We have all heard the saying 'A chain is only as strong as the weakest link'. This is true of the process of producing quality birds which will in turn be beneficial to the owners.

Brooding is perhaps the most difficult of the links as it tends to be filled with uncertain areas. Mistakes in breeder management usually result in lower hatch rates, and some weak chicks. Bad mistakes in incubation usually mean no results at all. Even the best chicks can be ruined in the first few weeks of their life, and though they may die they will never be much use for their managers. However the signs of ruin may be disguised and so only become apparent months later as the birds mature. A temporary halt in growth in the brooding stage is difficult to make up later.

Brooding Methods

There are about a dozen different systems used for brooding chicks of all species. There are only two methods of brooding and all the different systems and techniques fall into these two methods.

Method 1

The first method is hot air brooding. This is where the heat source heats the air in the brooder area to a temperature which is comfortable for the chicks. This method usually involves adjusting the air temperature every few days, gradually reducing the temperature as the chicks develop and are able to handle the lower temperatures. Often, though not always, this method uses temperature regulators to accurately control the amount of heat available to the birds. Hover brooders, battery cage brooders, hot water brooders, carbon filament lamps, hard glass brooder lamps and many gas brooders are used in this category. This method has some advantages and some disadvantages. Perhaps the biggest advantage is that the air temperature is easily measured with a thermometer. The predominance of lamps in this category also means that the chicks are often reared in continuous light, which can be useful in that the chicks are attracted to the light and learn quickly to go to it when requiring heat. The higher light levels also mean that night time inspection is easier.

The disadvantages of the system are several. The first is that the birds use the evaporation of moisture from the lungs as an evaporative cooling system. If the

air temperature is just a little too high, and the humidity also a little high, the evaporative temperature control mechanism of the chick cannot work. This means that the chick is under heat stress. This effect is worse in the first few days. So accurate temperature control is important.

Secondly if continuous light is used, it tends to upset the sleeping habits of the chick. As !he growth habit of birds is triggered by the light stimulus to the eye, which stimulates the production of various hormones, continuous light can produce negative symptoms, including hyperactivity, cannibalism, and early sexual maturity. The effect of continuous light is most marked in the less domesticated species such as pheasants. The less domesticated the species, the more susceptible they are to over stimulus.

The third disadvantage is that the birds grow feathers more slowly. The feathering rate is determined by diet, genetic factors, and air temperature. The air temperature is the factor of importance here. If the air temperature is close to the body temperature of the bird, heat losses are minimal, and the bird needs less feathers to stay warm. The production of feathers is slower when the air temperature is higher and increases when the air temperature is lower.

Method 2

Radiant heating is the second method used for brooding. This involves the use of heaters which heat the objects they are aimed at without heating the air.

This sounds a little odd at first but if you think of the domestic bar radiator you will see the principle. If you turn on the radiator and measure the room air temperature you will find the room temperature only slowly rises. If you sit in front of the radiator you will soon feel very warm, though a quick check of the air temperature will show that the room temperature has barely moved. As the walls warm up they do heat the air a little but that is another story.
This type of brooder also has advantages and disadvantages. The usual heat source for these is ceramic heaters and radiant gas heaters.

The advantages are lower light stimulus, and lower air temperature. The lower air temperature has two effects. The first as we have seen is the faster rate of feather growth. The second is slower disease transmission. If the air temperature is low

then many disease organisms travel more slowly and cannot multiply outside the bird's body. This can be taken to extremes where the disease resistance of the bird can be lowered due to cold stress. Because most of these type brooders have low light they do not disrupt the bird's growth pattern. They simulate the process used by the mother hen. If you observe the young chicks under a mother hen, you will see them walking around in the cold, then cuddling under the warmth, but often with the head out in the cold air. As well as this the mother does not have any lights so when the chicks sleep it is in darkness.

The disadvantage of this type of brooder is that they require a little more judgement and management for the first few days.

Because there is no light from the brooder, the chicks, do not have the attraction factor which leads them to associate light and heat. They tend to quickly go to the light and so do not need to be contained as much as when no light is used.

The brooder area will need to be more controlled for radiant brooding until the chicks learn that heat is heat. However having learnt where the heat source is, the chicks then regulate their position, moving in or out from the heat source according to their heat needs.

Another disadvantage appears to be emerging with this type of brooder. Because the heat is all overhead to the chicks, the chicks can tend to get hotter heads that by hot air brooding.

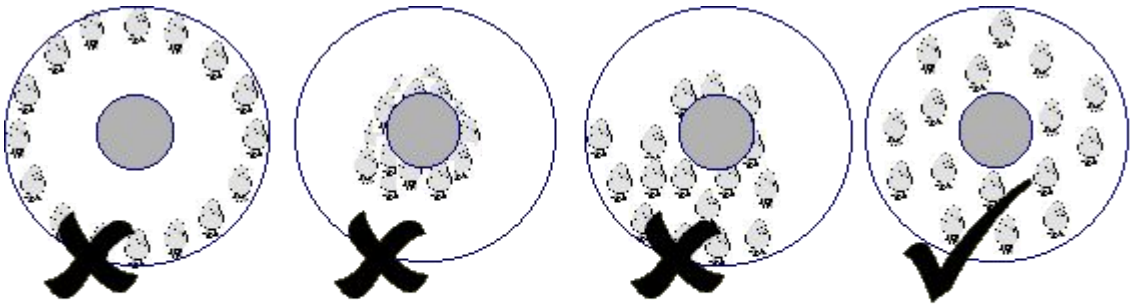
This can mean that in Mediterranean breeds such as Minorca and Leghorn commence comb development earlier and can develop comb weakness and overlarge combs.

Heat zones

Another aspect of brooding which can be important is the concept of temperature zones in brooding. Many think that the temperature in the brooder should be set to a specific temperature for each stage of growth. This may be correct, but the difficulty stems from our inability to correctly decide what temperature and then be sure that it is correct.
The easiest way to mimic nature here is to provide three zones of temperature. A

hot zone, which is a little above the optimum temperature for the chicks. This hot zone may be relatively small. A comfort zone which should be large enough to accommodate all the chicks, and set at about the optimum temperature for the stage of growth of the chicks. Thirdly a cold zone which should be considerably cooler that the optimum temperature required by the chicks. This allows the chicks to have a greater degree of control over their environment, and so allows a happier chick.
The chicks will adjust their position in the brooder area according to their requirements. In the active awake periods the chicks have a faster metabolism, i.e. they are eating more food and converting it to energy and so require less external heat input. In the sleeping phase the metabolism slows and the external energy requirements increase.

And of course there will be the times when they just want to stretch out and sun bake and so like the hotter zone. This zone also acts as a bit of a safety barrier just in case the weather changes and cools off, allowing that bit extra heat if required.



Wrong. Too hot | Wrong. Too cold | Wrong. Too cold with a draft | Just right!

How much heat do chicks require?

The chick has basically three different stages of heat requirement.
It is important to stress here heat and temperature. The two are different things.

Heat is really the short name of Heat Energy. Heat and hot are different. Hot refers to temperature, heat refers to energy availability.

If I have some heat energy and I apply it to an object, the temperature of the object will rise. If I have a bowl of water and I put 2 units of heat into it, the temperature will rise by say 5 units. But if I tip half the water out, and then put in the same two units of heat into it, will the temperature change 5 units? No, the temperature will rise by more than 5 units. So we see that temperature is a measure of the effect of heat energy on an object.

Back to our chicks. They have three different stages of heat requirement. The first is the heat requiring period. This is where the chick has not developed its own insulation, and its digestive system is still not fully functional. At this stage the chick will draw heat energy from the environment. The chick must be kept able to accept heat from the environment as it cannot control its own losses. This stage can occur at any time in the life of the bird if the environmental temperature falls too low.

The second is the thermoneutral zone. This is where the chick has developed some insulation (feathers) and can eat enough to produce its own energy requirements, i.e. the food is converted to heat energy.

The third stage is where the chick is producing more heat that it needs and so gives heat back to the environment. This can occur at any time after the chick is hatched if the environment temperature is allowed to rise too high.

How much heat?

The key is observe the chicks. If the chicks are too cold they will huddle as close to the heat as possible, in extreme cases piling on top of one another. They will often peek pitifully and generally look uncomfortable.
If the chicks are too hot they will spread out around the edge and try to get away from the heat. They will also tend to have their wings spread and beaks open, panting to try to get rid of the heat.

If they are comfortable they will be spread over most of the brooder area, some sleeping under the hottest part, some moving around the cooler parts.

The other factor which can cause havoc in brooders is draughts. These cause an effective lowering of the brooder temperature and will cause the chicks to be

uncomfortable, and can cause substantial losses and poor growth. Drafts tend to be obvious as the chicks cluster on one side of the brooder.

Practical Application

The lowest temperature that will occur in the brooder room is important to consider. Even with radiant brooders a minimum air temperature must be considered. If the air temperature is too low the amount of heat required to keep the chicks warm will be enormous. Absence of drafts is important, but there must be adequate fresh air. Watch out for heat traps where the birds have moved into a cooler comer to avoid the heat. However at times the cooler corner is still hotter than the chicks can stand. But for the chick to get out of the cooler comer to a place of true comfort means the chick must move into the hot zone. The chick will not do this but will die in the comer struggling to get away from the heat.
Roof insulation is worth considering. Even insulation will prevent condensation and frost. Frost can badly effect chicks especially in sheds with plain iron roofs.

A brooder surround is essential where hover brooders and radiant brooders are used. This is a sheet metal, cardboard or wooden circle which will be used to control the area the chicks move in and to prevent floor drafts. If battery brooders are used, consideration must be given to draft prevention at the height of the brooder.
Brooder areas are covered with three different materials. The first is shavings, or as some call it litter. The second is litter covered with paper. This is usual for small chicks such as bantams, pheasant, and quail or for very large numbers of chicks. The paper gives better footing for the first few days then breaks up and mixes with the litter.
The third method is wire floors as in battery brooders. These also are often covered with paper for the first few days. Wire floors can reduce some parasite problems, and can make brooding large numbers of chicks in a small area a possibility.
When using ceramic radiant brooders, the many different sizes should be used with a surround on litter. They are rugged, with good heat distribution in central hot zone, and outer comfort zone. The shade MUST be kept shiny on the **outside** to keep efficiency. Sometimes used with an attraction lamp.

Exceptions

One breed which defies the rules is with turkeys. If turkeys are being brooded with radiant methods it is a good idea to have an extra light in the brooder area for the first week. Turkeys have limited vision for the first week or so of life and so having extra light makes it a little easier for them to find the feed and water.

Feed and water

These of course are necessary items. It is better to have a little too much feeder and drinker space than is required than too little. I also recommend the use of soluble vitamins in the water of the day olds. This helps overcome any stresses which may have occurred in the transportation or settling in of the chicks to the brooder.

Ducks and geese will take up more area, and so less birds will be covered by the brooders. For larger birds such as ostrich and emu, use will be determined by individual application. The above tables are guidelines only. If the chicks are too cold lower the height, and if too hot, lift the heights. Double the height of the heat source will increase the area covered by a factor of 4 and reduce the intensity by a factor of 4.

Explanation of different types of heat

I am a fan of models which assist us to see all the factors involved in the management process. This helps us to understand the dynamics of the situation without short cutting and over simplification but without undue scientific lingo. I hope the following model helps you too.
The model applies to birds of all ages.

BIRD COMFORT = TOTAL HEAT GAIN - TOTAL HEAT LOSS

BIRD COMFORT is where the bird is able to maintain its body temperature without stress, and where all body functions can occur at the optimum level. Chicks cannot maintain their own body temperature levels and so need outside assistance. Older birds actually produce more heat than is necessary and so must lose some heat to the environment perform satisfactorily.

TOTAL HEAT GAIN = CONVECTIVE HEAT +CONDUCTIVE HEAT + RADIANT HEAT + METABOLIC HEAT

CONVECTIVE HEAT GAIN from warm air and air heaters.
CONDUCTIVE HEAT GAIN from contact with warm surfaces.
RADIANT HEAT GAIN from radiating bodies which are hotter than the bird. This may also be hot roofs and walls in summer.
METBOLIC HEAT from the conversion of food to growth and activity.

TOTAL HEAT LOSS = CONVECTIVE HEAT LOSS + CONDUCTIVE HEAT LOSS+ RADIANT HEAT LOSS
+ EVAPORATIVE HEAT LOSS.

CONVECTIVE HEAT LOSS is loss to the air, by drafts, by contact, and by exposure (ie lifted wings in hot weather).
CONDUCTIVE LOSS is loss by contact with cooler surfaces. e.g. dust bathing.
RADIANT HEAT LOSS is loss to cooler surfaces and objects. Not greatly significant in older birds.
EVAPORATIVE HEAT LOSS is one of the main controllable losses from the fowl. In chicks evaporative losses are small but actively used. In large birds, the bird quickly puffs air in and out of the forward air sacks, is an important method of removing body heat.

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