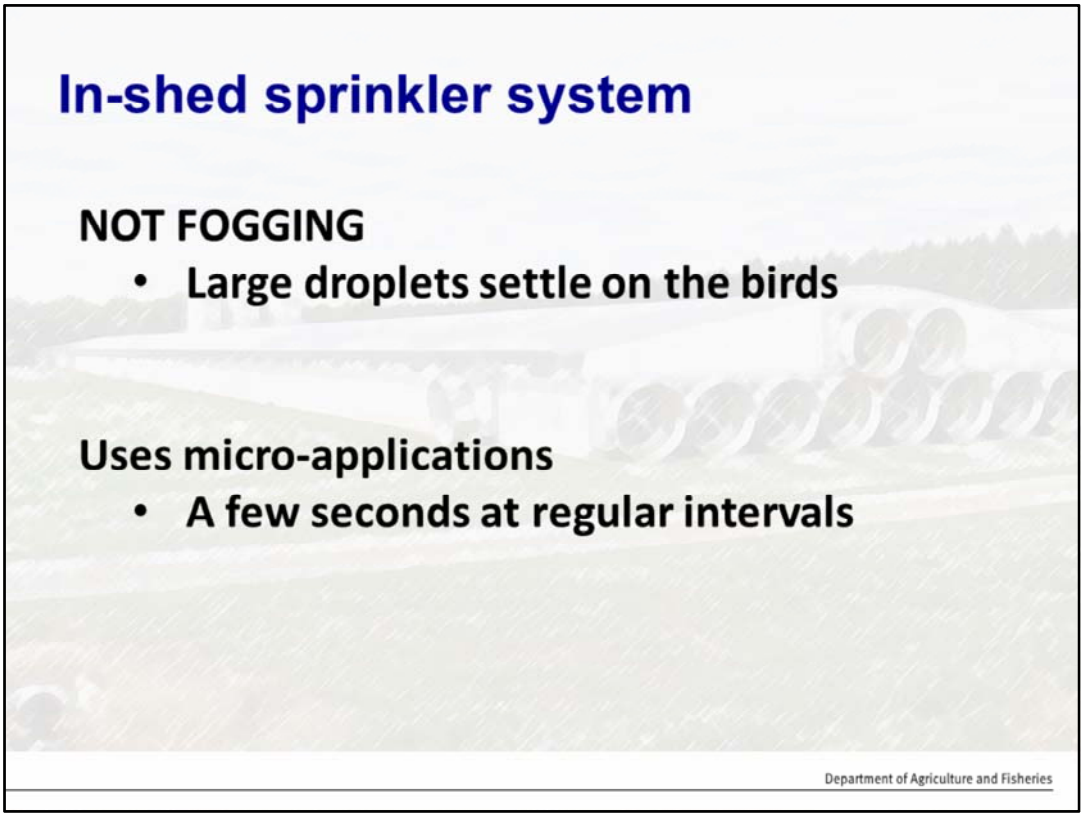
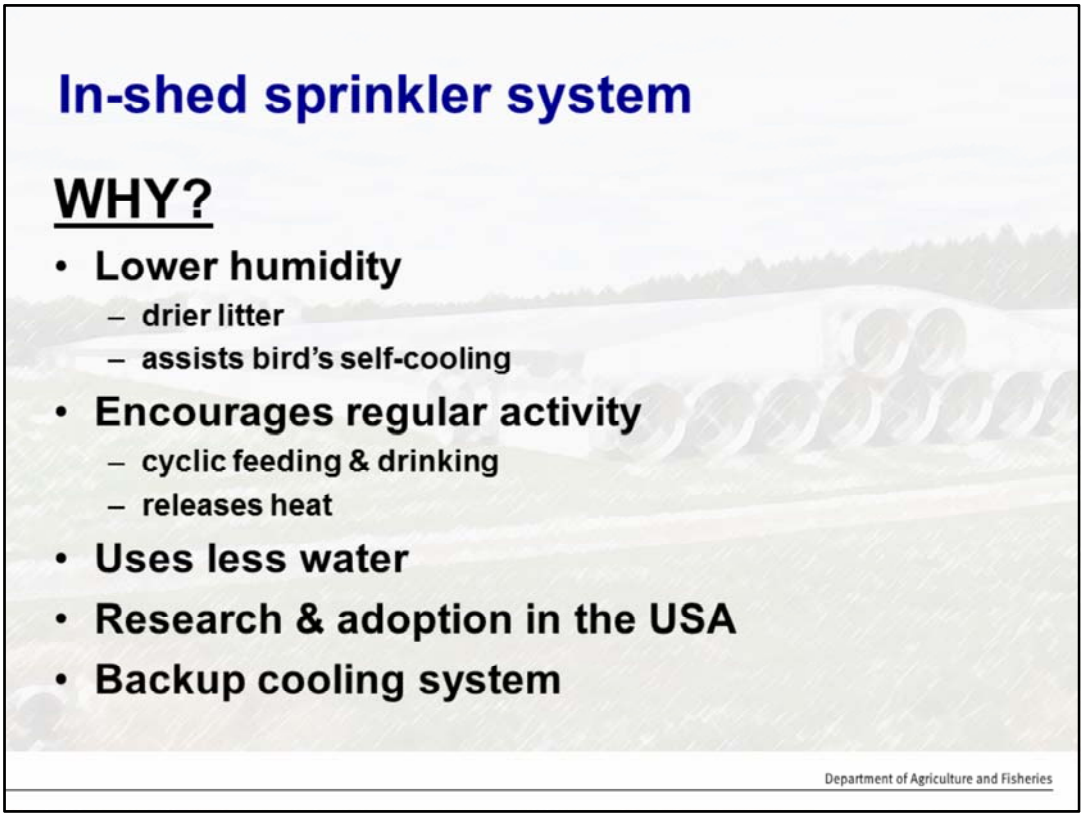
This presentation was presented at the AVPA scientific meeting, 15-17 November 2017, at Geelong.

Acknowledgments of organisations that have supported and been involved with the research

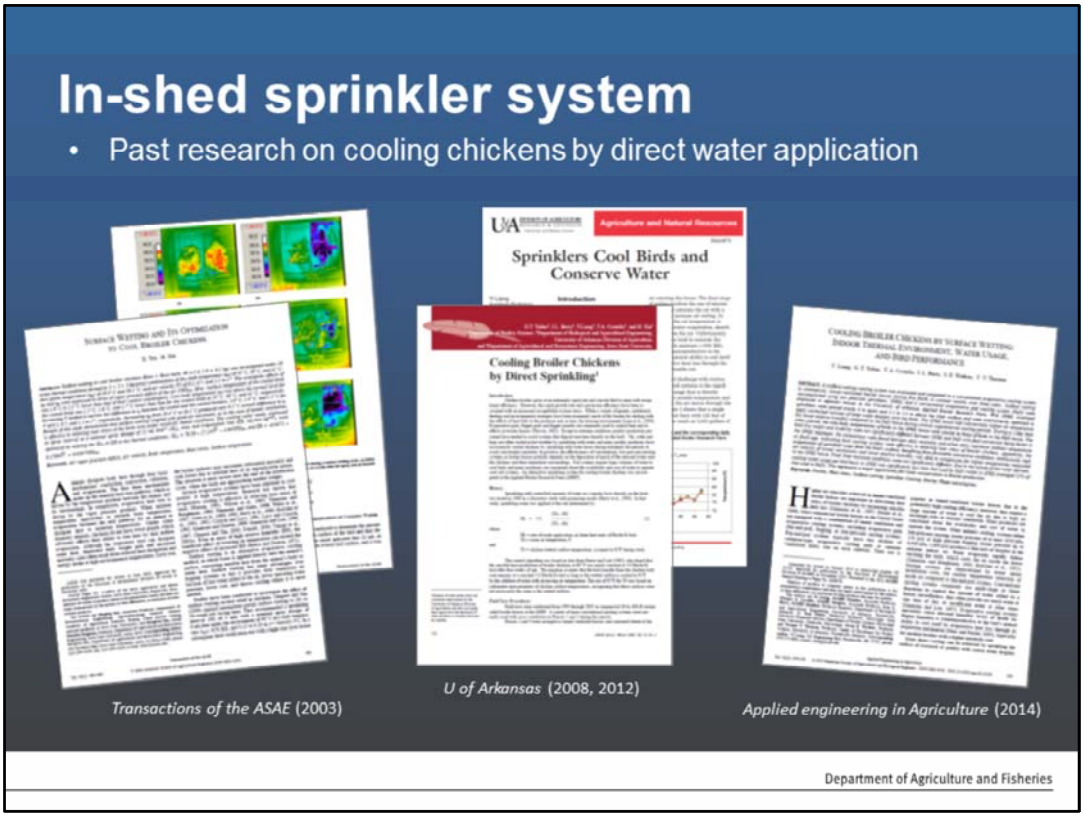


This presentation re-introduces the concept of using sprinklers inside meat chicken sheds as a means of cooling the birds. It has also been seen to promote bird activity when used appropriately.

The system being discussed in this workshop uses a dedicated controller to apply water for very short durations, 5–20 seconds, at regular intervals (e.g. every 7 to 60 minutes). The grower can control these application times. The system uses temperature sensors in the shed to apply more water as temperature increases above a set point. The main set point is set by the grower, and is changed daily. Once established, a temperature curve can be programmed into the controller.



The sprinklers are a relatively low-cost option ($5000-8000 per shed). They are a useful aid to the other ventilation and cooling components in meat chicken sheds.



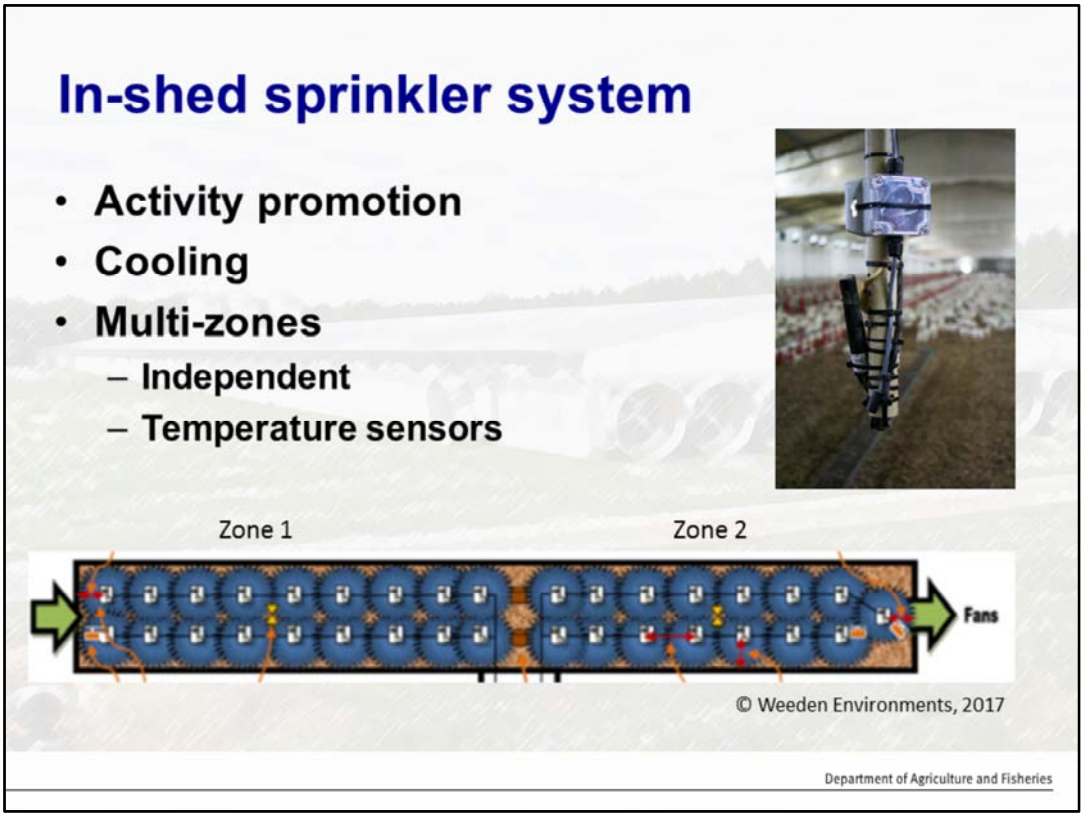
Some of the published research discussing in-shed sprinklers, and/or spraying water directly onto birds for cooling.

These are the main components of the sprinkler system that we've used. It has a controller (left), a manifold that includes solenoid valves, filter and pressure regulator (centre) and the in-shed sprinklers (right), that are suspended from the header pipes installed along the ceiling on flexible droppers.

In sheds without curtains, the sprinklers can be installed close to the ceiling. The sprinklers are usually spaced every 6 m. In sheds with baffle curtains, it may be better to install a sprinklers in the middle of the baffles rather than having long droppers to but the sprinklers below the baffle. It will depend on the baffle curtain spacing.

Non-drip valves are fitted to each sprinkler.

If a sprinkler falls of, will water run out like it does from the drinkers? NO. The water is not flowing until the controller turns it on for the 5-20 second application time. Water from the line will drain out of a missing sprinkler so there will be localised wetting, but the floor won't become flooded.

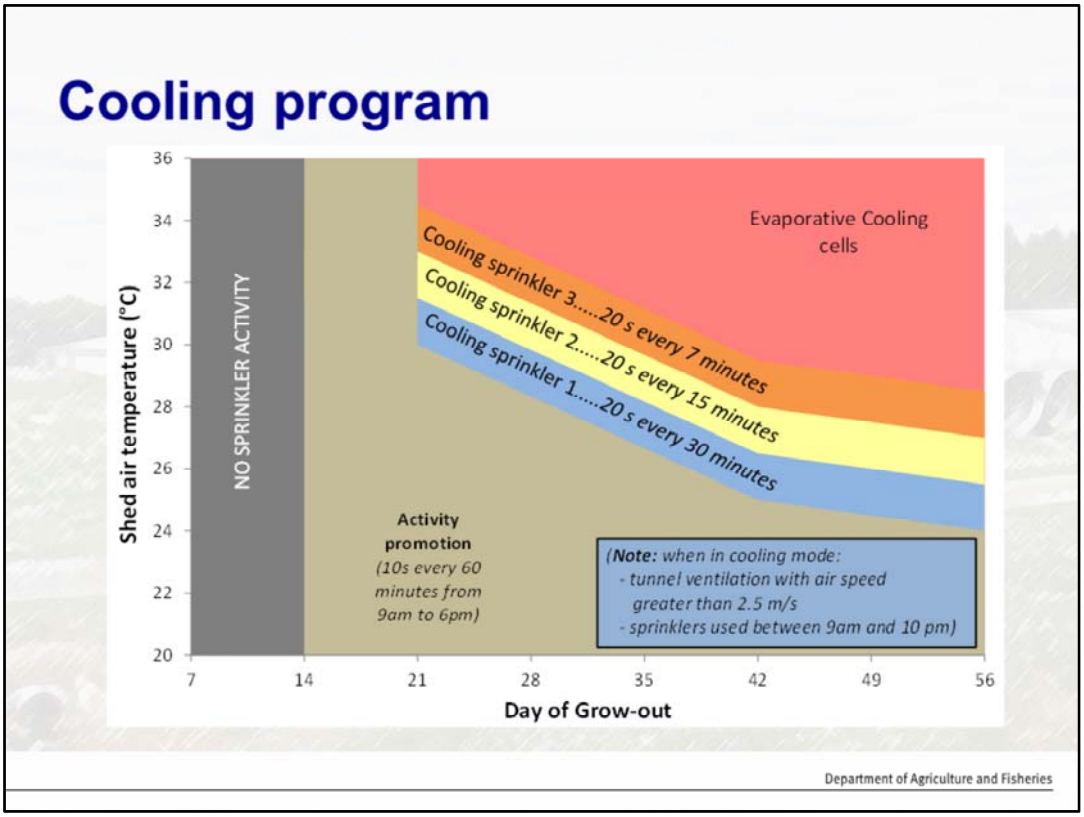


The blue circles in the diagram show an approximate layout of the sprinklers.

The shed can be divided into different zones. For tunnel ventilated meat chicken sheds, it is logical to divide the shed into the front and back due to heat energy moving through the shed. newer versions of the controller allow up to 4 discrete temperature, but it may not be worthwhile dividing the shed into too many zones.

A temperature sensor is installed into each zone. Each zone operates independently. Zone 1 may be in activity promotion (under the temperature set point) while zone 2 may be in level 1 or 2 cooling.

For sheds 15m or wider, a third sprinkler line up the middle provides more even coverage. It can be installed as a separate sprinkler line (that can be turned off when not needed) but can share a temperature sensor. Another reason for installing the middle sprinkler line separately is there are limits to how many sprinklers can be installed before water flow rates become a limiting factor.



Here is an example of a program for the controller.

Up to day 14, the sprinklers are turned off.

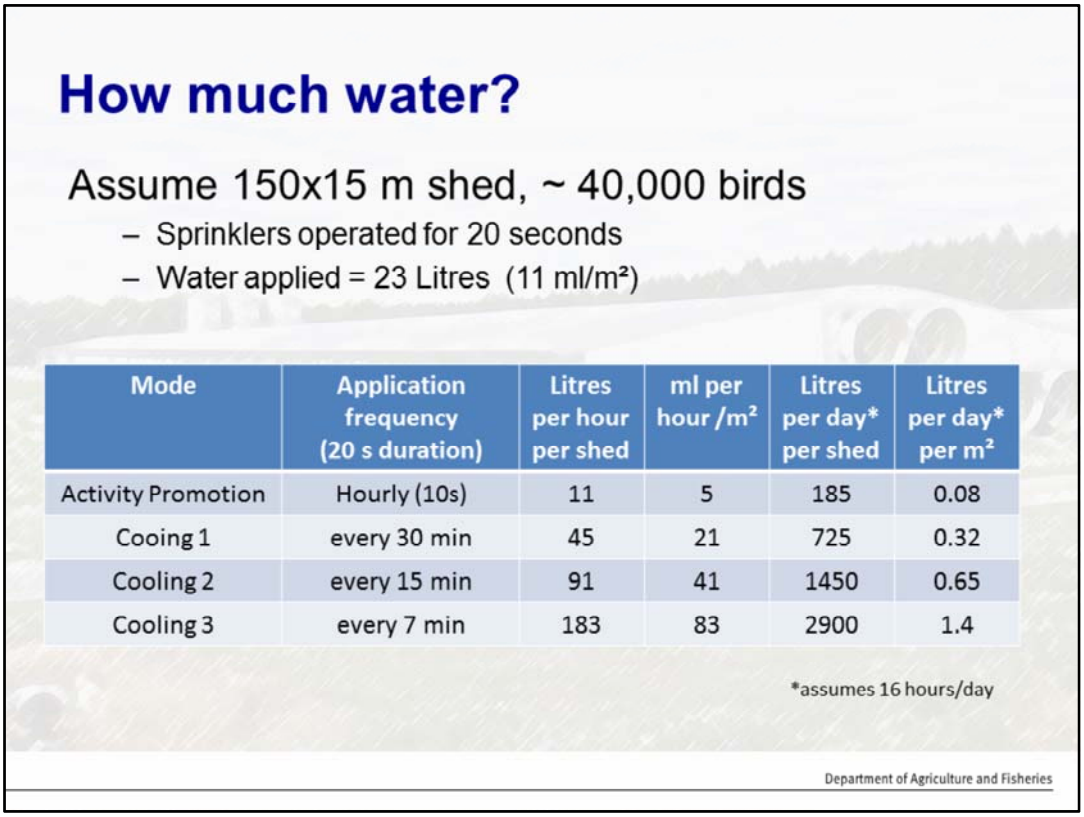
From day 14-21, the sprinklers are used for activity promotion, where the sprinklers are operated for 10 second every hour during the day (e.g. 9am to 5pm). Sprinklers are not used at night to allow birds to rest (with lighting program) and because high outside relative humidity may allow the litter surface to remain over night.

After 14 days, activity promotion continues. The temperature sensors are then monitored and if the temperature rises above the first set point (about 30°C at 21 days in this figure), the sprinklers will operate for 20 seconds every 30 minutes. This is called 'level 1 cooling' and provides little actual cooling due to water evaporation, but gets the birds to stand up and release heat from their underside and the litter. As the temperature continues to rise, the sprinklers are activated more frequently. At some temperature, the cool-pads are then re-introduced. But this time, much less water has been used compared to if the cool pad were turned on at the level 1 cooling temperature.

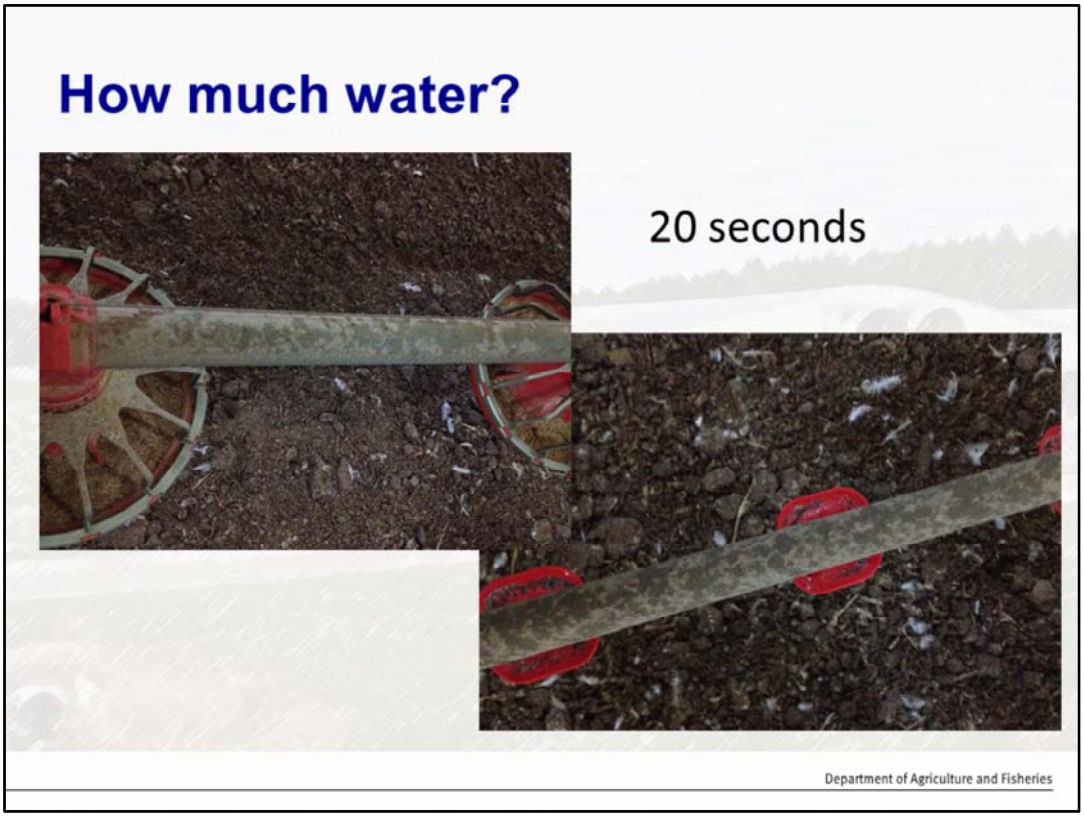
The sprinkler supplier has mentioned that some growers are using activity promotion for birds from day 5 (5 second applications). There is no data but it has been mentioned that birds are getting better performance.

ALL temperature set points, batch day restrictions, daily time restrictions, sprinkler

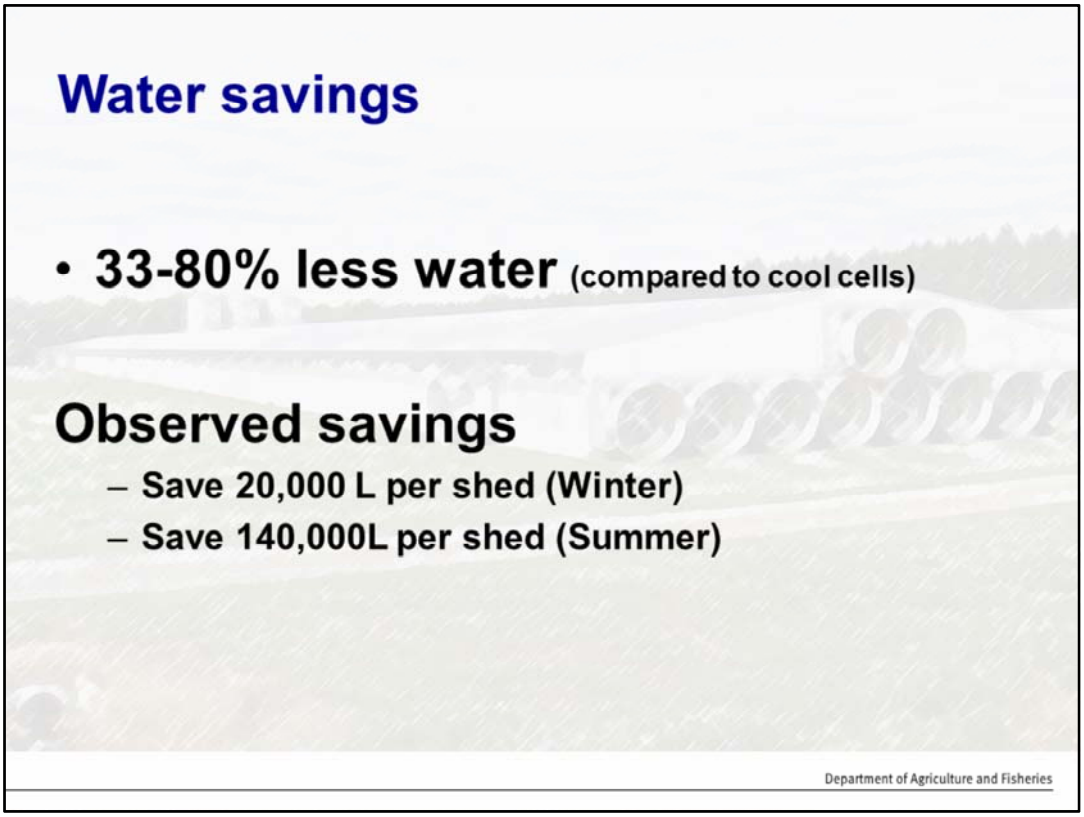
durations and intervals are able to be programmed into the controller and easily changed by the grower.



Only a very small amount of water is used during each application.

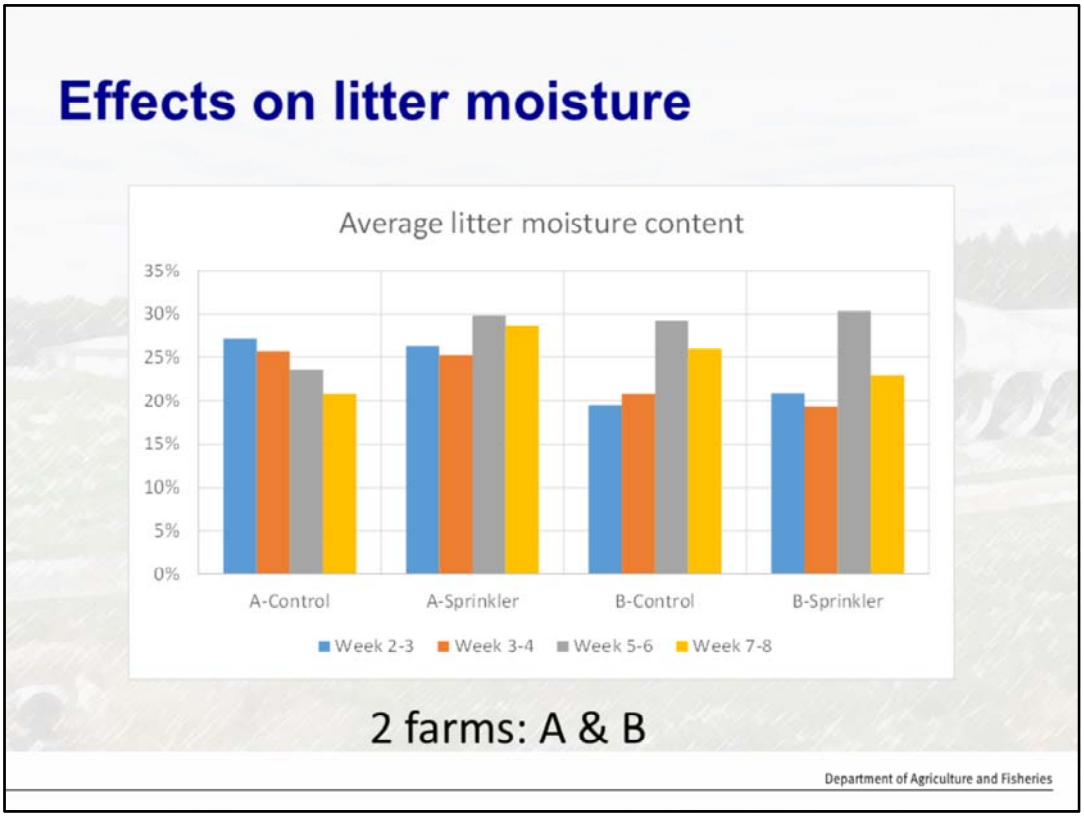


A 20 second application barely connects the drops of water.



The water savings are from comparing sheds with sprinkler-cool cell combined cooling with using evaporative cooling only (the normal practice). In these trials, the evaporative cooling cells were still used in the sprinkler sheds but started being used at a higher temperature than normal (as per the program on a previous slide).

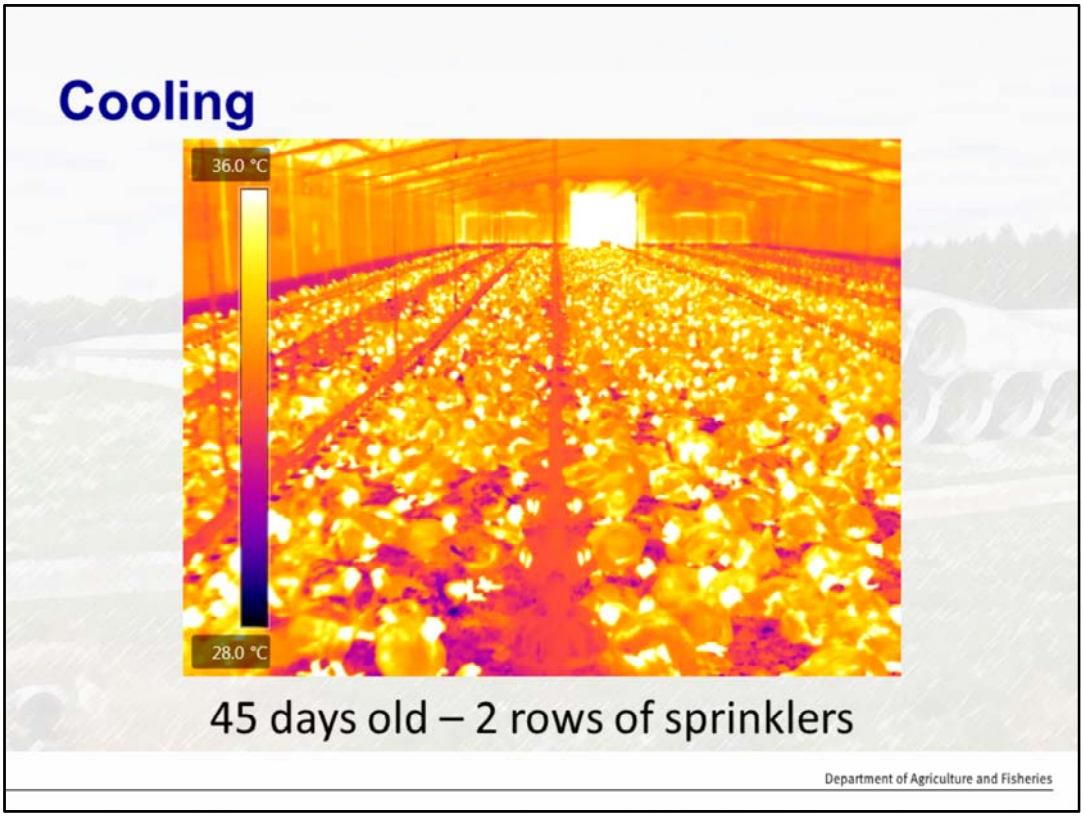
Delaying the use of cooling pads and allowing the sprinkler applications to cool the birds resulted in the water saving.



There was no systematic effect of the sprinklers wetting the litter. Activity promotion does add more water into the shed then normal and this may contribute to damper litter.

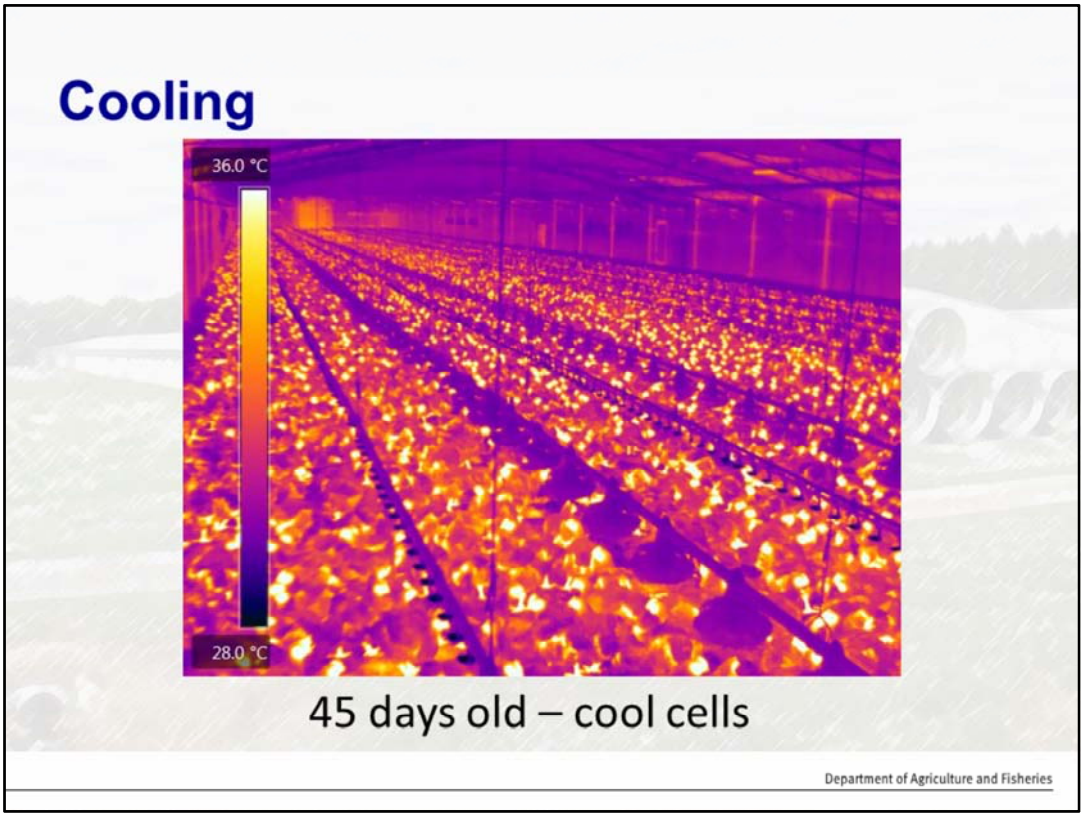
The use of sprinklers during cooling does not affect litter moisture because:
- The water mostly falls on the birds (except when density is low following thin-outs)
- Water applied evaporates before the next application.

The sprinklers encourage the birds to stand. Many will eat or drink.



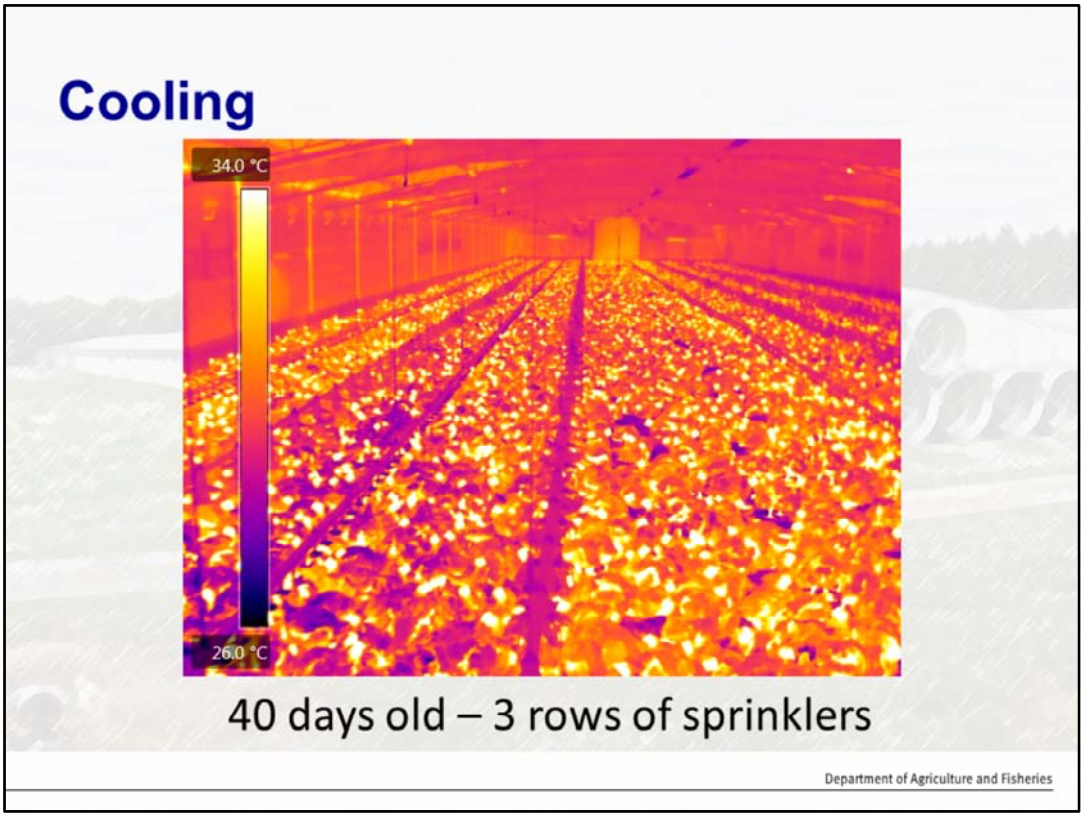
This time series shows the water cooling the birds, even though air temperature is not reduced. The birds become the evaporative cooling cells.

This is a 15 m shed with two rows of sprinklers. Note the birds in the middle receive less cooling. Some water still fall on the birds in the middle, but it isn't as intense as those directly under the sprinklers. My observations are that the birds in the middle are equally comfortable. Birds also move around, so while they may not receive water during one sprinkling, they may get it in the next.

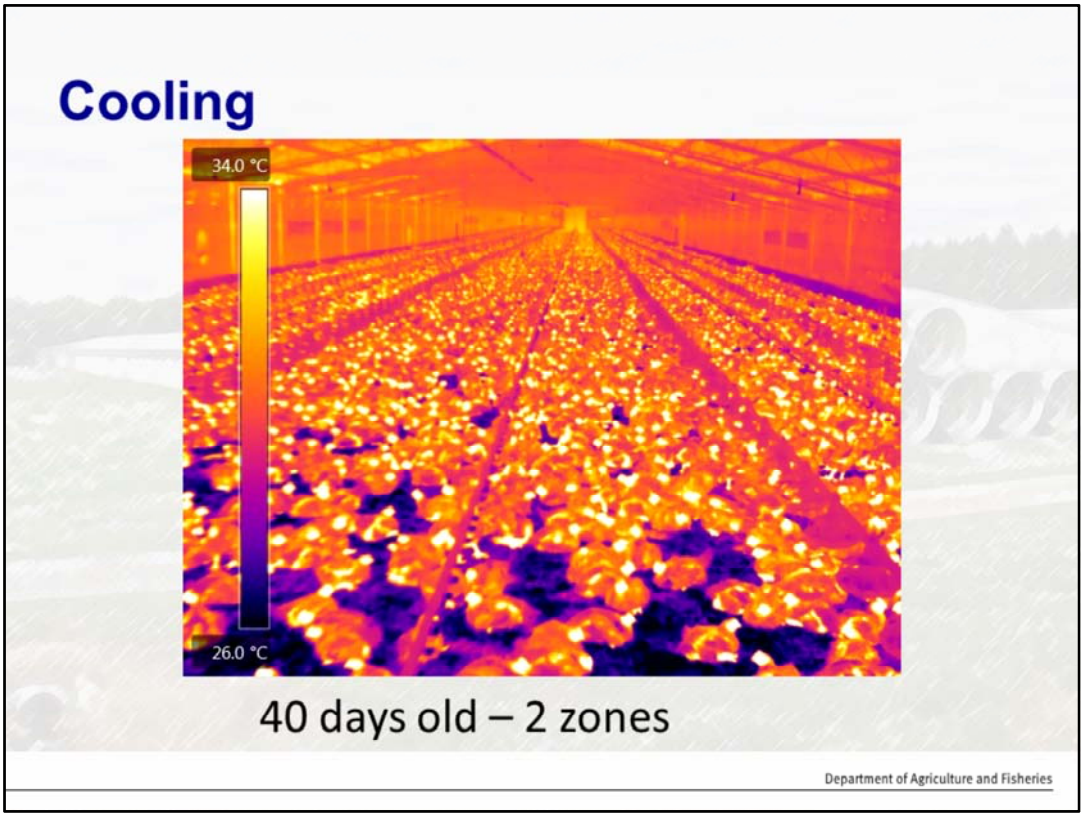


By comparison, this is a neighbouring shed at a similar time using evaporative cooling. Temperature is lower, but RH was higher by 10-15 RH%.

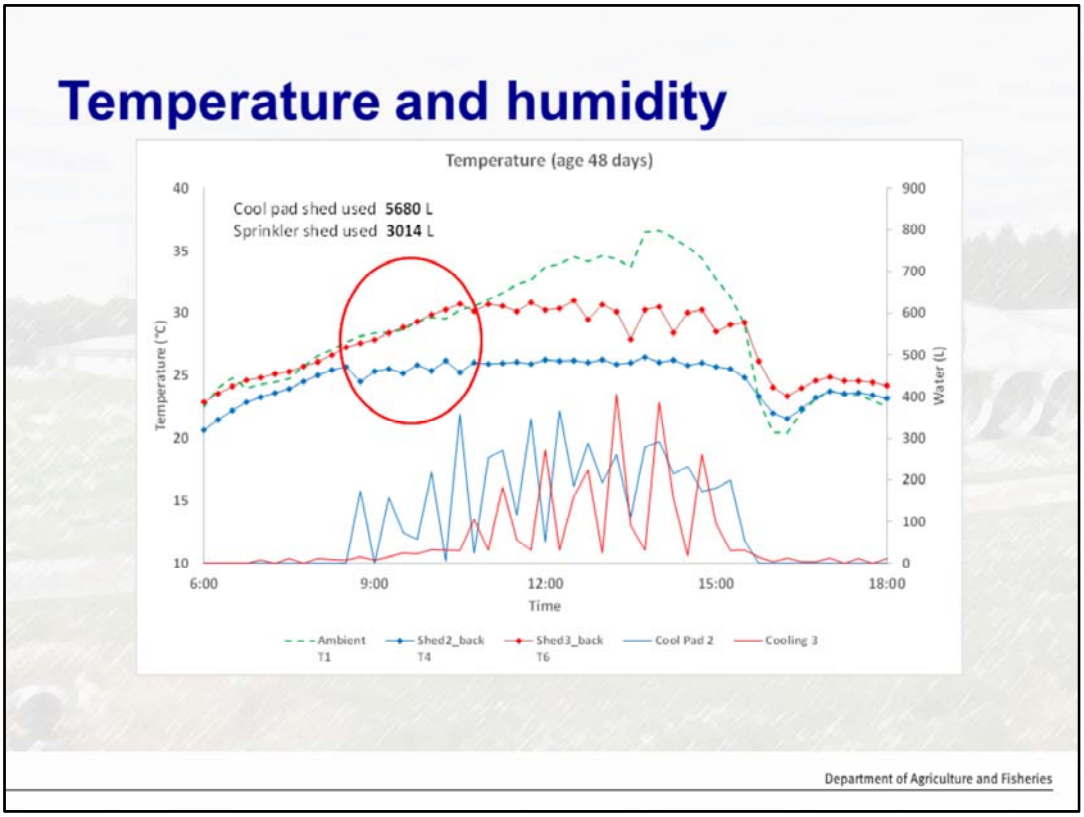
The birds looked similarly comfortable, perhaps even warmer based on breathing/panting, compared to the sprinkler shed. The grower commented that the birds in the sprinkler shed looked more comfortable. The birds in this shed with evaporative cooling were sitting and hardly moving.



This sequence shows the back half of the shed after we installed a row of sprinklers up the middle of the shed. It provide more coverage.

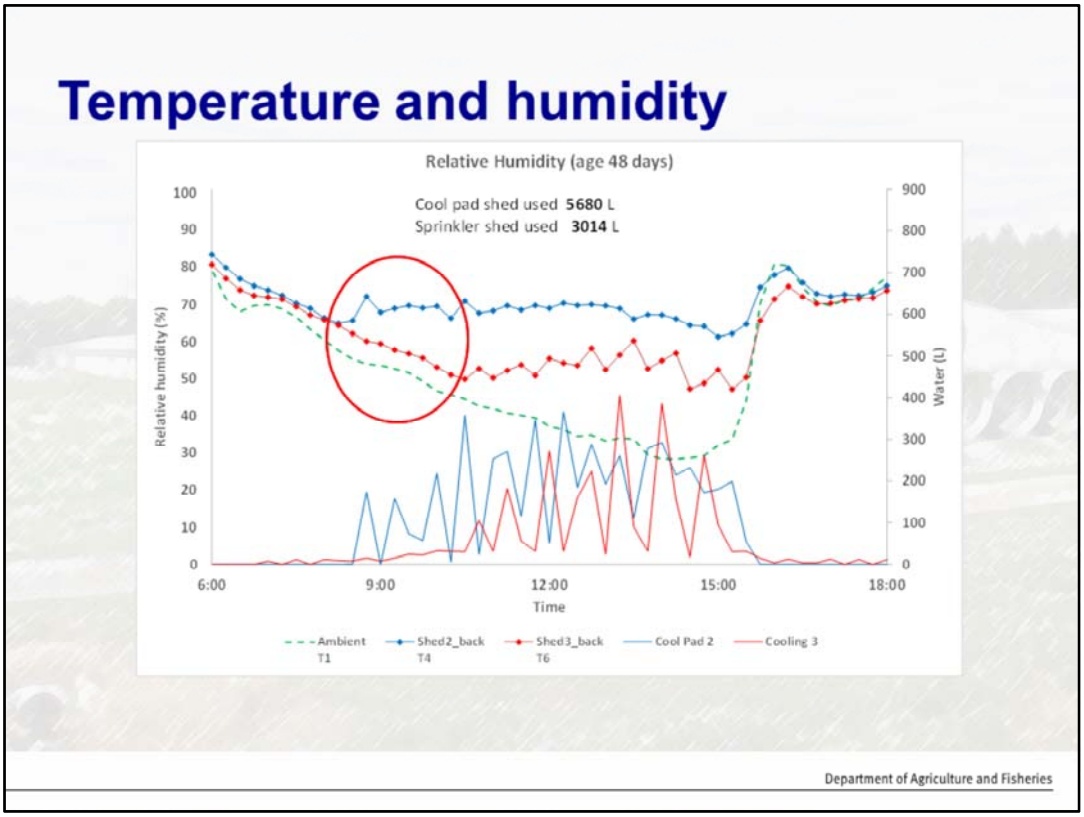


This sequence shows the entire shed, with front and back zones working independently from their own temperature sensors



This figure shows the temperature in the shed with sprinklers and evaporative cooling, and a neighbouring shed (with only evaporative cooling cells). The air temperature in the sprinkler shed increases (red line). During this time the sprinkler water usage increased (red line at the bottom of the graph). In the neighbouring shed (blue lines), the air temperature was held about 25°C but water usage in the cool cells was much greater than with the sprinklers.

In the sprinkler shed, the cool-pads started working when air temperature was about 30°C.



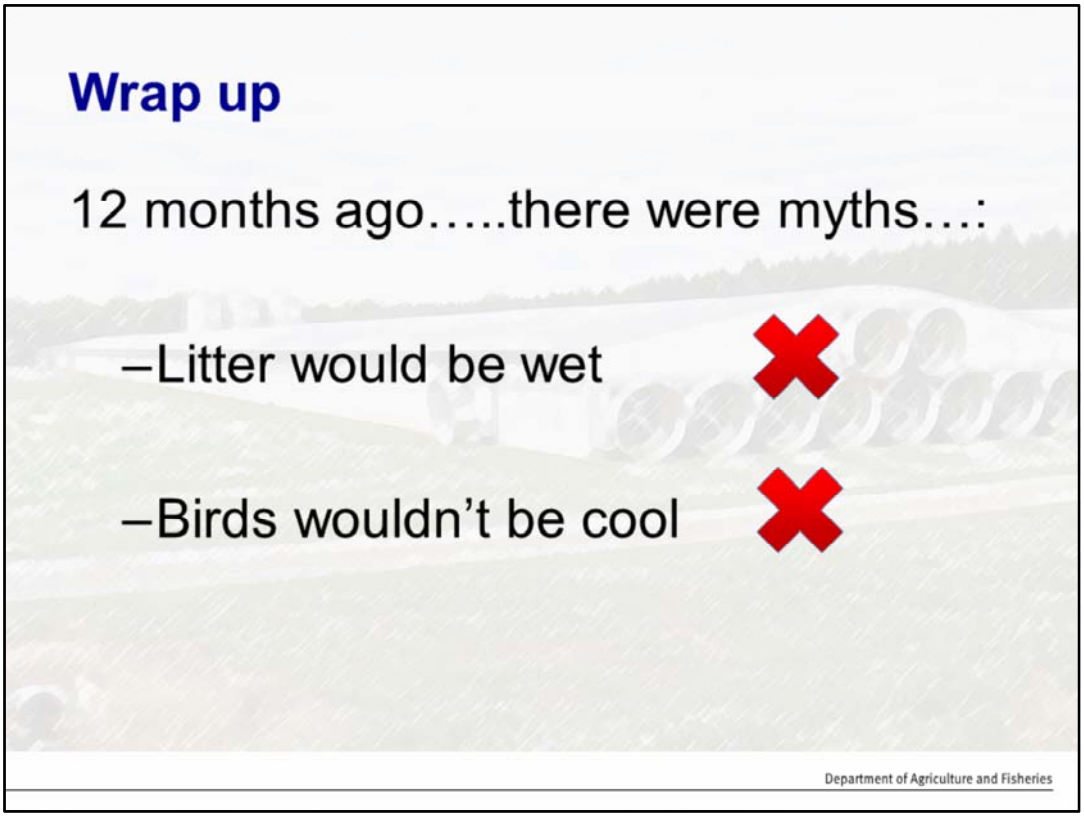
This figure shows the relative humidity for comparison to the temperatures in the previous slide. In the shed with sprinklers, the relative humidity was about 50-55% during the day. In the evaporative cooling cell shed, RH was consistently above 70% for most of the day. This higher humidity results in birds feeling warmer.

Early observations

Grower's comments

- Dirtier fans and drinker/feeder line surfaces
- Wetter litter after thin-outs
- Wet litter only coinciding with leaking drinkers
- Warmer birds at (dry) cool-pad inlets
- Dirtier feathers

- "Overall happy and would consider own installation"
  - flexible cooling
  - activity promotion
  - cooling redundancy
  - water saving



This trial hasn't answered all questions about using sprinklers. Before this trial, it was thought that litter would be wet, sprinklers would flood the shed and the birds would die from heat stress.

We have observed that this is simply NOT the case. Sprinkler systems can be incorporated into meat chicken sheds to reduce water usage while still cooling birds. Using sprinklers has had minimal effect on litter conditions. If a grower observes a decline in litter conditions, they can adjust the sprinkler settings.

Wrap up

Greatest benefits

- Water savings – suits farms with limited water
- Backup cooling – relatively cheap option
- Lower humidity

Greatest challenges

- Coordinating two control systems
- Limited air cooling (Alarms ?)

There are opportunities to test if promoting activity in young birds (e.g. 5 days old) assists with gut development or leg development.

From a welfare perspective, is the use of sprinklers enriching or annoying to the birds? This may need to be further examined.