

Lecture 6

SINGLE- AND MULTI-STAGE INCUBATION

There is no best way to set eggs. Individual circumstances dictate which way is best. The mother hens methods need to be monitored, fine tuned and then adapted to circumstances.



While **Multi-Stage** is a system of **Continuous Averages** that suits the **majority** of eggs, **not the extremes**. It is disadvantaged in that young (coldest) and old (warmest) eggs suffer because **average conditions are maintained** thereby causing higher levels of early and late deaths. Single stage on the other hands creates **no extremes**. The eggs in each individual zone are **exactly the same** (age and flock). It can provide the **exact conditions** desired at each stage of the embryonic development for **every batch of eggs**.

Completely sealing (using a sealed box) the cabinet for 9-10 days is **needed** to obtain the **benefits** of Single-Stage. This creates a **totally stable**, homogenous, environment **free** from temperature, humidity and ventilation fluctuations. It also **minimises** moisture loss from eggs. Completely sealing the cabinet also helps to **maintain albumen pH** at levels **best to fight** infection. Albumen **alkalinity** is also **optimised** to promote **calcium transfer** from shell to embryo.

The Need for Paddle Fan in Mixing High Concentrations of Heavy Gas in an Incubator

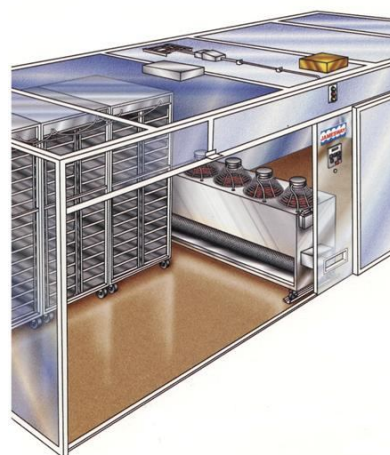
Many setter manufacturers use the **horizontal air flow** paddle fan because it is **better** at mixing the **CO₂** (a heavy gas) within the setter cabinet. However, **Vertical air flow**, impeller fan, systems are much **less efficient** at distributing high concentrations of **heavy gas**.

Customers/Hatcheries using the vertical air flow (impeller) air flow ventilation system found **similar increases** in hatch and the early feeding on farm. Interestingly **differences** in the **grow-out data**, especially that birds reached kill weight up to 4 days early, were **not** noted.

Birds stopped rapid weight gain early in the grow-out cycle and usually reverted to the **same weight** (or kill day) as the multi-stage birds. This is occasioned by the fact that lack of proper distribution of the CO₂ prevents birds from developing a stronger skeletal system. It should be noted that the birds' skeletal support could not add muscle and meat at the same rate as birds that had benefited from horizontal fan effect of CO₂ distribution.



**Horizontal Air Flow
Paddle Fan**



**Vertical or downward flow
Impeller Fan**

Appropriate Egg Weight Loss during Incubation in Single- and Multi-Stage Incubation

The target weight loss in an egg (Multi-Stage) is 11-13%. It has been reported that less weight loss than that will cause, in effect, drowning of the chick. It will not be able to pip out. However, the target weight loss in Single-Stage is really in the 8-10% range. This is because the embryo absorbs **more** of the egg shell and moisture so the **shape** of the air sac **changes** - it still extends on the top to the wide point of the egg but it doesn't hold the same volume of CO₂. Just enough to let the healthy chick pip out!

Multi-Stage CO₂ Enhancement Kit

With the knowledge and experience gained from modern high performance Single-Stage incubation practice, the **Multi-Stage CO₂ Enhancement Kit** was developed to increase productivity from existing Buckeye Multi-Stage Setters. The effect of increasing water cooling and reducing the fresh air intake encourages similar environmental conditions to those found in a typical modern Single-Stage setter.

The Benefits

- ✓ Increased Hatchability (HOF) about *0.3% on Average*

- ✓ Better Quality Chicks to “Single-Stage standard”
- ✓ Tighter Hatch Window
- ✓ Energy Savings of up to about N57 000* per setter p/a
 - * *If using the Vostermans Fan option*
- ✓ Higher Chick Weight and Better Uniformity
- ✓ Broilers have Lower Mortality and Greater Weight Gain

The Kit is composed of:

- ✓ Double Bank Cooling Coils
- ✓ High-seal Rear Extraction Dampers
- ✓ CO2 Sensor (set at 0.6%)
- ✓ Multi-Valve Cooling Solenoid
and Return Manifold
- ✓ PLC and Touch Screen Updates
- ✓ High Performance Vostermans Fan and Plastic Fan-Board Assembly (*optional*)

How Does It Work?

Standard Buckeye Multi-Stage systems typically rely on 75% water cooling and 25% air cooling. This Kit upgrades setters to 100% Water Cooling. The upgraded machine has a very stable environment with a tighter band of temperature distribution throughout the entire egg mass. Little or no fresh air intake reduces the requirement for artificial humidification. More stable moisture levels within the cabinet also means that embryonic heat transfer is much more efficient. More stable temperature results in less “heat-on” time which in turn results in improved hatch and better chick quality. It is believed that higher levels of CO₂ stimulate improved vascular and skeletal development of embryos.

EGG DATA LOGGER



*Connects directly to your computer for instant access
and visual display of temperature readings*

It provides full temperature traceability from farm to hatchery and beyond. It has the following benefits:

- ✓ Easy to use PC software to launch and offload

- ✓ Memory capacity of 8,000+ readings
- ✓ Temperature range of 0° - 45°C
- ✓ Accurate to within 0.1°C (@ 37°C)
- ✓ Has resolution steps of 0.01°
- ✓ Rugged waterproof enclosure

Maximizing Performance from Single Stage Machines

Understanding the concept

There is no doubt that this could be the first hurdle as the concept of single stage operation is totally different to that of multistage. Many hatcheries have been running on a multistage operation for a good number of years. It may be difficult for the existing hatchery manager and his or her staff to come to terms with this new way of working. However, like all of us, we have to face changes in our lifetime and have learned to adopt. A hurdle at first maybe, but within time this will be less of an issue.

Training nevertheless will pay a vital part in aiding a smooth transition from the multistage to single stage operations. The customer service team will pay a vital role in assisting any existing hatchery changing to the single stage operation, especially in the early weeks and months.

Management skills

The success of the operation will depend much on the skills of the hatchery manager; he or she will need to above all fully understand the concept. It is not rocket science however and should be well within the capabilities of the majority of hatchery managers working within the industry. Within the single stage operation the manager is much more able to take full control of the daily operations. To get the best out of single stage, the manager needs to be able to take control. Whereas, good results are achievable using a standard recipe, fine-tuning will optimise results. This is especially true with Breeder hatcheries. An example of this would be the controlling of weight loss to compensate for chicks destined for a long journey and risk of dehydration.

Simple or more complicated?

It is generally thought that the single stage operation requires a greater level of understanding. This aside, however, with the automated process it is fact generally a more simplified operation to that of

multistage. This again is all dependent on the manager skills to manage the staff but at this level the routine operation should not give rise to any concern.

Skill Requirements of General Staff

There is absolutely no reason why current staff working within a multistage operation will not be able to adapt to single stage. As mentioned, with the automation the process it is in fact simpler and requires probably less input from the staff carrying out the routine operation of loading and transferring from machines. With the automated process providing that the manager takes particular attention to how the machine is loaded, once loaded and under normal circumstances no further intervention is required until the machine is transferred some 18 days later. The manager should monitor the machine over the 18 days and has the very useful Galaxy system tool in which to facilitate this.

Maintenance Engineer

Whereas the system may not be complicated, due to the Control system and CO₂ sensor etc, the maintenance engineer will require some expertise. He or she needs to have a good understanding of the machine so that they are kept in good working order. This would be a very important position in the Hatchery. Co₂ and Humidity sensors are sensitive devices and will need be checked and calibrated at regular intervals.