

Multi- or single-stage, that is the question.

Traditionally, the majority of the incubators in the world are used multi stage. Until quite recently, only a few incubator manufacturers focused on single stage machine, although most manufacturers had both single stage and multi stage machines available. Nowadays, we see an increasing share of single stage machines and for a new hatchery, single stage machines will be considered a serious option.

But why do we see this trend, and what should be the arguments to choose for either single stage or multi stage? For many years, the major argument for single stage machine was hygiene, the possibility to clean and disinfect the machines between every set. This is of course an important argument, not only because embryos and day old chicks are very sensitive for contamination, but also because the hatchery is a crossroad between breeders and broilers, and diseases and zoonoses can spread fast through an operation if the hatchery gets contaminated. However, the downside of single stage is the energy consumption. As we place fresh eggs and old eggs together in multi stage machines, the heat of the developing embryos will warm up the starting eggs, and the starting eggs will help to cool the more advanced embryos. This is without any doubt a benefit. Although in single stage machines we are able to use the heat from the cooling system to warm up other machines, still a multi stage system will be more energy efficient. And as a single stage machine needs more cooling and more heating capacity, also the machine itself will be more expensive.

So traditionally costs were an important factor to choose for multi stage systems, in spite of the obvious downsides on hygiene. But what is changed, why are we nowadays changing our way of thinking in favor of single stage systems? One issue is that single stage machines are easier on labor requirements, as well as on planning of the settings. But the biggest issue is that we started to realize that hatcheries are not about reducing costs, but about maximizing profits.

Multi stage machines have the disadvantage that the same environment is created for eggs of all moments of incubation. This means that we cannot reduce the temperature in the latter part of the incubation process, and due to the internal heat production of the embryo, the internal temperature of the eggs will go up. Since we started approx 20 years ago to think more in terms of embryo temperature (or more practical, egg shell temperature) than in terms of air temperature, we realized more and more that temperatures at the end of incubation are coming up high for the embryo if we are not able to lower the temperature of the air. Research and practical experience have learned us that the consequences of this for the embryo but especially for the resulting chicks are enormous. It is not uncommon to see that the temperature of the embryo goes up more 1oC or more than 2oF above the optimal temperature for its development. This results in a lower hatchability, but especially in smaller, less developed embryos with bigger residual yolk sacs. These embryos hatch with a 20-25 % smaller heart size, reduced bursa weight and less energy. And as a bird, they suffer more from mortality, leg and foot pad problems, issues with immune response to diseases, ascites, and finally it results for broilers in up to 100 gram less final body weight for age, and 2 to 5 points higher feed conversion.

So although multi stage machines are cheaper in investment and cheaper in energy usage, the disadvantages in results outnumbers the advantages in costs by far. This does not mean that single stage machines are always better. If a single machine is not designed, maintained and operated well, the results can be poor as well, especially when the temperatures of the eggs cannot be kept under control. But a properly managed single stage machine will at the end outperform a properly managed multi stage machine, simply because the possibility for controlling the temperature of the embryos is better. And at the end that is the only thing that really counts.

Unfortunately, it is not simple to convert multi stage machines in single stage machines, as it requires a different design with different cooling and heating capacity and different ventilation. Also hatcheries are sometimes too small to have economical feasible machine sizes for single stage settings, as eggs have to be set several times a week for a three week period. And last but not least, to destroy capital by replacing machines that are in itself are still functioning is always painful. But at the end we have to realize that poultry production is not about costs but about profits. If an incubating system is not performing as it should, a simple calculation will show that machines that do not maximize broiler (and layer) performance are incredibly costly.