Effect of breeders and incubation on broiler performance

The breeder industry is well aware that management and nutrition of parent stock play a key role in achieving the maximum number of strong chicks with good vitality.

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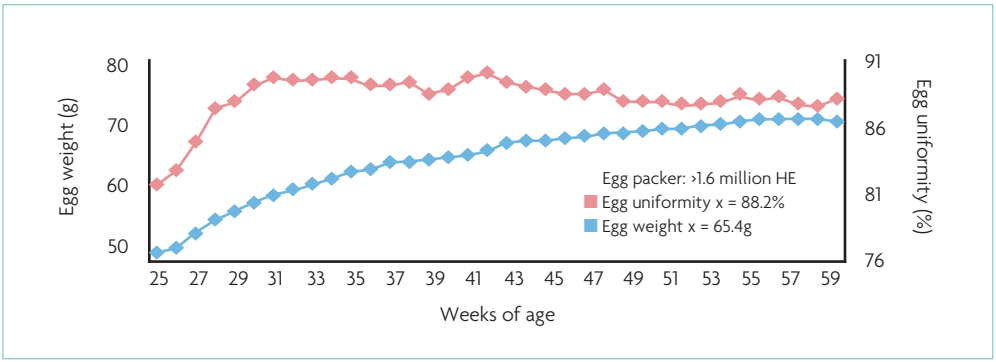

Fig. 1. Egg weight and uniformity for the Cobb 500 FF.

Important aspects of parent stock management can influence chick quality, such as:

- Uniformity of female frame and egg weight.
- Female condition (fleshing and fat reserves) at moment of light stimulation (MOL).
- Vaccination program to cover local disease challenges.
- Quality of the hatching eggs sent to the hatchery.

In the first eight weeks frame uniformity is achieved and from 16 weeks fleshing and fat uniformity is important for good sexual uniformity of the hens. The hens should be as close as possible in size and development throughout rearing.

In Fig. 1. an average uniformity is observed for the Cobb500 FF breeder tracking the average egg weight and uniformity over an egg packer so that all the hatching eggs of a flock are being traced.

As can be seen, the average uniformity is just below 90% and on average 88% with ±10% spread.

This means that chicks hatched from these eggs should have uniformity above 80% at hatch, which is a good number for starting chicks on a broiler farm.

At 25 weeks of age the hatching eggs over 50g already reach uniformity above 80% and then climb fast to 89% to stabilise.

Female condition at light stimulation

In large integrations it is seen that there is a positive correlation between total feed amount consumed or bodyweight condition of the parent females at the end of rearing (147 days of age) and broiler livability at seven days of age from young breeders.

Parent flocks with not enough nutrient intake or the wrong body condition show the highest first week mortality in broiler chicks in the first six weeks of the young parent stock with a negative impact on final broiler results.

Table 1 is an example of how feed intake (female nutrient intake) can show its effect on mortality in the first seven days of age not to mention the impact on uniformity and final results (body weight and feed conversion). Breeder companies improve broiler feed conversion in the broilers by enhancing growth rate, selecting for larger portions of breast muscle and reducing total body fat. This body fat is a key component at first light stimulation to obtain:

- Good sexual synchronisation of the females.
- High peak production and persistency.
- High early hatchability, and good chick quality and vitality.
- Reduced mortality in females going to peak production.
- Low percentage of floor eggs.

Cobb conducted trials in conjunction with Lagerwey Hatchery in the Netherlands and Hatchtech, using 2 x 4800 egg capacity setters and 1 x commercial setters (57,600 eggs) to determine the effects of temperature in incubators. Cobb then followed these chicks from different temperature profiles to two broiler trial facilities.

Cobb 500 eggs were used in three separate trials with eggshell temperatures being maintained at 100.0°F for the first seven days of incubation in all trial groups and until transfer for the commercial setter. One of the small setters was reduced from 100.0°F at day seven to 98.5°F by day 10 and the other small setter was increased in temperature from 100.0°F at day 7 to 101.5°F/102.0°F by day 10 until transfer at 18 days of incubation, as seen in Fig. 1. Probes were attached to designated eggs in positions in the trolley for each setter to record eggshell temperatures every nine minutes during the first 18 days of incubation.

Table 1. Impact of feed intake on mortality.

Period 26-32 weeks of age	Total farms	Farms with	Parent stock accumulated
At light stimulation	Average mortality 0-7 days	Highest mortality 0-7 days	Feed intake 0-25 weeks
Under conditioned females	1.30%	2.33%	± 12.7kg
In condition females	0.75%	1.15%	± 13.6kg

Results

- **Hatchability**

The low temperature (98.5°F) eggs were adversely affected with over 10% lower hatchability and over 1.0% higher cull rates.

- **Hatch window**

Hatching time is influenced by temperature. Measuring eggshell temperatures and hatch windows can help to avoid chicks hatching too early and reduce risk of dehydration.

- **Chick length**

A direct correlation of chick length to hatching times could be seen. Chick length (cm) was greater on the early hatching chicks, which we assume, is related to growth from the absorption of the nutrients from the yolk.

- **Organs**

Samples from each trial group were saved and a post mortem conducted to analyse the differences in organs. The organs were weighed and calculated as a percentage of the chick weight. The heart showed no difference for the low and normal temperature groups, but the high temperature group showed adverse growth. Residual yolk weights showed higher levels for

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Temperature (°F)	Day 7	Day 14	Day 21	Day 29	Day 36
98.5	186	510	1005	1610	2136
100	194	532	1034	1681	2177
102	193	521	1014	1587	2119

Table 2. As hatched – Trial Farm 2.

Temperature (°F)	Day 7	Day 14	Day 21	Day 34	Day 38	Day 34-38
98.5	173	485	1005	2395	2807	412
100	181	504	1029	2432	2843	411
102	179	488	1009	2347	2737	390

Table 3. Males – Trial Farm 1.

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the low temperature groups due to the chicks hatching later and reduced absorption levels. The high temperature group showed negative yolk absorption to the normal group, even with the chicks hatching earlier.

Growth of the liver is linked to nutrient absorption but best optimum growth of the liver can be seen from the normal temperature group of 100.0°F.

● **Chick yield percent**

Chick yield percent is a measurement of chick weight divided by initial egg weight. In our trials and experience in the field we have seen a direct correlation with chick yield to seven day mortality and seven day weights.

Historically, with multi-stage incubators the old rule of thumb was chick weight equalled two-thirds of egg weight with a weight loss at 18 days of incubation of 12-14%.

Today with many single-stage machines it is not uncommon to see a weight loss at transfer of only 9-10% of initial egg weight due to the damper being closed for up to nine days of age.

The closed damper aids the uniformity of temperature in the setter and development of the chorio-allantoic membranes with the increase in CO_2, but the higher humidity levels result in lower weight loss. Do we compensate for this in the hatcher?

More often than not we do not, hence why higher chick yield percentages are seen.

If this is the case then the preference is to start opening up the damper in the setter at say day five or six rather than nine to achieve weight loss levels of at least 11.0% in the first 18 days of incubation. This period for oxygen supply is essential when certain organ development is critical ie. heart, lungs.

Broiler results

The chicks from these trials were placed on two trial farms. One was a small pen facility with many replications to better measure differences in performance (238 pens x 10-15 birds/pen) and the other with large pens to mimic real world commercial conditions (12 pens x 950 birds at 20 birds/m^2).

● **Bodyweights**

In all trials, the normal temperature groups (100.0°F) gave the best weekly bodyweights. The low temperature groups gave the lowest bodyweights in the first 21 days of the cycle, whereas in general the high temperature groups had the poorest weight gain post 21 days.

● **Mortality**

Once again the normal temperature gave the best results whilst the low temperature gave the highest mortality in the early stages The high temperature gave the highest mortality in the latter stages of the broiler cycle.

● **Feed conversion ratio**

An incubation temperature of 100.0°F gave the lowest feed conversion ratio at 37 days of age, with the difference being one point adverse for low incubation temperatures of 98.5°F and four points adverse for high incubation temperatures of 102.0°F.

Summary

● Maintain eggshell temperatures between 100.0°F minimum and 101.0°F maximum at transfer stage (18-19 days of incubation).

● Low eggshell temperatures affect hatchability and cull rates the greatest.

● Eggshell temperature influences hatching time and potentially chick weights by yolk absorption.

● 100.0°F eggshell temperature gave optimum development of the organs and broiler bodyweights, FCR and mortality levels.

● Low eggshell temperatures (98.5°F) gave lowest broiler bodyweights for first 21 days and highest seven day mortality levels.

● High eggshell temperatures (102.0°F) gave lower bodyweight gains and higher broiler mortality levels post 21 days of age, more heart attack losses due to reduced development of the heart and higher FCR for males at 2.1kg and 2.8kg.

● Chick yield can be used as a good indicator of correct incubation environment to attain optimum chick quality. ■

Table 4. Mortality.

Temperature (°F)	Day 7	Day 14	Day 21	Day 29	Day 36	Days 21-36
98.5	1.84	2.72	3.39	4.70	6.60	3.21
100	0.56	1.14	1.42	2.33	3.72	2.30
102	0.81	1.28	1.75	3.54	6.18	4.43