Maximising productivity and eliminating *Campylobacter* in broilers by manipulating stocking density using “biosecurity cubes”

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Background

- *Campylobacter* is the leading cause of bacterial gastroenteritis worldwide.
- Approximately 250,000 cases reported within the European Union annually.
- Broilers have been identified as the primary source of human infection.
- Poultry farms have been established as the most effective point for control.
- Enhanced biosecurity identified as the best method to achieve this.

Context

Previous research in our group developed a biosecurity cube to protect birds from *Campylobacter*.

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Protecting broilers against *Campylobacter* infection by preventing direct contact between farm staff and broilers

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Objectives

Design a biosecurity cube that could prevent *Campylobacter* colonisation of the birds contained, while not restricting air flow throughout the house.

Observe the effect of the biosecurity cube on broiler health and wellbeing.

Study the impact of stocking density on broiler growth rate & overall productivity.

Biosecurity cube - design

- Prior to upscaling, small scale trials were carried out to identify the optimum barrier material.
- Eliminating contact between test birds and general flock, preventing *Campylobacter* infection.
- Cardboard → wire mesh → polyurethane film

Biosecurity cube - upscale

- Polyurethane film was effective.
- The experiment was upscaled to 8 biosecurity cubes.
- Half having a barrier of polyurethane film and half of flyscreen.

Results

Table 1. *Campylobacter* status of birds reared in biosecurity cubes with polyurethane and fly screen barriers.

Number of cubes to remain *Campylobacter* negative	Time to detection of *Campylobacter*	*Campylobacter* count at time of detection (log_{10} CFU/g)
Control		
Trial 1, NA	D35	6.1
Trial 2, NA	D35	5.9
*Trial 3, NA	D28	5.3
Polyurethane film		
Trial 1, 3/4 **negative for *Campylobacter***	D35	4.3
Trial 2, 4/4 **negative for *Campylobacter***	NA	NA
*Trial 3, 0/4 **negative for *Campylobacter***	D28 (2 positive), D35 (2 positive)	0.72 and 4.8 (D28), 6.3 and 6.5 (D35)
Fly screen		
Trial 1, 3/4 **negative for *Campylobacter***	D35	5.8
Trial 2, 4/4 **negative for *Campylobacter***	NA	NA
*Trial 3, 0/4 **negative for *Campylobacter***	D28 (1 positive), D35(3 positive)	2.04 (D28), 6.2, 65, 5.6, and 6.5 (D35)

*Fans were set to max speed resulting in air from outside the broiler house to be blown down throughout the house

Biosecurity cube – stocking density

- During each trial biosecurity cubes were stocked at the following densities.
  - 12, 14, 16,18, 20, and 22 birds/m^2 (b/m^2).
  - Birds in the general flock, stocked at 20 birds/ m^2, were used as the control.

Results

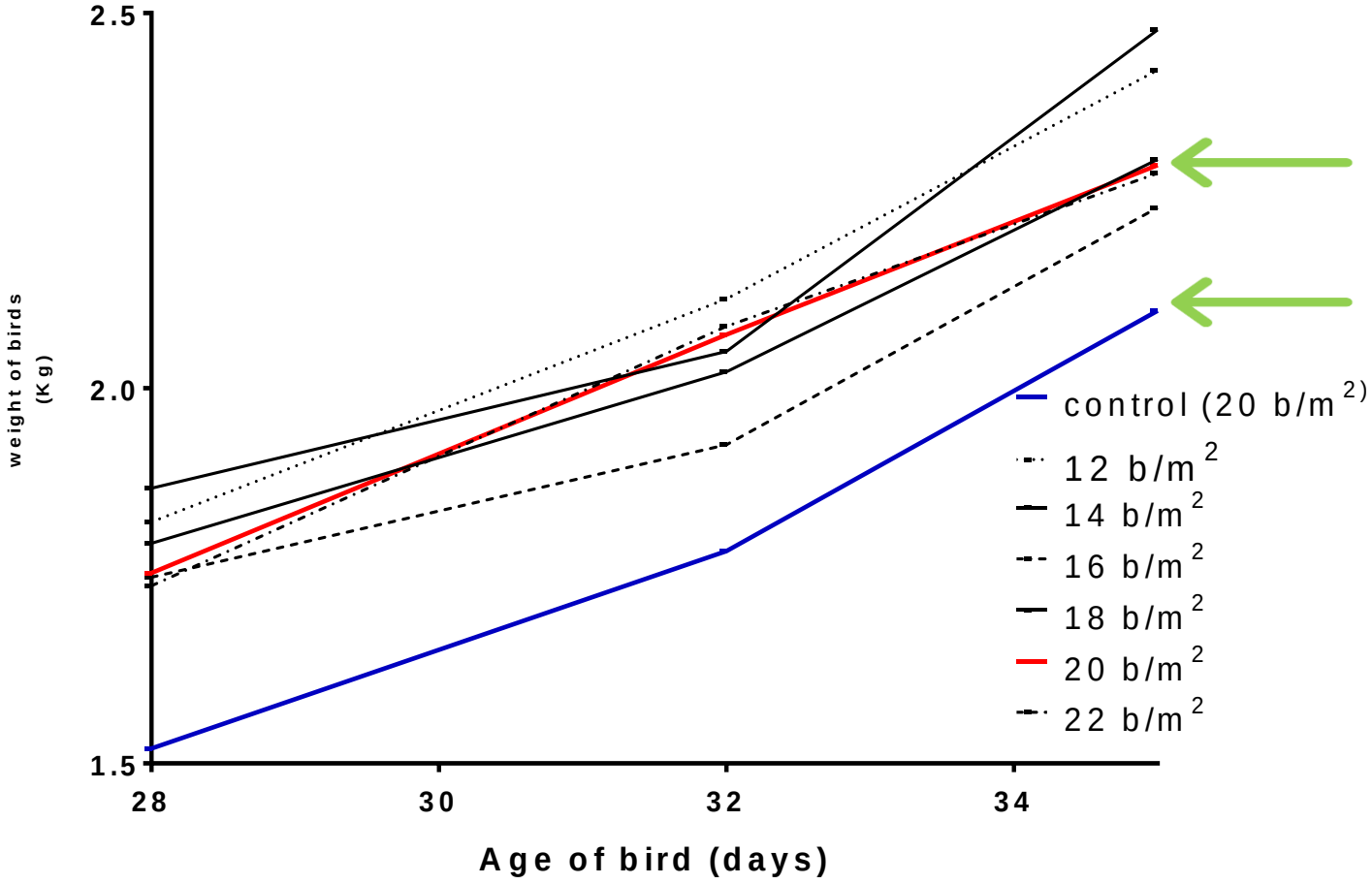

Figure 1. Weight of birds (Kg) compared to bird age (days)

- All test birds reached 2Kg before the general flock (control).
- Birds stocked at the same density also hit 2Kg before the general flock

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Impact on broiler industry

- Biosecurity cubes stocked at 20 birds/m^2 reach 2Kg 3-5 days earlier.
- Allows for an increased productivity of 11-20% (depending on time between flocks).
- Biosecurity cubes provide a potential solution to the "*Campylobacter* problem", allowing for production of *Campylobacter* free birds.

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