## Size matters

By dr Ron Meijerhof

During incubation, the content of an egg is transformed into a living, day old chick. This miracle of life is the result of a very delicate process, that requires a high level of understanding and control for optimum results. Everybody in the (incubation) industry knows how sensitive these processes are and how subtle the changes in settings and conditions that make the difference between good and poor results.

But the question arises, what are good results in an incubation process, which results from incubation are important for the poultry production chain. And if we have determined that, how can we measure and quantify them, preferably in an objective and repeatable way. Traditionally, the performance of a hatchery is judged on the quantity of chicks produced from the (fertile) eggs set. More often even, the judgement is based on the cost price per chick hatched. Although these are important issues, they do not really pay justice to the role a hatchery plays in a total integration. And although survival rate in the first week is an important trade and is related to quality of the incubation process, also this measurement is not adequate to express the importance of incubation as a part of the whole production chain.

Research has shown that the quality of the day-old chicken, and with that the quality of the incubation process, has a big influence on performance of the broilers at processing age. In an experiment at Penn State university (Gladys et al, 2000) a difference of 5 to 7 points in feed conversion for broilers at 6 weeks of age was observed, depending on the temperature conditions in the last 5 days of incubation. As this is 100 to 140 grams of feed for a 2 kg broiler, it is obvious that the benefit of a good incubation process goes far beyond a good hatch of fertiles or low costs per chick hatched.

The most important driving force during incubation is temperature, and then especially the temperature that the embryo experiences inside the shell, the so-called embryo temperature. Fluctuations away from the optimum embryo temperature result in a less optimum development of the chick, and consequently a performance below maximum. (Lourens et al, 2004). Several researchers focus at this moment on the effects of this temperature on the incubation process, chick quality and its effect on broiler performance. In this article I want to focus on the effects we can observe on the day old chick.

During incubation, the content of the egg is used by the embryo to build up its body. The energy that is needed for that process comes for a large extent out of the burning of the yolk. As we know, the remaining of the yolk is taken up in the body cavity before hatching and is used by the chick in the first days after hatching. This means that if we measure day old chick weight, we measure the amount of chick that is formed during incubation together with the remaining yolk. This weight does not tell us how much chick is formed during incubation. For instance, a 45 gram day old chick can be a combination of 35 gram real chick plus 10 grams of residual yolk, but also of 42 gram real chick plus 3 grams of residual yolk. Although this is in absolute numbers only 7 grams difference in body tissue, it does mean that the 42 gram chick has 20% more body tissue developed then the 35 gram chick. This shows in the weight of the so called yolk free body mass (chick without yolk) but also in the length of the chick, if we measure for instance the length of the spine or the length of the total chick from tip of beak to tip of toe, when stretched out over a ruler. Research within Hybro (Wolanksi et al, 2004) has shown a good correlation between length of the chick and amount of yolk free body mass.

We can imagine that a chick that builds up more body tissue during incubation and became larger at the moment of hatching, might be considered a more developed chick. At the end of the incubation process the total length of the embryo (tip of beak to tip of toe) increases with about 1 cm per 24 hours, which suggests that a longer, more developed embryo at moment of hatching is in a way more "mature". Our first measurements indicate that this extra development does not only show in length of the chick, but for instance also in length of its intestinal tract.

Although we are getting more knowledge about the influence the length and development of the day old chick has on bird performance, a lot of the consequences are at this moment still to be investigated. To mention a view of them:

Our own research has shown that there is a positive correlation between length at moment of hatch and broiler performance at 6 weeks of age.

We also have observed that the length of the intestinal track increases with chick length, which perhaps is also an indicator for a more developed gut system.

The yolk contains the maternal anti bodies that mother hen passes on to her offspring to protect them against the disease challenges she is experiencing. If there is a difference in utilisation of the yolk during incubation, it can be questioned if the immune system in the day old chick develops in the way we expect.

When we vaccinate chicks in-ovo, we want to deliver the vaccine in the amnion fluid, the swallowed by the embryo during incubation. When the development at a certain moment during incubation is not sufficient and the embryo is too small, the vaccine will not be delivered in the amnion but in the allantoic membrane, which makes the vaccination ineffective.

Although there is still a lot unknown about the effect and value of chick length, we do know that an increase in length has a positive effect on broiler performance, and that an extra centimetre in development pays off.