

Energy-efficiency in pre-conditioning inlet air

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by Gerd de Lange, Senior Poultry Specialist, Pas Reform Academy

Hatcheries are found in a variety of climates, from the hot, humid tropics of South East Asia to hot, arid zones in the Middle East or the changeable climates of Central Europe or the USA. Typically, external temperature and relative humidity are subject to seasonal changes (e.g. rainy season, very cold winters) or even a day and night rhythm. The challenge is to establish whether outside air is directly suitable for incubation and, if not, how to make it fit for that purpose. To a certain extent, setters and hatchers can deal with climatic variations to inlet air, although most incubator manufacturers specify the climate conditions under which their equipment will perform at its best. Untreated, inlet air can be:

- **Too cold:** this may lead to low temperature uniformity and, especially if occurring early in incubation, an extended hatch window.
- **Too warm:** during late incubation in the setter and certainly in the hatcher, this will overwork the water cooling system, produce excessive condensation and ultimately wet floors, which will cause eggs close to the floor to become too cold.
- **Too dry:** humidification (rotating disc, nozzles) in the incubator may compensate for this, but will cause cold spots due to localised evaporation.
- **Too humid:** this may cause difficulties in achieving sufficient egg weight loss during incubation, which can only partially be compensated for by a higher ventilation rate and might ultimately lead to reduced hatchability and poor chick quality.

Table 1 below shows a realistic range of climate specifications for setter and hatcher inlet air. For hatcheries at sea level, dew point specifications can also be converted to a specific humidity of 8.2-13.8g water/kg of air. There are several Mollier Diagram/psychrometric chart-based climate calculation tools available online to help make these calculations. Conditioning outside air to inlet specifications is not without cost, as demonstrated in the following two examples:

Table 1. Example of climate requirements for setter and hatcher inlet air. Above 70% RH increases the risk of fungal growth.

| Temperature | Relative humidity | Dew point |
|-----------------------|-------------------|-----------------------|
| 21-27°C (69.8-80.6°F) | <70% | 11-19°C (51.8-66.2°F) |

● **Outside air of 10°C and 75%RH:** This air contains only 5.7g water/kg of air, which means that both heating and humidification is required to bring it within climate specifications. Just heating to 21°C is not enough, because subsequently adding water by spraying or fogging causes the temperature to drop again with evaporation. The most energy efficient option within the climate specifications is 21°C/53% RH (= 8.2g water/kg) and for that, the outside air should first be heated up to 27.6°C. This requires 17.8kJ/kg of air.

● **Outside air of 30°C and 75%RH:** Although relative humidity is the same as in the previous example, this air contains 20.2g more water per kg of air. Cooling this air down to 25.1°C will result in 100%RH, which equals the condensation or dew point. However water content is still the original 20.2g/kg of air; further cooling to 19°C is required to achieve the maximum specification of 13.8g water/kg of air. This air, however, is still too cold and should be heated up to at least 21°C. But at that temperature, relative humidity is 88% – far higher than the maximum specification of 70%. To reach that relative humidity, heating up to approximately 25°C is required. The energy required for cooling from 30-19°C is 27.6kJ/kg of air and subsequently heating to 25°C takes another 6.1kJ/kg of air.

Advice

- Consult your incubator manufacturer for setter and hatcher inlet air climate specifications.
- Choose the most energy efficient (cheapest) combination of temperature and relative humidity within these specifications after taking outside climate into consideration.
- Ask your incubator manufacturer about available options to further reduce the energy costs for hatchery climate control.
- Do not waste expensive, pre-conditioned air: avoid over-ventilating your incubators and keep the doors of clean air plenums closed as much as possible.

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Pas Reform Hatchery Technologies

On-farm traying: a smart idea?

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On breeder farms eggs are traditionally collected in paper or plastic trays that each hold 30 eggs. Typically, these are stacked six-high and transported to the hatchery in boxes, crates, trolleys or on pallets.

Before incubation, hatchery staff have to transfer the trayed eggs to setter trays, either manually or (semi)-automatically. So far, each hatching egg has already been handled at least twice before incubation begins – and each time with the risk of causing hairline cracks and contamination that will ultimately undermine hatch results.

On-farm traying, both manual and automatic, is becoming increasingly popular as it minimises labour and reduces the need for egg handling. With the eggs already placed on setter trays at the breeder farm, they are then transported in specially designed farm trolleys to the hatchery, where the setter trays are transferred from the farm trolleys to setter trolleys. The eggs are not handled individually any more – and even this final transfer before incubation can be automated.

When choosing a tray type for egg collection on the farm and subsequent transport to the hatchery, there are several important considerations that will also have important consequences for managing the hatching eggs:

Rate of cooling down

Egg temperature at the moment of collection varies from egg to egg. For those still holding a temperature of >25°F/77°F, further cooling is required. When placed at the centre of a paper tray and covered by the next full tray, a newly laid egg with a temperature closer to that of the hen's body (41°C/105.8°F), will take much longer to cool down than an egg placed at the side of the paper tray. And packing warm eggs on paper trays directly into egg boxes will certainly lead to high embryonic mortality!

With a more open construction and the fact that they are not stacked di-

rectly on top of each other, filled setter trays allow sufficient freely circulating air to pass around the trayed eggs. This greatly promotes uniform cooling, but if temperature in the egg collection room is too low, there is a risk that the eggs will cool too rapidly, especially if exposed to cold air or a draught.

Plastic trays provide a mid-point between paper trays and setter trays, because plastic is not as good a thermal insulator as paper and it will allow some air flow over the eggs.

Mechanical impact

During loading, transport and unloading, shocks and jolts should be avoided, both to prevent damage to the fragile embryonic structure and hairline cracks in the shell.

Eggs are generally very well cushioned when transported on paper trays, so where road conditions are poor or trucks have poor suspension, paper trays may be the best choice. In other cases, well-designed setter trays without sharp edges provide good support for the hatching eggs and, when placed in farm trolleys with shock absorbing wheels, offer a valid alternative.

Further treatment of hatching eggs:

Placing eggs on setter trays is essential for effective disinfection or pre-storage incubation, neither of which is possible when eggs are tightly packed together on paper or plastic egg trays, as there is no free space around each egg.

Advice

- Think broadly about the various 'touchpoints' that hatching eggs will be subjected to from farm to hatchery when choosing a tray type.
- Choose paper trays when road or vehicle conditions from breeder farm to hatchery are poor.
- Recognise that eggs on setter trays may cool down too quickly after egg collection; do not place them immediately in the cold room.

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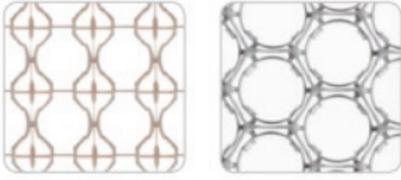
The advantages of using honeycomb high capacity trays

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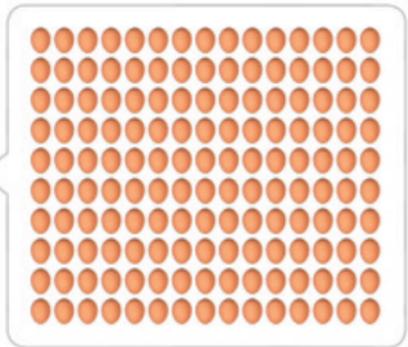
SmartTray 162



150 egg tray



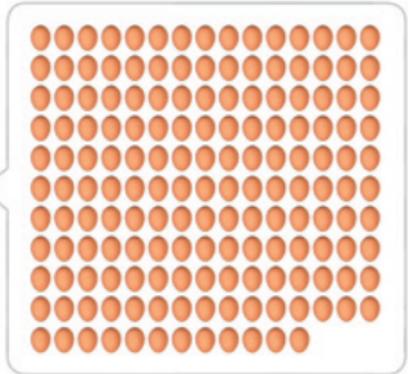
150
eggs



162 egg tray



162
eggs



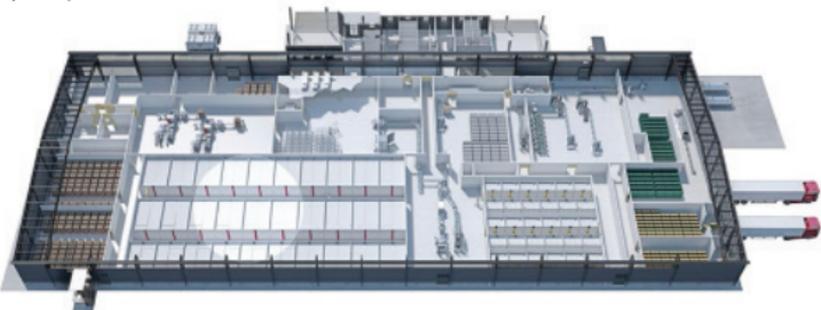
12 more eggs

.....
12

$$\frac{12}{150} \times 52 \text{ million} = 4,160,000 \text{ extra day?old?}$$

Hatchery capacity
1 million chicks/week

SmartTray 162 is designed in a space saving honeycomb structure for the highest number of hatching eggs per m2. Designed to cradle eggs of any size safely, SmartTray's open construction is proven to deliver uniform airflow during incubation. This helps to create an optimal environment for the growing embryos, promoting day-old-chicks of the highest quality.



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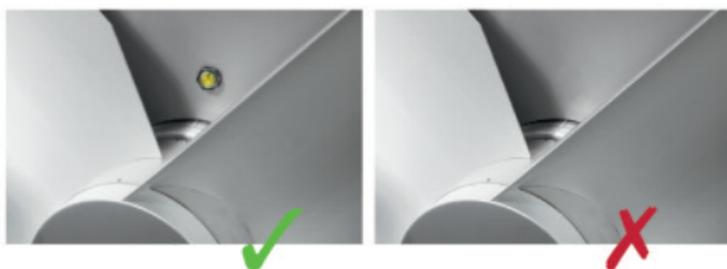


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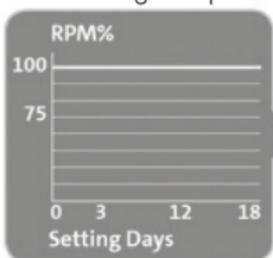
The benefits of the energy saving module

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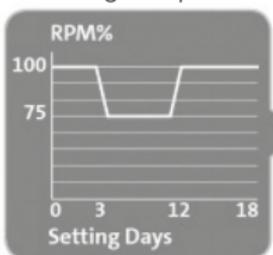
Maintaining fan speed



100%



Lowering fan speed



71%



29%

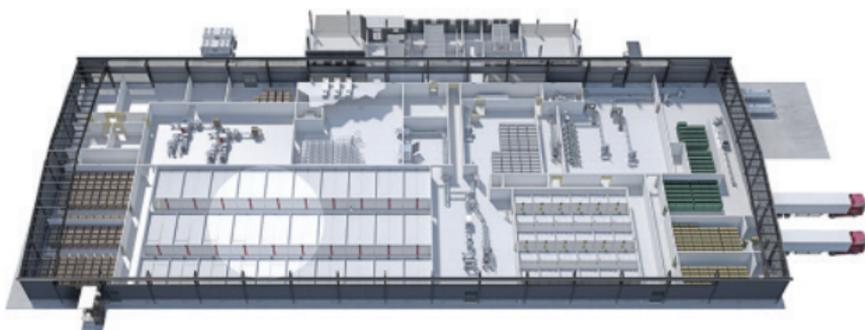
Average fan power consumption per egg per setting cycle.

$$29\% \times \frac{18.25}{1000} \times 52 \text{ million} = 275,210$$

Hatchery capacity
1 million chicks/week

While high fan revolution speeds are needed at the beginning and during the final phase of incubation to optimise the heating and cooling of the hatching eggs, this level of energy consumption is not required during the long period in between.

The ESM energy saving module allows the number of revolutions to reduce substantially during that part of the process.



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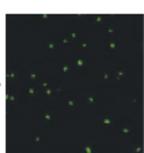
Pas Reform Hatchery Technologies

Microban Silver-Shield protection

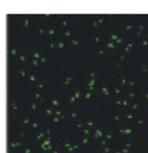
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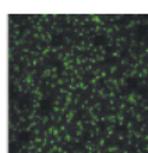
Hatcher basket – without Microban SilverShield protection



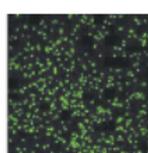
2 hours



16 hours

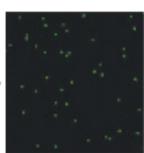


20 hours

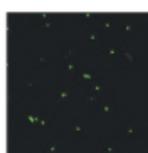


24 hours

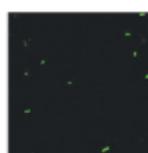
SmartBasket – with Microban SilverShield protection



2 hours



16 hours



20 hours

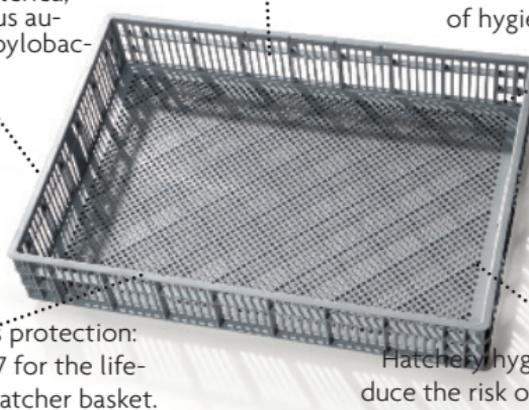


24 hours

Kills bacteria:
Up to 99.9% of Escherichia coli, Salmonella enterica, Staphylococcus aureus and Campylobacter.

Locked in: Never washes off or wears away.

Invisible protection: Works between cleanings and adds an extra level of hygiene in hard to reach areas.



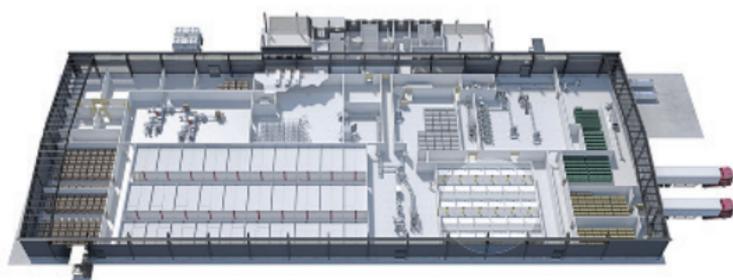
Continuous protection: Works 24/7 for the lifetime of the hatcher basket.

Hatchery hygiene: Helps reduce the risk of cross contamination.

| Bacteria species | Bacteria reduction (Log 10) | Bacteria reduction (%) |
|------------------|-----------------------------|------------------------|
| Salmonella | 3.8 | 99.99 |
| E. coli | 3.7 | 99.98 |
| Staph. aureus | 4.14 | 99.99 |
| Campylobacter | 4.4 | 9.99 |

Antibacterial test analysis by Industrial Microbiological Services Ltd.
Test method: MOD JIS Z, 2801:2000, Contact time: 24 hours, Date analysed: 31.08.2016

Silver is constantly presented on the surface of the hatcher basket and ready to be released 24/7. This means that polymers with Microban SilverShield protection offer continuous protection against bacteria, thereby helping to extend the effectiveness of disinfectant chemicals well beyond the 120 minutes before bacteria regain their foothold with disinfectants alone.

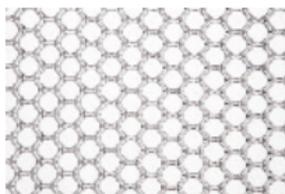


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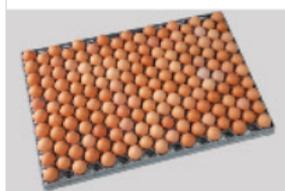
1. Supports hatching eggs at two levels:

One size fits all. Innovative design provides maximum protection for hatching eggs of all sizes with support points at two levels – and no hairline cracks



2. Open, spacious grid:

Promotes the free movement of air for more uniform heat and humidity distribution



3. Space saving honeycomb design:

Range of capacities includes SmartTray 162, for the highest number of hatching eggs per m²



4. Superior construction:

Highly impact and temperature resistant. Ideal for automated hatcheries



5. Stable and self-centring:

Ideal for in-ovo vaccination. Self-centring egg positioning provides a stable, secure target for accurate in-ovo vaccination



6. Safe, secure stacking:

Blind-find bottom design for fast, safe and secure stacking



7. HACCP compliant:

Smooth finish for easy, thorough, fully HACCP compliant cleaning



8. Ergonomic design:

Lightweight, ergonomic design for ease and comfort in handling



9. Microban antibacterial technology (optional):

The only setter tray to incorporate Microban continuous antibacterial technology. Microban is a registered trademark of Microban Products Company

Designed to cradle hatching eggs of any size safely, the open construction of Pas Reform's SmartTray is proven to deliver a uniform airflow during incubation. This helps to create an optimal environment for the growing embryo, to promote day old chicks, turkey poults or ducklings of the highest quality.

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