

The use of a novel disinfectant to eliminate *Aspergillus* spp. from within the incubation environment (setters and hatchers) of large scale hatcheries

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1. INTRODUCTION

A number of factors have a direct or indirect influence on chick quality including microbes. A high microbial challenge, especially *Aspergillus* spp. has a direct influence on hatchability, chick quality and chick health. Microbes enter the hatchery through various routes of which contaminated eggs from the breeder farms is a most important one; resulting in Embryo mortalities, Yolk sac infections (“Mushy chick disease”), navel infections, Fungal pneumonia (“Brooder house pneumonia”), high percentage of “Reject-“ or Second Grade chicks, etc. The ideal should be to eliminate microbes from entering the hatchery in, as well as on contaminated eggs. This is not possible even with the best control measures in place. There is always a risk of microbes entering the hatchery where conditions are on purpose manipulated to be ideal for the multiplication of living cells (= “incubation”), thus also creating a perfect environment for high levels of microbial multiplication during a very short period. It is very difficult to control these microbes, especially spore forming microbes like *A. fumigatus*. Spores are very resistant and special measures need to be taken to destroy fungal spores in a hatchery.

Good hygiene practices in and around the hatchery will prevent microbes from multiplying out of control in the hatchery. Cleaning and disinfecting takes place every day in the operational areas but not in the setters and hatchers. Setters and hatchers are cleaned and disinfected only when they are empty. Microbes need to be controlled in both the setters and the hatchers. Dirty or infected eggs can be placed in the setters under ideal conditions, contaminating clean eggs. Others explode (so called “poppers”

or “bangers”) during the incubation period as a result of accumulated gasses from bacterial multiplication inside the egg, and in the process contaminate the entire contents of such a setter /hatcher . This situation adds impetus to the microbial challenge to all eggs/embryos inside the setter/hatcher and can easily lead to disastrous consequences to the entire newly hatched batch of chicks. In conjunction with visual (and olfactory !) inspection and removal of all infected eggs (“leaking”) regularly during the incubation period ,the only way to control these microbes during incubation is through the continuous dosing of a wide spectrum, safe disinfectant into the setters and hatchers. This means that the disinfectant should be bactericidal, fungicidal, virucidal and sporicidal. It should also be non-toxic, non-corrosive and non-irritating.

Traditionally formaldehyde or glutaraldehyde based products have been used on a periodic basis to disinfect and fumigate setters and hatchers but never on a continuous basis because of their inherent toxicity and adverse affect on embryo development and hatched chicks. Therefore in most instances the control of fungal spores with these biocides has been problematic.

The disinfectant of choice should have a total spectrum capacity, it should be safe to use on the eggs and in the presence of chicks, it should be safe to apply (non-toxic and non-irritating), it should not have a detrimental affect to the incubator and equipment within them (non-corrosive). F10 Super Concentrate (F10SC) Disinfectant manufactured by Health and Hygiene (Pty) Ltd has all of these ideal attributes.

Case study notes of the trial:

The trial was designed after consultation with Drs Horner, Odendall and Verwoerd.

F10SC was introduced to control *Aspergillus* spp. into a large hatchery comprising 40 setters and 40 hatchers, producing a million chicks per week, situated in the Gauteng Province of South Africa. F10 was used from week 18 no. 2001 up to week 3 no. 2002, a total of 38 weeks. The specific areas of concern were the setters and the hatchers. Fluff samples were taken weekly to analyse for the presence of bacteria and fungus. High levels of *A. fumigatus* were of great concern for the hatchery. It was

decided that F10SC will be introduced into the system and that the process will be monitored on a continuous basis.

2. AIM

To control *A. fumigatus* and other microbes in the setters and hatchers, using F10SC

3. MATERIALS

3.1 F10SC Application

- F10 Super Concentrate Disinfectant manufactured by Health and Hygiene (Pty) Ltd, PO Box 347 Sunninghill 2157, Tel (011) 474 1668, email: formten@icon.co.za
- Two DI16 Dosatron units supplied by Dosatron Sales and Service - Southern Africa, PO Box 2217 Southdale 2135, Tel. (011) 434 2887.
- Atomiser Fogger Model 1037BR supplied by R L Flomaster via their local agent Health and Hygiene (Pty) Ltd, PO Box 347 Sunninghill 2157, Tel (011) 474 1668.

4. PROCEDURE

4.1 Water supply

- F10SC was fed continuously to the humidification nozzles in the setters and hatchers via a two stage dilution process using two Dosatron units (Figure 1).
- The required dilution was 200ppm (1:5000), To obtain this, the first Dosatron was set on 1.33% and the second on 1.5%.
- The settings on the Dosatrons, transfer tubes and the level of the F10SC were checked daily.

4.2 Fogging Setters

- Setters were fogged daily from week no.18 to 34 with an atomiser sprayer owned by the hatchery but from week no.40 using a 1037BR Fogger supplied by Health and Hygiene.
- The droplet size of the hatchery fogger was unknown but the 1037BR was set to 12 μ m.
- A concentration of 1:250 (28 ml F10SC / 7 litre water) F10SC was used for daily fogging in the setters.

- The Fogger was left in the setter for 5 minutes; the setter volume was 65m³.
- Setters with “floor or dirty eggs” were fogged twice daily for 5 minutes at a time with a concentration of 1:250 (28 ml F10SC / 7 litre water) F10SC.
- The time and droplet size were considered very important in order to prevent the humidity going above 88%, but ensuring a total coverage in the setter.

4.3 Fogging Hatchers

- Hatchers and bay areas were fogged for 20 minutes with a 1037BR Fogger after terminal cleaning to prevent any potential recontamination of eggs coming into the hatchers.
- A concentration of 1:250 (28 ml F10SC / 7 litre water). F10SC was fogged for 20 minutes into the hatchers and bay area.

4.4 Microbial Isolations

Sampling Procedure

- Hatchery staff took fluff samples every day.
- Samples were taken from each hatch when chicks were removed from the hatcher.
- Samples were collected in sterile sample bottles supplied by the in-house laboratory.
- Sixty grams (60g) of sample was collected per hatch.
- Samples were sent once a week to the laboratory for analysis.

Isolation Procedure

- Weigh 0,1 g aseptically from the 60g sample.
- Mix with 10ml Buffered Peptone Water.
- Transfer 0,5 ml of dilution to a Rose Bengal Agar plate.
- Spread evenly over plate.
- Incubate for 5 days at 25°C.
- Count and calculate number of colony forming units.

Calculation

$$\text{Colony Forming Unit (CFU)} = \frac{\text{Number of Colonies X Dilution factor}}{\text{Inoculum}}$$

$$\begin{aligned}
 \text{Example: CFU} &= \frac{20 \times 100}{0,5} \\
 &= 4\,000 \\
 &= 4 \times 10^3 \text{ CFU/ml}
 \end{aligned}$$

5. RESULTS

Results are shown in Figure 2.

It is clear from results that F10SC was effective in controlling *Aspergillus* spp. in the setters and hatchers.

6. DISCUSSION

Figure 2 indicates the following:

- The situation from week 1 up to week 18 in the hatchery before F10SC was introduced. During that period the number of positive samples was unacceptably high.
- During the first three week period surface swabs were taken every 7 days from differing age eggs in 5 setters to monitor microbiological surface contamination levels. The laboratory results indicated that over the 18 day incubation period microbiological surface contamination was substantially eliminated which confirmed that using the fogging method was effective way of applying F10SC.
- The period from the time F10SC was introduced. F10SC dosing and fogging started at week 18. From week 24 up to week 34 no *Aspergillus* spp. was isolated, only for a small peak at week 32. From week 35 to week 41 there was an increase of *Aspergillus* spp. Initially during this period the hatchery atomiser sprayer was unserviceable and no fogging was carried out in the setters. Fogging recommenced in week 40 with another Fogger with a droplet size of 12µm. The time of fogging to cover the setter without wetting the eggs was determined to be 5 minutes for a 65m³ setter. The number of positive *Aspergillus* spp. started to fall in week 42 and remained at virtually zero up to week 3, in 2002. There was an isolated peak of 40% positive in week 48 when it was found that the filter in the F10SC feed reservoir was blocked and the reservoir itself containing the F10SC solution was cracked and leaking resulting in a lower than required concentration of F10SC entering the setters and hatchers.

A wide range of factors will influence chick quality like flock age, flock health, age of egg bank, egg grading, egg collection and storage conditions and others. It made it thus very difficult to determine what effect F10SC had on chick quality, however no abnormalities were observed over the period and day-old chicks were healthy and “more” lively. The presence of F10SC in the hatchers, lowered the risk of navel infections in day-old chicks and the absence of *Aspergillus* lowered the risk of infection from the hatchery ; manifesting as “brooder house pneumonia “ related mortalities / culls during the first week after placement. This resulted in a lower seven-day mortality rate which dropped from 1% to 0,7 % and below.

7. CONCLUSION

The results confirm that F10SC as applied will give 100% kill when eggs have been exposed during a complete incubation cycle. This was further confirmed when the number of *Aspergillus* colonies increased as soon as fogging stopped, and came down when fogging re-started again. F10SC needs to be over the full 18-day period in the setters and 3 days in the hatchers to ensure that a substantially complete kill level is consistently maintained. Although not scientifically proven there is the possible added benefit that chicks hatched into an aldehyde free F10SC environment in the hatcher could be “healthier” chicks, as hatchery personnel commented they were certainly “livelier” than had been the norm.

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Figure 1. F10SC HATCHERY TRIAL – MICRO DOSING UNIT

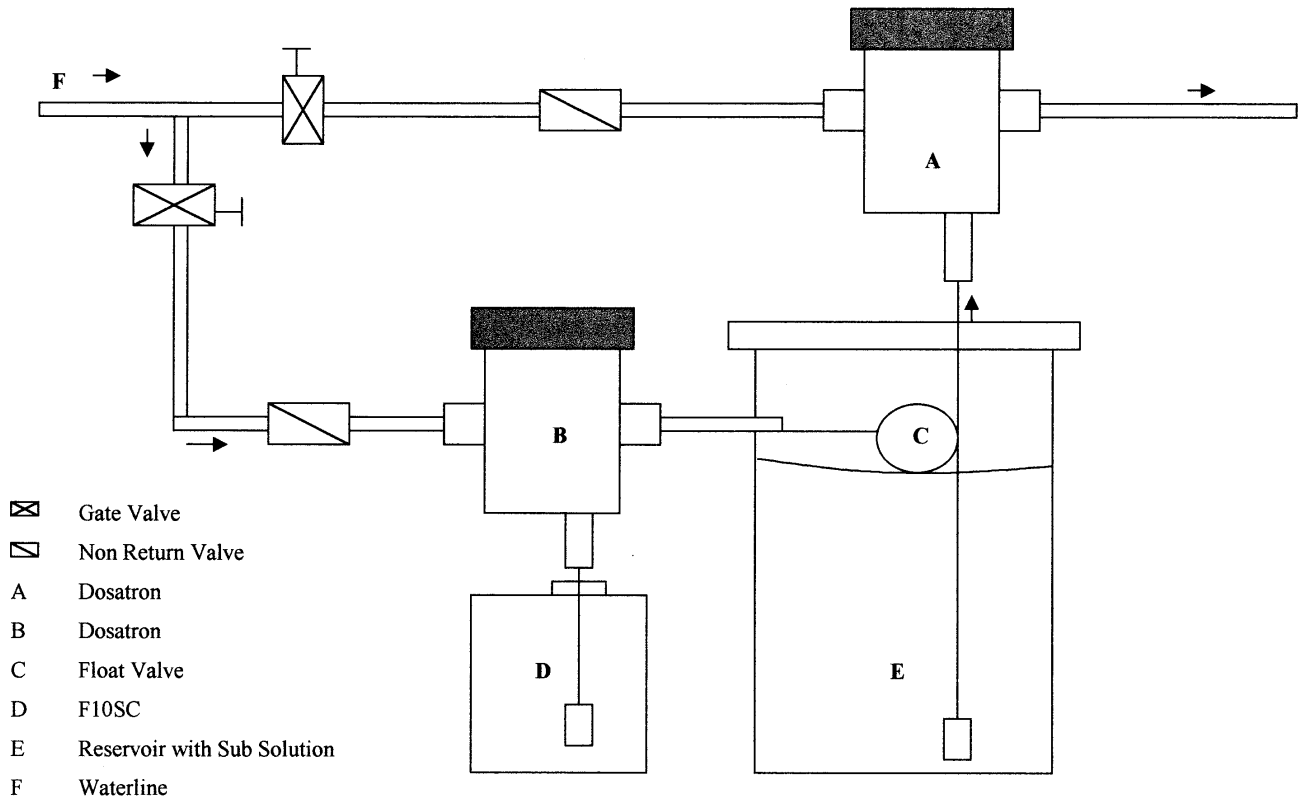


Figure 2: WEEKLY % OF FLUFF SAMPLES POSITIVE FOR ASPERGILLUS SPP.

