Feed for fuel: a hot topic

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Introduction

The cost of fuel and the use of raw materials (corn and other cereals) for producing alternative fuel sources are hot topics nowadays. Not only fuel prices are going up, but because more and more corn is used to produce ethanol and bio diesel, feed prices are going up as well, and consequently margins in the broiler industry are decreasing.
From the total energy costs for growing broilers, a lot is spent on heating up the house for the birds during the first days, As day old chicks have hardly any heat production when placed and loose heat very quickly, we must heat up the house (especially the floor) sufficiently to prevent them from loosing too much heat and dropping their body temperature below the optimum of 40-41oC. Once their body temperatures drops below this optimum level, the birds will slow down their activities and not move around any more. As a consequence of this not moving around, they will also not walk into the feed and start eating and growing. This means a loss of growth, but also a less quick uptake of the yolk and an increased risk on infection of the yolk sac, resulting in more mortality. As not all birds will suffer from this loss of body temperature, some birds will start quickly where others take several days to come to the same body weight, resulting in a loss of uniformity as well.

So on one hand heating up the house sufficiently is important for having a good start of the flock, but on the other hand heating costs will go up while doing so, and especially with nowadays fuel prices and reduced margins in broiler production, people try to cut their heating costs as much as possible. However, if we take a closer look to it, we might wonder if this cutting on heating costs actually leads to a real cut in costs.

Cutting costs or profits

First of all, if we cut costs that result in a loss of growth, we might find ourselves in a situation where cutting costs is leading to cutting profits. After all, we are not in the poultry business for the sake of cutting costs, but for the fun of making money.
Although this statement is valid, it is very difficult to put a real figure on it, as we can't really predict what the loss in growth, feed conversion and mortality will be.
But if we take a close look at what a bird is really doing during the grow out, we might find a more direct relation between cutting costs and cutting profits.

Optimal body temperatures

The body temperature of a bird (or any other animal) is the result between the heat production and the heat loss. The optimal body temperature of a bird is approximately 40-41oC, depending on the method that we use to measure. A practical and quick method is to use an infra-red ear thermometer on the cloaca. If we measure bird temperatures this way, an optimal temperature seems to be approximately 40oC (104oF). If the body temperature drops significantly below this level, the birds (during the first days) will stop moving around and eat, sit down and wait until better times will come. Some birds will huddle, but especially day old birds and then particularly day old chicks originating from young parent stocks can sit spread out and still be under cooled.
If body temperatures increase above 105.5-106oF, the bird is getting overheated and will start panting, trying too loose more heat by evaporating water. Even before this level is reached we can already see that the birds try to loose more heat by stretching out their wings and neck. Another effect is that the birds will start slowing down their feed intake, as this will reduce their temperature as well.

The heating effect of growing

Birds are not totally efficient in converting feed into growth. During the process of digesting feed and converting it into growth, some waste products are formed. One of the most important waste products of this process is metabolic heat. If birds grow, they produce heat, and if they grow faster, they produce more heat. Knowing this, we can take a closer look to the effects of cutting fuel costs.

If we don't heat up the house sufficiently, our day old chicks will be under cooled. As a result of this, a certain amount of birds will not start quickly. However, if these birds do not eat and do not digest feed, we must keep the house temperature up for a longer time, to ensure that the birds do not loose to much heat and get under cooled.

On the other hand, if we do heat up the house and all birds start very quickly to eat, digest food and grow, we must very quickly reduce the temperature, otherwise the birds will become very quickly overheated and start to slow down on feed intake. This can be observed often when we take daily temperature recordings of a small sample of the birds. The birds (or at least a part of the flock) are often too cold on the first day, but once they start growing they get overheated very quickly. And the more quickly they start growing, the more quickly they will get overheated and start to slow down their feed intake.

Growth and heat production

The heat production of birds and therefore the optimum environment to maintain their body temperature as easy as possible depends mainly on the growth. We normally expect an average bodyweight in a broiler flock at 7 days of approximately 160-170 grams. However, we know that under field conditions it is not unusual that average broiler weights don't exceed 120 grams at 7 days, where in other situations the same broiler flock can weigh 220 or even 250 grams. If we start with a body weight of 40 grams, we expect normally a growth of 120-130 grams in the first week (160-170 grams minus 40 grams) but it can also be 80 grams or 210 grams. A huge difference, not only in growth but also in heat production. We usually assume that when growth is 2 times as high, the heat production 3 to 4 times as high, which indicates the enormous difference. We have to react on this difference, because if we don't, the birds will get overheated and will simply slow down their growth, to keep their body temperature under control. This means that a flock that has started very well will not continue this performance if we don't adjust the environment to its needs. This doesn't only holds for starting flocks, but is relevant throughout their life.

Dynamic temperature profiles

We often use standard temperature profiles for broiler growing. These profiles are based on a average flock performance. First of all it is important to realize that not only temperature is influencing heat loss. If we create conditions with high air velocity (for instance with tunnel ventilation), birds will loose more heat at the same environmental temperature. This is beneficial at the end of the growing period when we have to deal with an excessive amount of heat production, but can work against us at the beginning when heat production is low. As heat loss is not only a matter of temperature but also for instance of air velocity, a certain flexibility in temperature control and an adjustment with other factors as air velocity has to be made to balance heat loss with heat production..

In the following table, a standard temperature profile for broilers is given (assuming that growth is linear in this period, which is actually not the case).

Age (days)	Bodyweight (norm)	Temperature (norm)
1	40	34
2	60	34
3	80	33
4	100	33
5	120	32
6	140	31
7	160	30

Although these tables are useful, it is important to realize that the optimum air temperature depends more on the bodyweight and the growth of the flock then of the actual age. This means that if the bodyweight of a flock is in reality different from the norm, we have to adjust the temperature profile as well. An example of a higher body weight then the norm is given in the following table.

Age (days)	Body weight (norm)	Temperature (norm)	Body weight (real)	Temperature (real)
1	40	34	40	34
2	60	34	70	33
3	80	33	100	33
4	100	33	130	31
5	120	32	160	30
6	140	31	200	29

7	160	30	240	27

Of course the body weight can also be lower then expected, for whatever reason. In such a situation, the temperature curve has to be adapted in the opposite direction.
What the table shows is that the optimal temperature profile is not determined by the actual age of the flock but by the growth. In a way, a flock that has reached the standard body weight of 7 days already at 5 days, has to be treated as a flock of 7 days. After all, the birds cant count well enough to realise that they are only 5 days of age.

What is the influence on fuel costs
If we preheat the house sufficiently and we are able to give the birds a better start, we not only get them to grow better, but we can also utilise the heat production of the feed that they eat. In other words, we can drop the temperature of the house much more quick, saving the same amount of fuel or more as we spent initially on heating the house. What is important in that is that we are willing to control the temperature of the house based on the body weight or better on the actual body temperature of the birds. If we keep on controlling the house temperature based on a standard curve, not adjusting for the increased growth, we are not only spending more fuel then necessary, but we are also punishing the bird for the extra growth that it gave us, and as a result the growth will go down again.
The common experience of people that work with this system is that fuel costs are not increasing but sometimes even go down, and that growth and especially uniformity is increasing.