

## Lecture 7

### Operation – Maximising the benefits

#### Key Objectives

Recent developments over the last few years has revolutionised single stage operation. Whereas, the benefits of concentration of CO<sub>2</sub> levels is not fully understood research has concluded that CO<sub>2</sub> converts insoluble CaCO<sub>3</sub> into soluble CaO, used to build the skeleton. CO<sub>2</sub> is thus a desirable element in the air surrounding the egg. The concentration of CO<sub>2</sub> levels as soon as possible at the start of the set stimulates and encourages embryo development.

However, not only is the CO<sub>2</sub> levels concentrated within the cabinet but also the sealing of the machine creates a very stable environment. For the first 10 days (chicken) the machine is totally sealed, this holds in the humidity within the machine. High humidity within the machine produces excellent convection properties creating an even temperature throughout. There is line of thought that this in itself could be playing a major part to the benefits. This new concept in single stage operation is actually very simple as probably follows more closely to nature than we first thought.

During the time that the machine is sealed for the first 10 days, the eggs are endothermic meaning that the egg capacity is requiring heat to hold in its body mass temperature. Since the machine is sealed the humidity and temperature is held within due to the insulated panels of the machine structure. Trials have proven that apart from the heat required to heat the machine initially, very little heat is required after the first 12 hours or so. The sealed cabinet produces an environment of self-containment.

During the 10-day period there is little or no weight loss as the high humidity condition is held throughout until the damper is opened at the end of the 10<sup>th</sup> day. Once past 10 days the eggs become exothermic, which by this time are giving off heat, at this time the damper is opened to release the heat, depress the CO<sub>2</sub> level and ventilate the eggs with fresh air. Now that the eggs are exothermic cooling is assisted with the aid of fresh air into the machine.

At this time, we are also able to get the dry down which was not possible during the 10 days when the machine was sealed. The damper position will open to 100% to give vigorous ventilation to facilitate the necessary weight loss.

Because of the high humidity conditions within the machine for the first 10 days artificial humidification is not required and appropriate settings are applied to disable the system.

The following attributes of the single stage machine produces an airtight environment for the first 10 days:

- The dampers have a seal to be near as possible gas tight.
- The doors have a double door seal.
- The motor pulley guard is completely sealed with the motor shaft running on a lip seal.

#### **The 10 day rule (14 days for turkey and ducks)**

- To raise the CO<sub>2</sub> level as quickly as possible, 0.3% within 3 days is the target.
- To allow the CO<sub>2</sub> to rise as high as possible within the first 10 days. (14 days for turkey and ducks) Expected levels are 0.6% to 1.2% the figure will be at its highest from young flocks when the fertility is at its highest.
- Sealing of the machine will give rise to very high humidity conditions and will be as high as 85 to 90% RH.

#### **The 8-day rule (11 to 18 days chicken and 15 to 25 days for duck and turkeys)**

- To ventilate the machine to achieve the required weight loss. Dropping the CO<sub>2</sub> set point to 0.3% forces the damper to a 100% opening.
- The vigorous ventilation assists cooling
- Control the damper position if necessary to control unwanted weight loss

#### **Practical Considerations:**

##### **Pre Warming, Machine warming, loading and warm up time**

Eggs need to be pre warmed to around 24 degrees Centigrade. It is not advisable to take the eggs straight from the cold room. The machine should be run for a few of hours to bring it up to running temperature. This policy will greatly assist in a swift time to temperature and will help reduce the hatching window.

Incubation does not start until the machine is at 37.8 °C (100.0 F). Warm up time will depend on the machine capacity. Depending on the machine capacity this can take up to 12 hours or even longer if the eggs are loaded cold.

This factor is extremely important to take into consideration and should not be confused with the pre warm up before the machine is loaded. If anything, this is where it can go wrong, it is absolutely essential that the 12 hours it takes to bring the eggs up to incubation temperature is considered at all times. *Unlike Multistage, the incubation period does not start as soon as the machine is loaded.* Failure to observe this will result in late hatches.

A low temperature alarm of 20°C for the warm up period is normal to prevent unwanted machine alarms. Typical warm up times for machines types are:

- A6 – 8 hours
- A12 – 10 hours
- A24 – 12 hours

### **Humidity System**

The humidity system is disabled throughout the incubation period. Appropriate settings need to be applied. A set point of 30% RH for the first 10 days (14 days ducks and turkeys) and 20% RH for the last 8 days (15 to 25 days for turkey and ducks) should be applied.

Humidity alarms should be set accordingly, the high alarm needs to be set at 95% RH for the shut up period and then reduced gradually for the last 8 days.

### **Temperature staged settings**

Temperature settings at the start of incubation need to be high to stimulate development, it needs to then stage down to transfer at a setting of 37°C.

### **CO<sub>2</sub> Settings – (If CO<sub>2</sub> Sensor fitted)**

The CO<sub>2</sub> setting is in actual fact irrelevant when running the damper in the manual mode for the first 10 days. If running the damper in automatic, a set point of 1.5% would be appropriate. For the last 8 days the CO<sub>2</sub> set point needs to be lowered to 0.3% and the damper placed into automatic. This will force the damper open to release the CO<sub>2</sub> and ventilate the machine with fresh air. If using manual damper settings, then set the damper settings accordingly, at day set the setting for 50% for 1 day and then 100% for the remaining time.

The CO<sub>2</sub> alarm setting is a very useful tool in detecting abnormal conditions. For the first 10 days we are concerned with building humidity as soon as possible. The CO<sub>2</sub> low alarm setting needs to reflect the expected build up of humidity relative to each step of the staged program. For example, should the dampers fail to close properly then the CO<sub>2</sub> would not concentrate within the machine.

The High CO<sub>2</sub> alarm setting is not that important for the first 10 days. For the last 8 days, however, this is very important and should be set to reflect dangerous CO<sub>2</sub> levels in this period.

**Vent Settings (damper)**

The damper should be in the manual mode for the first 10 days and then in the automatic mode for the last 8 days.

**Turning Mode**

The system has the capability of selecting the turning mode required for each step of the stage program. With the trays in the level position, the airflow over the eggs is increased which assists in transferring unwanted heat from the eggs.