The Effects of a Sprinkler Cooling System on Dust Concentrations in Broiler Chicken Production

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Background

The United States is the second largest exporter of poultry meat.

Workers are exposed to dust in broiler chicken production during daily work activities.

Poultry dust contains the following inflammatory agents: endotoxin, bacteria, allergens, ammonia.

Few engineering controls have been evaluated to reduce dust concentrations in broiler chicken production.

Water sprinkling systems used to reduce thermal stress in broiler production may also reduce dust concentrations.

Objectives

Evaluate the effectiveness of a water sprinkler system to reduce inhalable dust and ammonia concentrations in a broiler chicken house.

Methods

Inhalable dust and ammonia were measured daily for the entire production cycle of a flock of broiler chickens (63 days).

Inhalable dust was measured using a Button sampler; ammonia was measured using a ToxiRAE.

Sampling was performed on a mannequin inside two chicken houses. One house used a sprinkler cooling system to deliver a water mist throughout the house, the other was an untreated control.

Sprinkling system activation, from 6am to 10pm:

- Day 1-4: none
- Day 5-9: five seconds per hour
- Day 10-14: ten seconds per hour
- Day 15-Harvest: fifteen seconds per hour

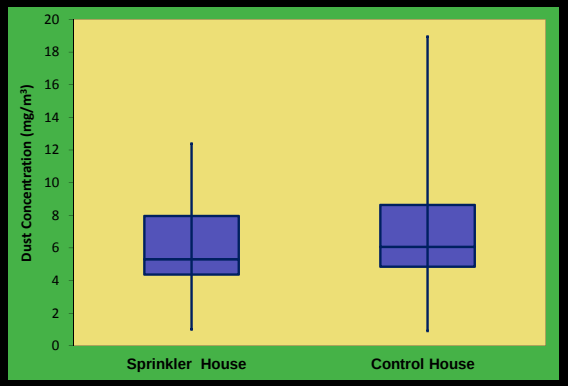
Broiler Chickens at Day 1 (left) and Day 62 (right)

Results

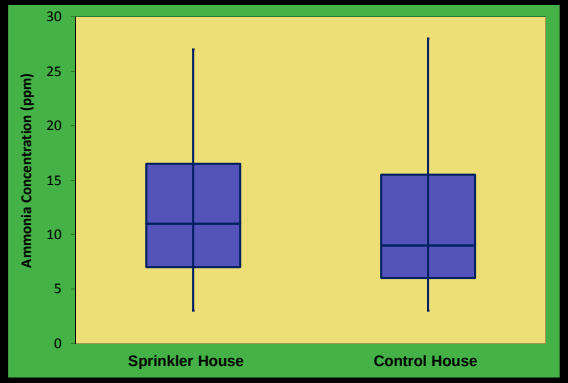
Dust concentrations in the house treated with the sprinkler system (GM 5.52; GSD 1.59) were lower than dust concentrations in the control house (GM 6.00; GSD 1.75).

The observed difference approached statistical significance ($p = 0.071$).

Ammonia concentrations were very similar in both houses and the difference was not statistically significant ($p = 0.223$).



Comparison of Dust Concentrations in Each House



Comparison of Ammonia Concentrations in Each House

Sampling Equipment on Mannequin

Discussion

Sampling was completed in one location located 25 feet upstream from fans in tunnel ventilated houses, concentrations measured in this location may not be representative of the house. However, sampling was completed at the same location in each house.

Concentrations may have been influenced by seasonal weather. However, to control for weather variability, paired sampling was used with an untreated control building.

Sampling was only conducted at one farm; this could impact the generalizability of the results.

Conclusion

The differences between the two houses were not significantly different, and the observed reduction in dust and ammonia concentrations were not sufficient to eliminate the use of respiratory protection.

Variability of dust concentrations were reduced in the sprinkler house.

Future Research

Future research should evaluate the effectiveness of adding a chemical amendment to house litter.

Using a litter amendment, in addition to the sprinkler system, may reduce re-aerosolization of dust in the poultry house.

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