16	18	20	25
40	10	10	11	14	16	18	23

Note:

Figures in the table are rounded up for safety margin.

Understanding the table:

In case a pre-warm room, or even the setter corridor, is at 28°C with 65% RH, then the lowest egg temperature to avoid condensation should be 21°C (it means that eggs at 20°C will condensate for a while until they reach 21°C or higher). In another example, if pre-warm room is at 30°C with 65% RH, then the eggs must not be colder than 24°C when loading.

As we stated in the beginning of this article, condensation may occur at any time when we move eggs from a cold to a warmer environment. Therefore, condensation can take place also when we load pre-warmed eggs into the setters! To better understand the importance of pre-warming the eggs on condensation, we left the orange shaded cells on the right side of the table on purpose, showing 27°C and 28°C.

If we connect the temperature on the header of the table (37,5°C) to the RH on the left side (50-55%) we will have pretty much what most multistage hatcheries have as profile for setters. It means that, to avoid condensation, eggs must be loaded into multi-stage machines at a minimum of 27°C. Thus, pre-warming for this kind of machines should be made at a minimum of 27°C.

Can't it be done at 25°C? Yes, it can, but slight condensation will take place, even considering ventilation of the machine. When eggs condensate in the machine, not only contamination is a drawback, but evaporative cooling of wet egg surface is also of major concern since it will cool the eggs, causing a heterogeneous start of the process, damaging the hatch window 20-21 days later.

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In case the pre-warming room has a high relative humidity enough to make the eggs to reach dew point and sweat, a dehumidifier installed in the room can help substantially. It removes the excess of water, making it virtually impossible to reach dew point. The good news is that a dehumidifier for a pre-warming room is a simple and cheap equipment.

For single stage system, we must follow the same rules on the table above. However, as the machines are empty, the pre-warm temperature can be much lower, usually the same as the setter corridor, around 24-26ºC with 50% RH.

In that case it is much less likely that eggs will condensate and, because of that, pre-warming can be carried out at a lower temperature, as per manager's decision.

When incubation program starts, temperature will raise gradually, which also avoids condensation.

Image 1. *A dehumidifier installed in a pre-warming room, with its reservoir being filled with water previously present in the air as vapor. By collecting this water, Relative Humidity in the environment drops to a level where dew point will never be reached when eggs are brought in.*

Once we understood how important it is to prevent condensation, now it is time to understand why it is important to heat up the eggs as high as possible, especially in multistage systems.

After the eggs are warmed, they can be loaded together with up to other 5 batches previously set in the same machine.

If eggs are loaded in a multistage machine without any pre-warming procedure, their cold mass will negatively influence the already set eggs, making their temperature do go down for a long time (not only machine's temperature goes down).

Until the machine can overcome it by constant activation of heaters and dampers closure. Even when we prewarm them, there is a negative effect.

The warmer the eggs are loaded, the less harm they'll cause to the existing eggs in the machines.

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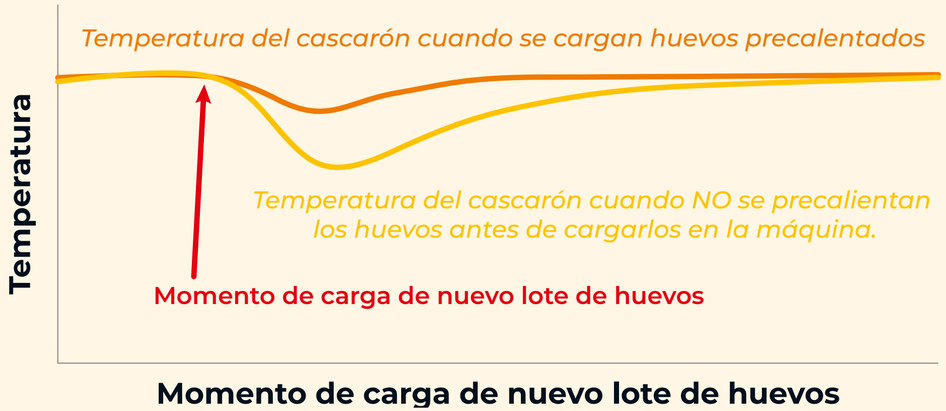


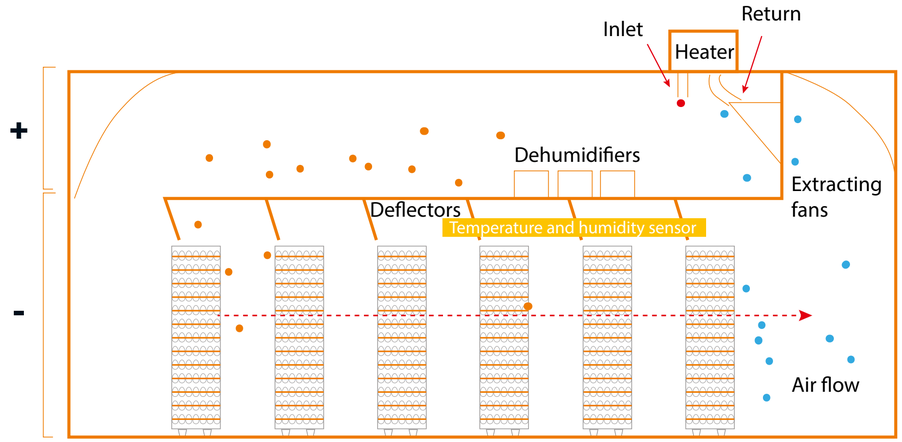
The graph above shows the temperature fluctuation undergone by existing eggs inside a multistage machine when a new batch of eggs is loaded with (purple line) or without pre-warming (yellow line).

A special and calculated pre-warming time can be an important tool to uniform embryos, of different age and breeders, and can help to differentiate the incubation time, and ensure homogeneous hatching "Perfect Hatch Windows".

In order to warm a big mass of eggs, we need not only a good heat source, but also means to ventilate the air uniformly so eggs can be heated homogeneously.

The best way to ventilate a large batch of eggs is by means of uniform airflow through each tray and this can be achieved by either using an empty machine or by having a dedicated well designed pre-warm room.

The pre-warm room can be a simulation of a tunnel ventilated chicken house, with air recirculation, since at this age, embryos need no fresh air at all.



Picture 1. *Sketch of a pre-warming room with a tunnel ventilation design. This will promote uniform airflow over the eggs, allowing a homogenous temperature increase.*

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Image 2. *Actual pre-warming room for 300.000 eggs at once, showing the deflectors and trolley disposal.*

Once the room is known, then it is a matter of calculation on how many extractors need to be installed to provide eggs with desired air speed. The use of deflectors on corners and eventually in some other strategic positions prevent air from seeking the way of least resistance.

Regardless of doing it on a sophisticated dedicated room, inside an empty machine or even in the setter hallway, we must make sure to provide eggs with uniform airflow and right temperature and humidity, for a correct start of development.

Please, feel free to contact LOHMANN BREEDERS Global Technical Service in case you need any help with this important step of the incubation process.

For more information and further toolbox articles, please visit our website ***www.lohmann-breeders.com*** *or contact us directly:*

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