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service bulletin

Factors Affecting Chick Comfort and Livability from Hatcher to Brooding House

INTRODUCTION

Unlike mammalian species, chicks hatch with an internal resource of moisture and nutrients in the form of residual yolk. At the time of lay, the yolk of a broiler line egg will be 30-33% of the total egg weight (e.g., 20 g [0.7 oz] of yolk in a 62 g [2.2 oz] egg). Because of this, it is possible to extend the duration of chick holding and travel times to placement, and also why regulations governing animal transport have historically allowed much longer journey times for day-old chicks than older poultry and mammals.

Recently, chick transport times have come under scrutiny due to:

- Interest from activist groups and non-governmental organizations
- Governmental reviews of current regulations
- Changes in customer and consumer preferences
- The recent development of technology that allows chicks to be fed in the hatcher or hatched directly on the farm

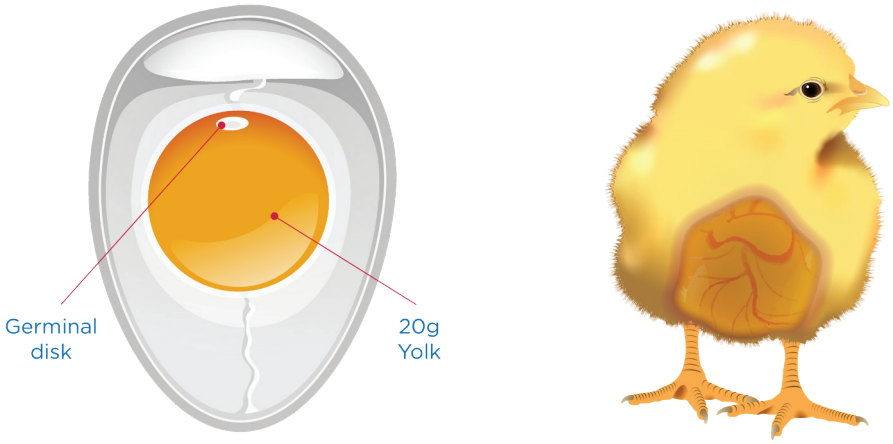
To ensure that our existing recommendations remain valid, Aviagen® has conducted several trials comparing our current lines with 1972 genetic control lines, observing the effect of chick holding temperatures and determining the effect of hydration supplements, through the consideration of factors such as yolk utilization, body temperature, livability to placement and to 7 days post-placement. However, it is recommended to always keep journey times as short as possible by using hatcheries closest to the customer and by selecting routes or flights that minimize the time chicks spend in transit.

REQUIREMENTS FOR TRANSPORT TIMES

Pedigree, great-grandparent and grandparent broiler breeding stock should have excellent health status to minimize the risk of vertical transmission of pathogens. They must be kept under very high biosecurity conditions, which are most effective if birds are in locations remote from commercial broilers or layers, and other avian species. High biosecurity requirements can result in a situation where day-old chicks supplied to breeding stock customers may need to be transported over long distances.

When considering chick transport times, poultry have a major advantage over mammalian livestock, in that chicks hatch containing a significant reservoir of residual yolk which is directly connected to the small intestine by the yolk stalk. In a properly incubated batch of eggs, incubated at an embryo temperature of 100°F (37.8°C) with an 18-day weight loss of 11% and pulled at a chick yield of 68%, the residual yolk will weigh between 4 and 5 g (0.1 and 0.2 oz); somewhere between 9.5% and 12% of the newly hatched chick body weight (**Figure 1**). The reserve of nutrients and water in the residual yolk is sufficient to keep the chicks in good condition for 3 days.

Figure 1. The change in size of the yolk from lay to hatch.



62 g (2.2 oz)

43.2 g (1.5 oz) chick weight with 4.43 g (0.2 oz) residual yolk

Most countries impose regulations which define the duration of and environmental conditions acceptable for different types of livestock in transit. Until recently, these regulations all reflected the unique advantages of transporting chicks while the residual yolk is still present, and permitted longer journey times for them (up to 72 hours after dispatch).

Recently, there has been a lot of discussion about how the time interval between when the chicks are removed from the hatcher and when they arrive on the farm should be handled. Recent development of systems that either allow the chicks to hatch on farm, or provide feed and water in the hatcher so that they can immediately be available to individual chicks as they hatch have provided alternatives to traditional methods. Both have the advantage of shortening the total cycle time from egg set to broiler processing, simply because the chicks have food available when otherwise they would not.

AVIAGEN INTERNAL TRIALS

Chick Holding Trials

Chick holding trials can be difficult to perform correctly. Some things to consider before beginning a chick holding trial include:

- Synchronization of hatch times
- Ensuring holding conditions are correct
- Confirming that farm placement conditions are identical over 3 days

Successful chick holding trials also take in to account the number of samples and replicates needed to produce more accurate data that is statistically measurable. The larger the pen size, the more likely it is to obtain results that are statistically significant. It is important to note that there should be sufficient numbers of replicate pens per treatment; the higher the replication, the better (**Figure 2**).

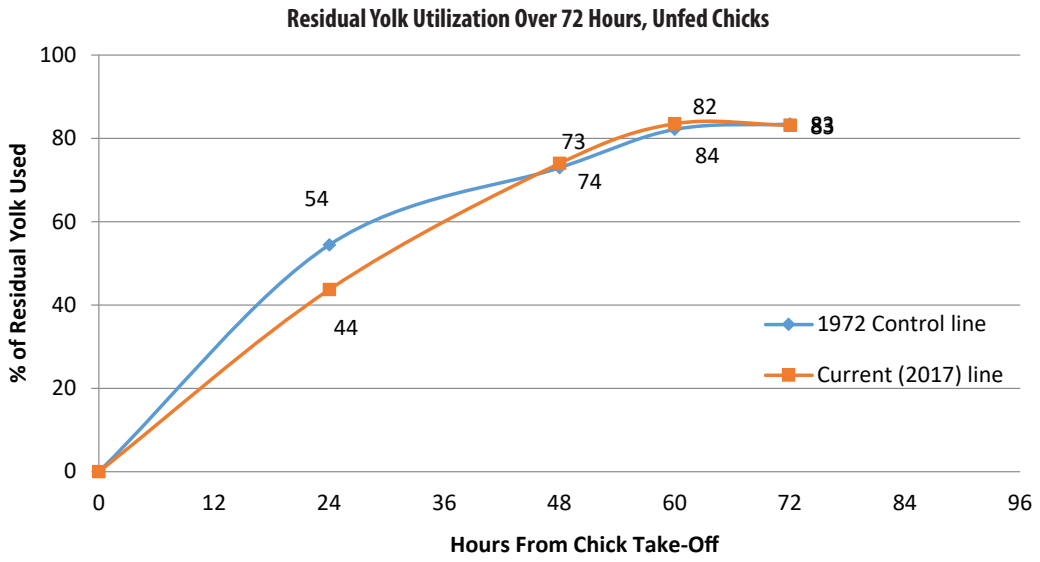
Figure 2. Twelve pens of 160 chicks per treatment should give a statistically significant difference of 0.4%.

Utilization of the Residual Yolk in Modern and 1972 Lines

One of the arguments for shortening permitted holding and journey times is based on the assumption that the modern broiler embryo produces more heat, and because of its "higher metabolic rate", is likely to utilize the residual yolk after hatch more quickly than in the past. Although this is an attractive theory, the published data do not support it.

Aviagen holds genetic control lines, which were separated from their respective pedigree populations in 1972. A trial in 2017 compared genetic control lines with their current equivalents. The rate at which the residual yolk was depleted was very similar in both the control lines and their modern counterparts. Held for 72 hours post chick take-off, the lines tested used just over 80% of the residual yolk present at hatch. **Figure 3** shows that the rate of utilization was slightly faster in the 1972 control line than its modern equivalent to 24 hours, and equal at 48 and 72 hours.

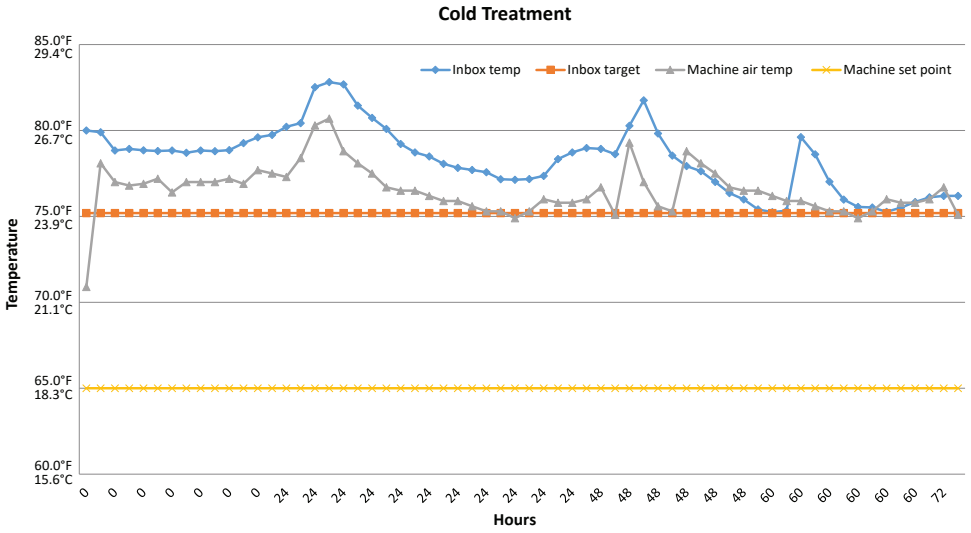
Figure 3. Rate of yolk utilization in male line chicks from the 1972 genetic control line and the current (UK 2017) equivalent.

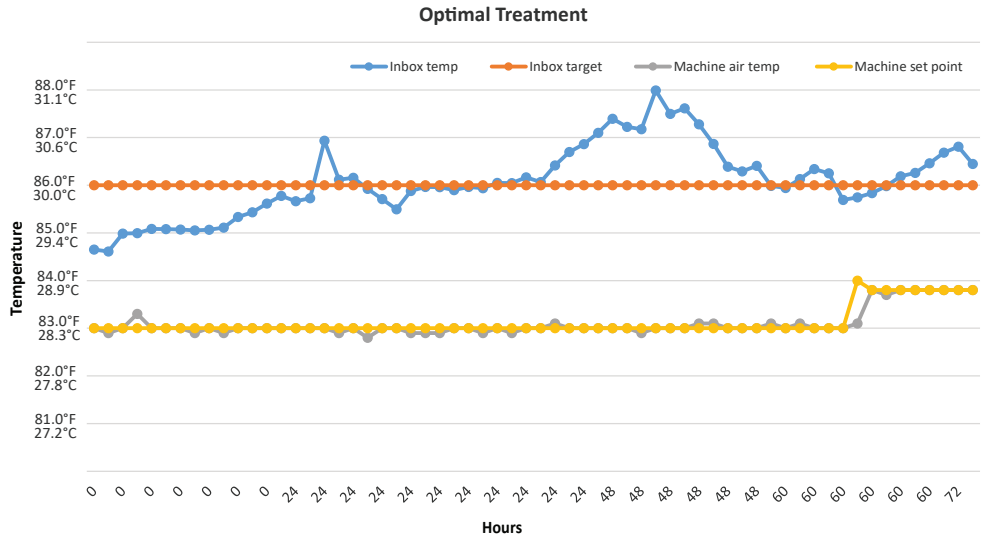


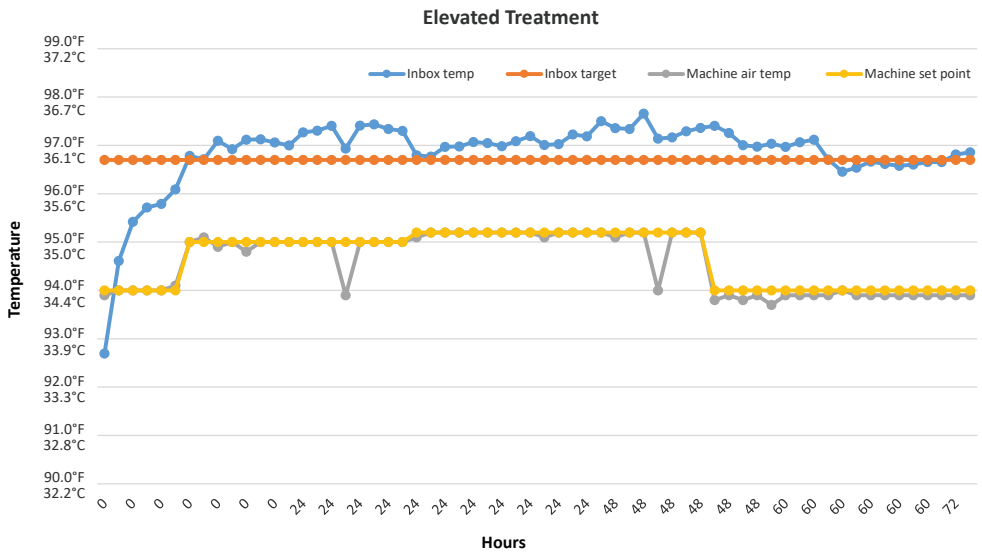
Holding Temperature, Body Temperature, Residual Yolk Utilization and Livability

Environmental temperature is important during chick processing, in the chick store and during transport in chick boxes. It is important to differentiate between the air temperature in the room, the air temperature around the chick and body temperature of the chick. The air speed around the chick will also make a big difference as to the temperature it feels (**Figure 4**).

Figure 4. Three chick treatments (cool, optimal and elevated) held in a modified hatcher at high air speed. The air temperature is 3.0°F (1.7°C), 2.3°F (1.3°C) and 2.0°F (1.1°C) cooler than the temperature in the cardboard chick box.





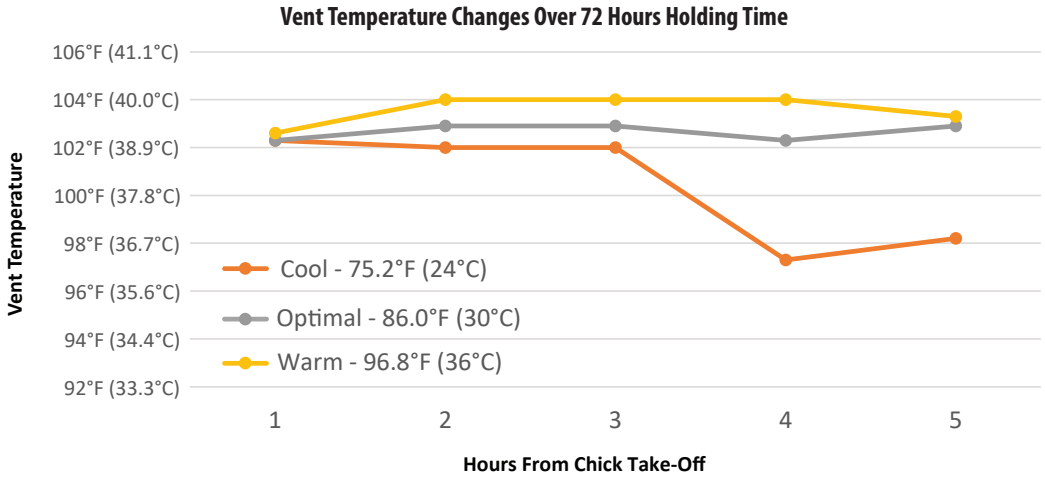


When chicks hatch, they do not have full control of their body temperature; it changes with the temperature of the surrounding air. However, chicks do generate metabolic heat, and are able to modify their behavior if too cold, by huddling together or if too hot by maximizing distances between individuals and panting (**Figure 5**).

Figure 5. Behavioral adaptation to temperatures outside a chick's comfort zone. (left to right) Cold chicks huddle, hot chicks pant, whereas comfortable chicks spread out and relax.

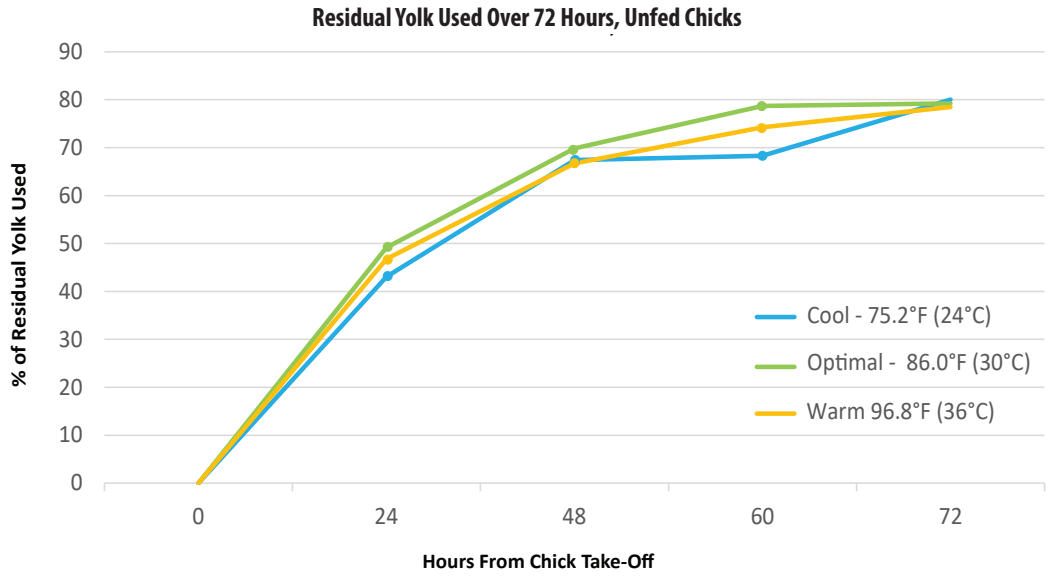
Day-old chick body temperature can easily, safely and accurately be measured using a Braun ThermoScan® pediatric thermometer at the vent. When small groups of unfed chicks sit in boxes for transport, the vent temperature target of 39.4-40.6°C (103-105°F) will usually be achieved if the in-box temperature is around 30°C (86°F). In internal trials where the environmental temperature in the boxes was lowered or raised by 6°C (11°F), to 24°C (75°F) or 36°C (97°F) the chicks' body temperatures also changed. Chicks in the warmer environment gained 0.4°C (0.7°F) and chicks in the cooler environment lost 0.4°C (0.7°F) body temperature over the first 24 hours. However, after 48 hours holding, the chicks' body temperature in the warm and optimal environments remained stable, whereas the chicks in the cooler environment lost a further 3.1°C (5.6°F). The change in vent temperature over time, averaged over three trials, is shown in **Figure 6**.

Figure 6. Chick vent temperature in chicks held for up to 72 hours at different in box temperatures.



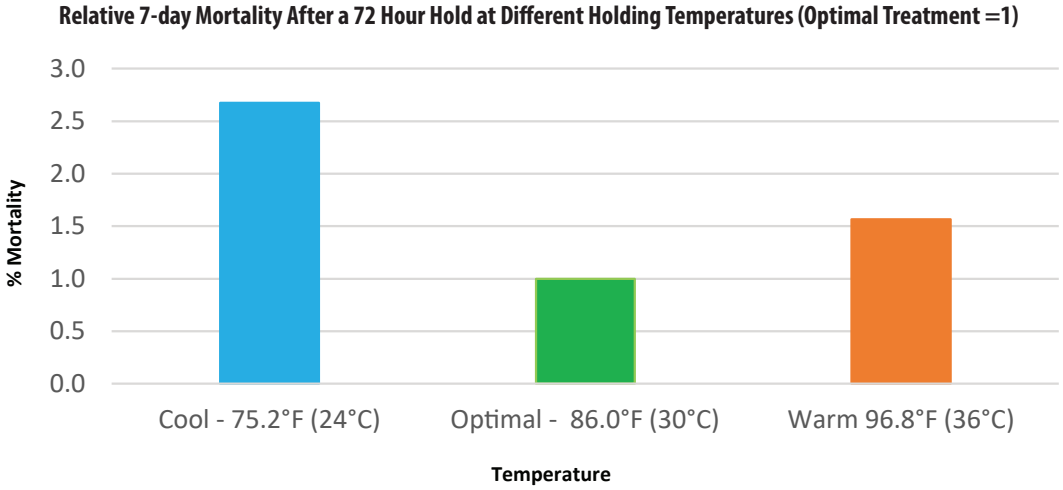
Holding temperature did not have much effect on how fast the chick utilized its residual yolk. However, a small number of individuals in the cool treatment stopped mobilizing yolk after 48 hours holding. This made the 60-hour utilization appear less than that of controls in an optimal environment. Reports in the literature suggest that temperature extremes post-hatch can delay or stop residual yolk utilization. **Figure 7** shows the yolk utilization over 72 hours, averaged over three trials.

Figure 7. Residual yolk utilization over 72 hours after take-off at three holding temperatures.



Livability to 7 days was different in each trial, but the treatment effects were very similar. In **Figure 8**, mortality rates for the control treatment in each trial were treated as a unit baseline, and the difference due to adverse temperature calculated as a relative increase. Populations kept in the cool environment lost 2.7 times as many chicks as those kept comfortable. The warm environment also increased losses, but the increase was only 1.5 times.

Figure 8. First week mortality averaged over 3 trials and expressed as a multiple of the mortality of the optimal temperature treatment.



Although transport that is too cool is harder on the chicks than transport that is too warm, chilling in transport is also much less likely to happen. Chicks produce metabolic heat, and sitting together in boxes the goal is to stop too much heat from building up. However, the trials gave a very clear message that in endeavoring to avoid overheating, it is vitally important not to go too far.

HATCHLING SUPPLEMENTS AND EARLY FEEDING

Regulations covering transport times and conditions for health certificates for day-old chicks take into account that the residual yolk will supply food and water to support them post-hatch.

It is common practice, and sometimes a legal requirement, to offer broiler, parent and grandparent chicks a hydration supplement at the hatchery. They are supplied in a gel form, with approximately 5% by weight taken up with gelling agent and electrolytes, and the remainder water. Uptake of these products is variable; sometimes chicks consume the gel enthusiastically, other times they will refuse it for no obvious reason. Distributing the product evenly across a box of chicks can be difficult, and checks on crop fill suggest that after 6 hours, 40-60% of the chicks will not have consumed any of the gel. In replicated trials, the first week mortality of chicks which have been offered hydration products is usually similar to that of chicks offered no supplement.

There is a specific risk to giving supplements at the hatchery before a long journey. Early tests conducted by Aviagen using a specialized hatchling supplement showed that although it improved 7-day weights after journeys of up to 40 hours, chicks did not survive as well on longer journeys.

Allowing individual chicks access to feed and water immediately after they hatch is possible, either in specialized hatchers or when partially incubated eggs are transferred to the broiler house after 18 days. In both cases, the eggs are candled so that only eggs containing live embryos are transferred. The eggs are held in a setter tray, small end down, and when the chicks hatch, they drop down with immediate access to food and water. This type of system eliminates the holding period between chick emergence and the offer of food and water. Having had food available for a day or more longer, the final broiler weights at a standardized age are usually higher.

There are some potential problems with early feeding systems, even when hatching broilers. First, the feed and water must be put in place before the eggs are transferred and will be held in a warm, humid environment until the chicks hatch. Feeders, drinkers and water lines must be clean if bacterial or fungal growth is to be avoided. Second, individual chicks may not show any interest in food for some time after they hatch. Therefore, it has been suggested that if chicks are to be fed in the hatcher, they should be kept in the hatcher for several hours longer to make sure that the last chicks to hatch have had time to find and consume feed. Third, fed chicks have a much higher metabolic heat output than chicks that have not eaten; 24 hours after feeding the heat output is roughly double that of unfed chicks. This is normal and is not an issue when it happens after hatching on farm, however, chicks fed in the hatchery must be transported and the ventilation and cooling capacity of the trucks must be upgraded if chicks are to be fed in the hatchers.

For broiler breeders, early feeding is problematic because:

- Chicks are much easier to vent sex when their guts are empty.
- Chicks with full guts produce wet droppings, which makes both the chicks and the boxes wet and dirty; cardboard boxes may collapse in transit.
- When chicks have not been fed, their digestive system is not activated and the residual yolk functions to keep them in an extension of the embryonic stage. Once feed is given, the gut is activated, producing stomach acid and digestive enzymes which can damage the gut if it is then allowed to become empty again. For long journeys, it is likely that the mortality will be increased if the chicks are fed at hatch and then left unfed throughout transit.
- The additional heat output from each fed chick is also a concern, especially for chicks transported by air, because the extra cooling needed will not be available on planes.

Some reports on the benefits of early feeding have suggested that when feeding is delayed, the immune competence of the chicks will be impaired. To sense-check this hypothesis, it is possible to compare the performance of grandparent chicks placed by Aviagen on company run farms worldwide. All of them are supplied from great-grandparent production bases in the UK and the USA. Performance data of birds in lay shows that there is no statistically or numerically significant relationship between journey time (and, therefore, the time elapsed between hatch and access to feed) and lifetime livability or egg production.

The hatchability of fertile eggs and chick quality in early feeding systems are usually good, often better than that of eggs from the same batch hatched conventionally. In both systems which offer early feeding, the effective stocking density of the chicks is much lower than in a conventional hatcher. It is possible that at least some of the advantages attributed to giving early feed and water are due to improved environmental conditions at hatch.

CONCLUSIONS

Having re-examined the holding and journey times, environmental conditions and nutritional status of breeding stock during transport, it was found that the rate of residual yolk utilization remains unchanged. The recommended target box temperatures also remain optimal and chicks can be delivered after journeys of between 60 and 72 hours without detriment to 7-day mortality or to lifetime performance, and without having to provide feed and water in the hatchery. However, it is important to note that hydration products come in many different forms and compositions, and research is underway to optimize both formulation and delivery of hydration products in order to maximize any potential benefits prior to any extended journey times.

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