Managing fertility: good breeding shows 25

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By Maciej Kolanczyk, senior poultry specialist, Pas Reform Hatchery Technologies

The percentage of fertile eggs is one of the most important parameters influencing the economic performance of a breeder flock. An embryo can of course only develop from a fertile egg.

Fertilisation takes place, and thus can only be influenced, on the breeder farm. When we consider fertility, we usually think of the males.

Yet in reality, the percentage of fertile eggs is a synthetic expression describing the condition and activity of the males, the condition of the females – and the propensity of both sexes to behave as nature intended.

Sexual behaviour is closely allied to the contentment and welfare of the flock. Or put another way, fertility can be seen as a reliable measurement of the flock's overall well being.

A flock performing well in respect to fertility is one where both cockerels and hens are healthy and well developed. Both groups (sexes) should be uniform, with similar levels of maturity and well matched in size, good feathers and healthy, strong legs. These tend to be the characteristics of flocks in a low stress environment, with sufficient space to promote natural behaviours and an optimum diet.

With these conditions, the inevitable changes related to the advancing age of the birds will proceed synchronically. In this sense, fertility is a trait that can be regarded as a dynamic process, rather than as a single characteristic.

From the economic point of view, the deciding factor is the level of fertility that can be delivered in the late production period, after 45 weeks. This is also a time when the most differences between the flocks can be observed.

Advice

To promote enhanced fertility in the flock:

- Give special attention to development and uniformity in rearing: a good start in the first week, harmonic, steady growth, maintaining body weight standards from the beginning of the chick's life and especially at 11 weeks are essential.
- Synchronise the maturity of males and females. Many potential problems arise from differences in development between the sexes. Males tend to mature earlier and may behave too aggressively for successful breeding.
- Observe behaviour in the poultry house in the afternoons – and be prepared to respond quickly. A good flock should remain active and well mixed at this time.
- Restrict water consumption at any age and take care of litter as a key factor in determining the house environment. Dry, loose litter helps the birds to remain clean and well feathered with healthy legs. Maintain feed to water ratio as 1:1.7-1.9 in rearing and 1:1.8-2.2 in the production period. Always ensure that the house is dry and warm.
- Avoid stress by limiting factors like diseases, drastic changes of housing conditions, feed composition or quantity, temperature and other basic parameters. Stick to routines.
- Stimulate mating by sprinkling grain on the litter in the afternoons. Let the males play the role of landlords, so they have the chance to show their leading position in the flock.
- Never keep too many males in the flock. Quantity cannot replace quality. It is better to keep fewer good cockerels than many of varying quality.
- If possible, replace old cockerels with new, mature males after 45 weeks of age.

Alternatively, introduce 'intra-spiking': the exchange of males between different houses.

This creates a new social order that encourages increased activity and renewed fights for social position. Replace or exchange at least 40% of the males in a house.

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Effective rodent control on breeder farm and hatchery 26

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

Rodents (rats and mice) are documented carriers of Salmonella spp. and therefore present a serious concern for public health. A review of Meerburg et al. (2007) showed infection rates in rodent populations ranging from 0-77%.

An entire breeder flock or hatchery can be contaminated by the presence of a single infected rodent, thus posing a risk to the rest of the food chain. Besides the danger of infection, rodents cause damage to buildings, electrical lines and water pipes, thereby affecting production and profitability. For these reasons, an effective rodent control program is essential.

Rodent control begins with getting to know your enemy. Rats are intelligent, social animals that live in colonies of several hundred individuals. These rodents have a strong tendency to burrow, especially into soil or under secure coverings such as piles of stones or rubbish – and they prefer to move under cover of darkness.

They have a range of 100 metres plus – and they breed quickly. A healthy female can easily produce five litters per year, each of 8-10 pups, with offspring attaining sexual maturity in 8-12 weeks. As many as one third of the females in a population may be pregnant at any one time and, because of their agility and their ability to squeeze through small openings, it is very difficult to keep them out of poultry houses, feed stores and hatcheries. The range of mice is much smaller (5m) than for rats.

However, as mice reach sexual maturity 42 days after birth, populations grow much faster than those of rats. Being so small they are very easily carried, unnoticed, in for example egg boxes. They can enter a building through gaps as small as 6mm – the diameter of a pencil!

Rodent infestation can quickly take hold without even seeing a single animal, because their nocturnal habits tend to keep them away from human eyes. If a single rat is seen during daytime, there is already a sizeable infestation.

To control rodents requires constant attention – and it is common for breeder farms and hatcheries, especially in the case of larger operations, to place responsibility for rodent control in the hands of a specialised pest control company.

An effective rodent control program involves three areas of activity:
1. Prevention – do not attract rodents.
2. Monitoring – looking for signs of rodent presence (seeing no rodents does not mean they are not there).
3. Control – the use of rodenticides to eliminate the pests and prevent populations from thriving.

Advice

- Keep the area around the breeder houses and hatchery clean and tidy. Avoid decorative shrubs within one metre of buildings and cut grass regularly.
- Do not attract rodents with food sources, such as chicken feed, hatchery waste and leftovers from canteens.
- Make the houses rodent proof: cover ventilation openings with wire netting and ensure there are no openings or gaps under doors.
- Monitor at weekly intervals for signs of rodents, such as runs, smears, droppings, urine odour, gnawings, foot prints, holes and burrows and uptake from bait boxes.
- Eliminate rodents by using an effective rodenticide mixed with an attractive bait.
- Place sufficient purpose designed bait boxes at carefully chosen points where rodents pass or gain access regularly.

- Monitor uptake from bait boxes and add or refresh rodenticide as required, to avoid resistance or 'bait shyness'. With preferred 'slow-kill poisons', rodents must ingest some of the poison daily for several days.
- Change the rodenticide at regular intervals to avoid resistance and 'bait shyness'.
- Consider using a specialised company to carry out the rodent control program. An effective rodent control program requires knowledge, experience and consistency.

Establishing true fertility in hatching eggs

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By Dr Marleen Boerjan, director R&D, Pas Reform Hatchery Technologies

If it comes to discussions on fertility two different definitions are practiced. A true fertile egg contains a well developed germinal disc (blastoderm), which indicates that the oöcyte, or zygote, was fertilised and an embryo developed during egg formation.

Secondly, in the practice of the hatchery fertility is often based on candling, whereby all clear eggs are defined as unfertile and by default the rest of the eggs are considered to be fertile. This second definition of fertility is strictly not correct since clear eggs may contain both truly infertile or they may contain (fertile) embryos that died early.

In hatchery practice problems with fertility are usually first recognised during the candling procedure, when the number of clear eggs is higher than expected. To identify the time and the cause of embryonic death, the hatchery manager may perform an analysis of candled eggs.

However, if candling is performed at transfer at day 18, as is often the case, it can be difficult to discriminate between true infertile eggs and eggs containing an embryo that has died before the blood ring stage. This is because membranes from dead embryos degenerate while the eggs are still in the incubator.

By candling at days 7-10, it is possible to reliably discriminate between true infertility and early embryonic death for two reasons.

Firstly, because embryonic membranes formed during the first days of incubation can still be recognised. Secondly, in clear eggs collected between days 7-10, a change in the colour of yolk as a result of embryonic activity is clearly visible.

The active young embryo transports water from albumen to yolk, which results in a whitish or light yellow ring around the embryo.

The fertile, unincubated egg contains an embryo (germinal disc or blastoderm) that developed from the fertilised oöcyte (zygote) during egg formation in the oviduct.

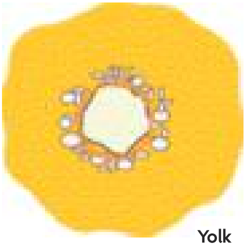
The blastoderm shows a recognisable area pellucida (AP) surrounded by an area opaca (AO) (Fig, 1a). The infertile germinal disc can be recognised as compact white spot with ruffled edges (Fig, 1b). If hatching eggs are analysed on arrival at the hatchery, before incubation, any issues with infertility can be communicated with the breeder farm without delay.

Advice

- Candle eggs at transfer (day 18) as a standard routine.
- If the number of clears is above acceptable or allowable standards, perform egg analysis, to distinguish between infertility and early embryonic death..
- Consider candling followed by egg analysis between day 7-10, as a more reliable means of measuring true fertility.
- Analyse a minimum of 10 fresh, unincubated eggs on a regular basis when fertility issues are suspected.
- If true infertility is too high, communicate with the breeder farm about male AND female management.
- If the rate of early death before the blood ring stage is too high, evaluate conditions during storage and the transport of eggs – and ensure that the setter is bringing the eggs to incubation temperature rapidly and without interruption. ■

Fig. 1a. Drawing of the appearance of a fertile germinal disc.

Fig. 1b. Drawing of the appearance of an infertile germinal disc.



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Spray vaccination of day-old-chicks at the hatchery 28

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Spray vaccination is the preferred method for administering respiratory vaccines, for example for Newcastle disease (ND) or infectious bronchitis (IB), especially when vaccinating birds for the first time.

Spray vaccination can be undertaken either in the hatchery or immediately after reception at the farm, while the chicks are still in boxes. Vaccinating in the hatchery is generally considered more effective, as the process is automated and therefore more controlled than the hand-spraying that tends to occur on the farm.

Hatchery automated methods include either the use of a spray cabinet that is triggered each time a box of chicks is placed inside, or a spray vaccinator mounted over the conveyor line for chick boxes.

Vaccines suitable for spray delivery are live vaccines, produced by growing the required virus in incubated eggs or tissues cultures.

After attenuation (= weakening), the viruses are freeze-dried and appear as a pellet in a glass vial containing 1,000- 10,000 doses. This allows the vaccines to be stored under controlled conditions for several months until expiry date.

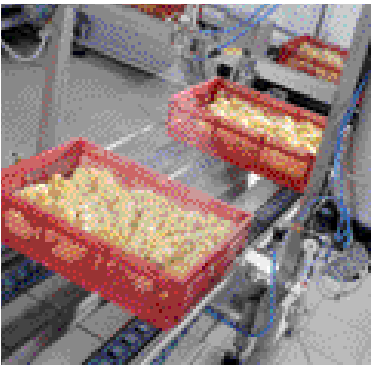

Photo courtesy of Intervet International BV.

Prior to use, the vaccine is dissolved in water, after which it expires within hours and therefore must be used immediately. The water serves as a transport medium for the live virus to the day-old-chicks. Once sprayed, the vaccine will attach to the mucosa cells of the chicks' eyes and upper respiratory tract. Preening (= cleaning feathers with beak) optimises uptake.

Once in the body, the virus will multiply inside the mucosal cells, to develop good local immunity in the respiratory tract.

When administering vaccines by this method, it is important that the spray is 'coarse', ie. that droplets are at least 100- 150 microns in size.

Any smaller and the vaccine will be inhaled too deeply into the respiratory tract, resulting in an excessive post-vaccination reaction. This presents as mild disease symptoms in the flock 3- 5 days after vaccination – and will have a negative effect on production.

Advice

- Store vaccines in a refrigerator kept for this sole purpose until use.
- Follow the manufacturers instructions for use carefully.
- Ensure that the water used for diluting the vaccine is of good quality, not chlorinated and low in mineral content. Use demineralised water if tap water does not meet these criteria.
- Dilute vaccines in a bucket or vessel only ever used for this purpose. Any traces of disinfectant will kill the live, attenuated virus and render the vaccine ineffective.
- Adjust the spray vaccinator according to the size of the chick boxes and the speed of the conveyor belt. Check regularly that no vaccine is wasted and that the total surface of the chick box is uniformly covered by spray, for example by placing absorbent paper inside an empty chick box.
- Apply coarse spray only. Install a suitable nozzle and adjust pressure to achieve this.
- Record the batch number of the vaccine used. In the case of an adverse reaction, this will help the manufacturer to track the problem.
- Inform customers which vaccination birds have received at the hatchery. Spray vaccination that targets the same organs within 10-14 days should be avoided.
- Do not mix different vaccines on your own initiative. If different vaccinations are required, use only registered combinations formulated by the vaccine manufacturer and tested for compatibility.
- Leave chicks in boxes for at least 20 minutes after spraying, to optimise the effect of preening.
- Avoid placing wet chicks in a chick despatch room with a suboptimal temperature or draught.

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Uniform eggs are laid by uniform hens

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Uniformity in day-old chicks is increasingly important as a contributor to economic efficiency.

Producing chicks of a uniform size requires two basic conditions: an optimised incubation process, which depends on the quality of the incubators and the incubation programs – and uniformly sized hatching eggs, which relies upon many factors linked to the breeder farm.

Breed, the age of the hen, the hen's body size, feeding, diseases and the farm environment are all key factors.

In the hen's life cycle, egg size changes according to a natural pattern, being smaller at the beginning of lay and becoming larger towards the end. From the breeder flock, we expect the production of as many hatching eggs as possible in an optimum size range of 50-70g.

If the hens are uniform in size and maturing at the same age, we can expect eggs laid by them to be uniform.

Physical and physiological development depends mainly on rearing. In all management guides, body size is described by body weight. However the reproductive physiology of a small, fat hen is different from her tall, skinny sister - even if their body weight is identical.

Actual body size is related to the dimensions of skeleton. Breeders within one flock that are uniform by skeleton size and body weight at 20 weeks will respond similarly to programs that stimulate maturity.

Because the skeleton is fully formed by 11-12 weeks of age, the first half of the rearing period becomes an important phase – a limited period during which uniformity can be successfully influenced.

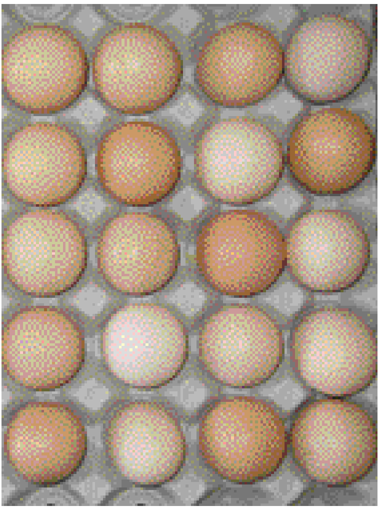
The first rearing week is the period when the most intensive growth in a hen's life occurs – potentially leading to great differences between birds.

These differences are mainly a reflection of variation in the development of internal organs, which dictate whether the bird will be a more, or less, efficient organism in the future. A good start from the first hour on the rearing farm is the best investment for achieving the smooth development of the pullet later.

Early, effective control of growth, smooth development, passing important 'check points' at six and 12 weeks and starting the lighting program at optimum age all contribute to the development of a uniform flock that will produce uniform eggs.

Advice

- Ensure the highest growth rate in the first week of life. High average body weight at seven days – usually related to high uniformity – is an indication that all chicks started well.
- Avoid needing to correct body weight. Start feed restriction by the end of first week and apply small but regular weekly increments of daily rationing.
- Start grading in the fourth week, to allow sufficient time for directing extreme groups towards the common target at 12 weeks.
- Aim to keep the flock strictly on target body weight at six and 12 weeks of age.



- Assure good environmental conditions, regular feed increments, sufficient feeding space and good disease control during the entire rearing period.
- Start maturity stimulating programs when the majority of hens are ready. Even a uniform flock will include a proportion of birds that mature earlier or later. Well controlled lighting during rearing and not starting the stimulation program too early are basic requirements.
- Ensure good feed composition, avoid overfeeding and apply water restriction during the production period. These factors help to maintain uniform egg size. ■

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Optimal weight loss profile during incubation

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Good hatchability is dependent on meeting all crucial incubation parameters. One of these important parameters is weight loss. Eggs should lose 11-13% of initial weight during the first 18 days of incubation.

Weight loss in hatching eggs is caused by the continuous evaporation of water from the eggs – and inseparably linked to achieving optimum embryonic development during incubation.

Continuous weight loss from the egg is essential for the formation of the air cell and at the same time, the evaporation of water from the egg facilitates optimised water and mineral balances in the different embryonic compartments formed during embryonic development.

As soon as internal egg temperature increases, evaporation through the shell and the transport of water from albumen to sub-embryonic cavity both increase.

The transport of water to the sub-embryonic cavity can be observed as a circular change in the colour of the yolk (Fig. 1b). At day six, most of the water from the albumen has been redistributed, leaving a small jelly-like clod of albumen proteins (Fig. 1c).

As embryonic development continues, the transport and redistribution of water also continues, such that at days 10-12 of incubation, the different embryonic compartments – including the yolk sac, amniotic cavity (Fig. 1d) and the allantois – are filled with a watery solution containing a balanced concentration of essential minerals. A balanced composition of the embryonic compartments is essential for the transport of nutrients to and waste products from the embryo.

The redistribution of albumen water over the different embryonic compartments has no effect on absolute weight loss, but it does affect the pattern of evaporation within the egg and therefore has an important effect on mineral balance in the different embryonic compartments. This is best illustrated during the first days of embryonic development, by the loss of egg weight as a result of evaporation from the albumen.

In the second week of development however, water evaporates mainly from the allantoic cavity, directly under the egg shell.

If during the first week the valves of the incubator are kept closed and as a result relative humidity levels increase to 75% or more, weight loss is restricted.

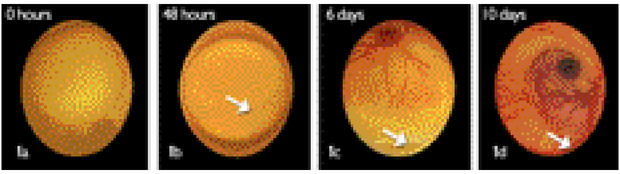
The consequence of this limited weight loss is that compensatory weight loss must then be achieved during the last days of incubation, by maintaining low settings (40-45%) of relative humidity.

However, if climate in the setter and/or hatcher is very dry during the final days of embryonic development, water will evaporate not only from the egg shell and shell membranes, but also and undesirably from embryonic tissues like the skin and legs.

Advice

- Aim for 12% total weight loss from initial egg weight during the first 18 days (between 0.6-0.7% per day) for optimum chick quality.
- Open the air inlet after four days of incubation to avoid relative humidity becoming too high, as this will require relative humidity to be kept low during the last days of incubation to achieve the desired 12% weight loss at day 18.
- Increase relative humidity during the last days of incubation if chicks, shells and shell membranes show signs of dehydration. Dehydrated chicks show dried scales and shanks and the muscles on thighs and drumstick feel small.
- Relative humidity levels of 50-55% in the egg's micro-environment allow sufficient evaporation of water. ■

Fig. 1a) Uniform coloured yolk in a fresh egg. b) The light coloured yolk (arrow). c) Albumen is reduced to a jelly like clod (arrow). d) Embryo protected by the amnion (arrow).



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Adjusting ventilation to improve hatch window and chick quality

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By Marleen Boerjan, Director R&D, Pas Reform Academy

Reducing ventilation at the start of incubation generally avoids the inlet of cold air. Because moisture is trapped in the closed incubator, the humidifier cold spot is also absent.

Consequently, closing the valves during the first days improves temperature homogeneity and heat transfer to the eggs, producing a good, uniform environment for continuing embryonic development – and an ideal start for achieving a narrow hatch window.

However, at the same time, hatchery managers are aware that total weight loss may be challenged if ventilation is closed for too many days, with the result that relative humidity levels become too high. This is especially true in climates typified by high humidity.

For optimum chick quality, high (above 75%) relative humidity during the first seven to 10 days should be avoided, because this forces compensatory weight loss during the last days of incubation through low settings (40-45%) of relative humidity.

The latter may affect hatchability and chick quality, because the very dry atmosphere during the final days in the setter will force evaporation from the allantois cavity and embryonic tissues like the skin and legs.

It is generally accepted that eggs should lose 11-13% of initial weight during the first 18 days of incubation, for optimum hatchability and chick quality. Hatching egg weight loss is a result of the continuous evaporation of water from the eggs – and inseparable from the function of ventilation, which facilitates the removal of moisture from the incubator.

Since eggshell is porous, the release of (water) vapour from the egg starts immediately after laying, continuing throughout egg handling, storage and the incubation of the eggs. Evaporation from the eggs – and thus weight loss – is mainly a physical process, driven by differences between internal and external vapour pressures. Internal vapour pressure is mainly represented by the saturation vapour pressure in the air cell, which increases as temperature increases – thereby facilitating increased evaporation (weight loss) at a certain relative humidity.

In environments with high humidity, weight loss is limited. So for example if relative humidity in the setter reaches 75%, the daily weight loss of the eggs is only half of the weight lost from eggs placed in a setter with 50% relative humidity.

We can conclude, that closing ventilation for the first three to four days of incubation is beneficial, supporting uniform embryonic development for each egg in the incubator to facilitate a narrow hatch window.

Subsequently, ventilation should be opened gradually to support optimum daily weight loss, by the continuous removal of moisture from the eggs.

Advice

For setters with programmed valve positions:

- Start to ventilate at a low level after 3-4 days of incubation to avoid relative humidity being higher than set point for too long.
- Set relative humidity at 50-55% to achieve optimal weight loss.
- Do not ventilate unnecessarily: open valves always disturb the internal incubator climate, which affects humidity, carbon dioxide and temperature distribution.

For setters with automatic controlled valve positions:

- Set relative humidity at 50-55% and maximise the carbon dioxide level at 0.4%. ■

Improving transport performance 32

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

The transport of day old chicks from hatchery to farm has a critical role to play in subsequent performance. Hatcheries operate in a fully controlled indoor environment, while transport entails the risk of exposing the chicks to uncontrolled, outdoor conditions.

The modern hatchery is a major investment in state-of-the-art science, technology and engineering. It therefore makes sense to create a professional, modern chick transport fleet, specifically designed to maintain an optimised environment, to ensure that the birds arrive at the farm in the same condition in which they left the hatchery.

Day old chicks are naturally well equipped for transport. Born with a residual yolk, they are comfortable without feed and water for up to two days – providing that temperature inside the chick boxes is kept within their thermoneutral zone.

Within this narrow temperature range of 32-35°C, the chick's metabolism is just at maintenance level with minimal heat production and water loss.

If temperature inside the chick boxes rises above this range, the chicks will start to use energy from the yolk sac at a much faster rate, to facilitate panting behaviour in an attempt to maintain optimal body temperature of 40-40.5°C. Proteins used for this purpose are then no longer available for the development of the immune and digestive systems. Panting results in water loss, with the risk of dehydration.

When the temperature at chick level is below the thermoneutral zone, the day old chicks are forced to use their own resources for thermoregulation, rather than for growth and health. In general terms, temperature stress causes discomfort while also suppressing efficient production.

Temperature inside the chick boxes should be kept at thermoneutral zone by balancing the heat produced by the day-old-chicks with the amount of temperature-controlled air flowing through the boxes. The optimal temperature of air circulating inside the truck is dependent on air velocity: the higher the speed of the air, the higher the optimal temperature and vice versa. Well mixed, preconditioned inlet air must flow uniformly through all the boxes, effectively absorbing and dispersing the metabolic heat, moisture and carbon dioxide produced by the chicks.

This should not only be the case in fully loaded trucks, but also in the case of partial loads.

Transport conditions are still too often neglected, when in fact they have the potential to significantly affect growth rate, feed conversion, meat yield and the development of the immune system. Optimising these conditions is highly beneficial for subsequent performance on the farm.

Advice

- Realise the importance of optimising transport conditions from hatchery to farm for subsequent performance. Judging the quality of transport solely by the number of dead chicks on arrival is inadequate.
- Choose reliable chick transport trucks, capable of operating independently from driving speed within the range of prevailing, external climatic conditions in the geographic location of your hatchery and customers.
- Maintain a temperature of 32-35°C inside the chick boxes by optimising both the temperature of circulating air and its velocity.
- Work quickly during the critical process of loading and unloading when no forced ventilation is present and/or provide sufficient space between individual chick boxes.
- Take the location of temperature loggers into consideration while reviewing the output; avoid direct contact between chicks and sensors!
- Adjust the number of chicks per box if optimal temperature inside the chick boxes cannot be achieved due to limitations in transport equipment.
- Ensure that drivers are well trained and motivated: their professionalism contributes significantly to optimised chick transport. ■