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## Acknowledgements

AgriFutures Australia – Chicken Meat Program



Department of Agriculture and Fisheries,  
Queensland (DAF)



Participating integrators and growers

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## **In-shed sprinkler system**

### **NOT FOGGING**

- **Low pressure (40-50 PSI)**
- **Large droplets settle on the birds**

### **Uses micro-timed applications**

- **A few seconds at regular intervals**



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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 sprinkler system is **LOW PRESSURE**, and is designed to get the water droplets onto the birds. It is not fogging.

## In-shed sprinkler system

### WHY?

- **Research & adoption in the USA**
- **Uses less water**
- **Lower humidity**
  - drier litter
  - assists bird's self-cooling
- **Encourages regular activity**
  - cyclic feeding & drinking
  - releases heat



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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.

The sprinklers have been trialled in the USA and have been adopted on farms there.

Reports of the benefits include:

- Less water use than cool-pads
- Lower in-shed humidity
- Drier litter
- Better bird production stats
- May use more electricity

## In-shed sprinkler system



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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 put the sprinklers below the baffle. It will depend on the baffle curtain spacing.

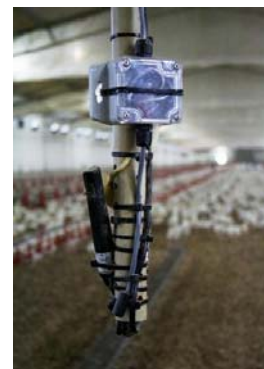
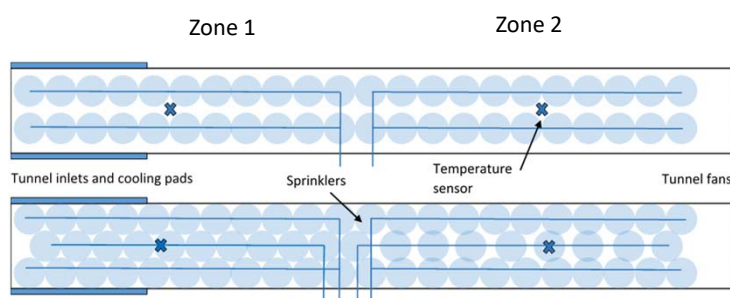
Non-drip valves are fitted to each sprinkler.

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.

## In-shed sprinkler system

### Multi-zones

- Independent
- Temperature sensors



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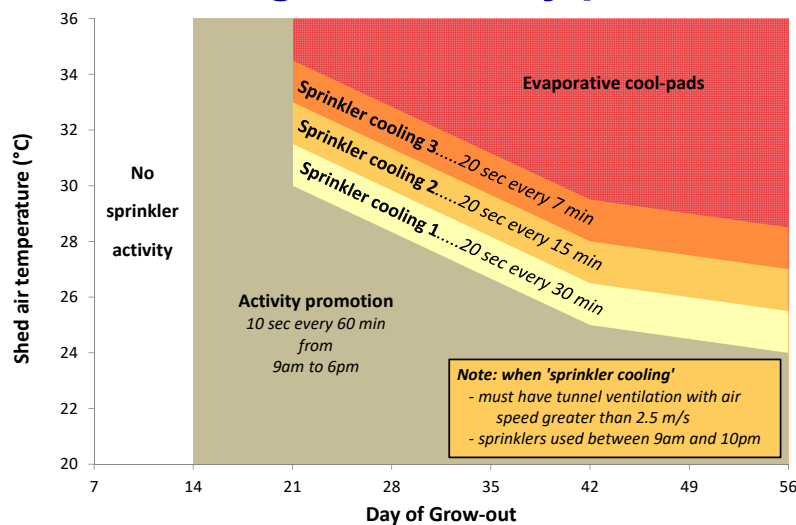
The blue circles in the diagram show an approximate layout of the sprinklers.

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.

## Program – Cooling and activity promotion



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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.

## How much water per application?

Assume 150x15 m shed, ~ 40,000 birds

- Sprinklers operating for 20 seconds
- Water applied = 23 Litres (11 ml/m<sup>2</sup>)

Mode	Application frequency (20 s duration)	Litres per hour per shed	ml per hour /m <sup>2</sup>	Litres per day* per shed	Litres per day* per m <sup>2</sup>
Activity Promotion	Hourly (10s)	11	5	185	0.08
Cooling 1	every 30 min	45	21	725	0.32
Cooling 2	every 15 min	91	41	1450	0.65
Cooling 3	every 7 min	183	83	2900	1.4

\*assumes 16 hours/day

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



## How much water?



Water drops after  
20 second sprinkling



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A 20 second application barely connects the drops of water.

## **Water savings**

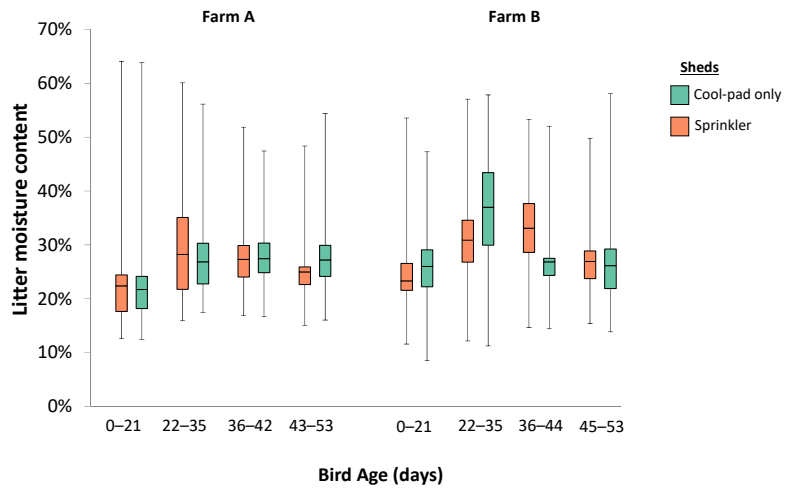
- **27-77% less water** (compared to cool-pads)
- **3,000–136,000 L per shed per batch**
- **Greatest savings during warm weather (~30 °C)**

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The water savings are from comparing sheds with sprinkler-cool pad combined cooling with using evaporative cooling only (the normal practice). In these trials, the evaporative cooling pads 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.

## Litter moisture



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There was no systematic effect of the sprinklers wetting the litter. Activity promotion does add more water into the shed than 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.

## Activity Promotion

Sprinkler

ON



7 minute intervals

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

## Cooling



Ambient conditions

34 °C

55% RH

Shed

29-30 °C

70% RH

2 rows of sprinklers (7 minute intervals)

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

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.

## Cooling



Ambient conditions

34 °C

55% RH

Shed

28 °C

80% RH

Cool pads only

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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.

## Cooling



Cool-pads only



No cool pads,  
after sprinklers

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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%.

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## Cooling



Ambient conditions  
29 °C  
62% RH

Shed  
27.8 °C  
68% RH

3 rows of sprinklers (7 minute intervals)

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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.



## Cooling



2 zones (7 minute intervals)

Ambient conditions

28°C

68% RH

Shed

27 °C

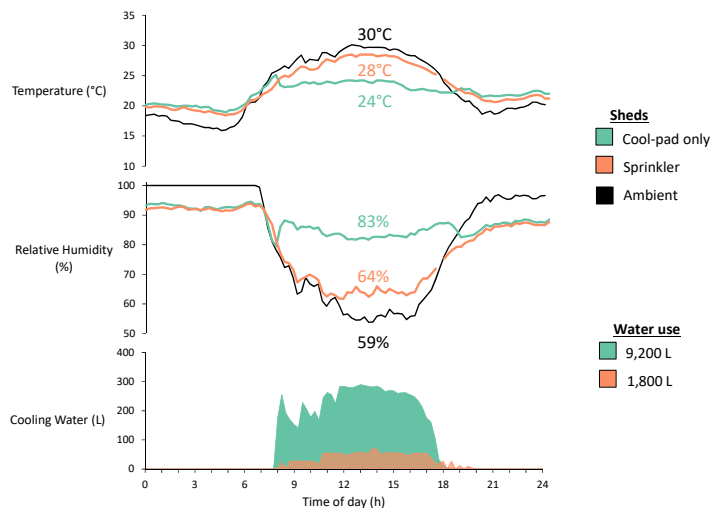
72% RH

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

## Temperature, humidity & cooling water

Day 38



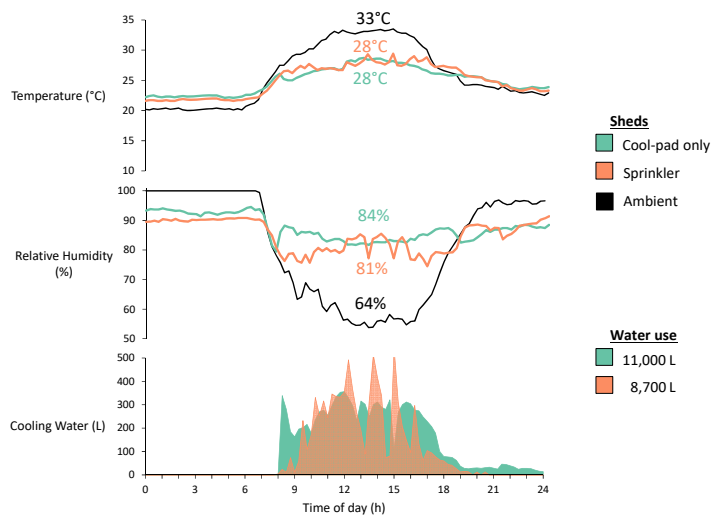
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This figure shows the temperature & RH in the shed with sprinklers and evaporative cooling, and a neighbouring shed (with only evaporative cooling pads). The air temperature in the sprinkler shed increases (orange line) but is just cooler than ambient. During this time the sprinkler water usage increased (orange area). In the neighbouring shed (green lines), the air temperature was held about 24°C but water usage in the cool pads was much greater than with the sprinklers.

In the sprinkler shed, the cool-pads started working when air temperature was about 24-25 °C.

## Temperature, humidity & cooling water

Day 31



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This figure shows the temperature & RH in the shed with sprinklers and evaporative cooling, and a neighbouring shed (with only evaporative cooling pads).

This is a hotter day than the previous slide. The cool-pad operated in both sheds for much of the day. In both sheds, air temperature was maintained about 28 °C and RH was about 81-84%. The delay in cool pad use in the sprinkler shed still reduced some water (20% less).



The peaks in water use in the sprinkler shed may indicate that the two systems weren't in harmony, with cool-pads possibly over-reacting in the sprinkler shed.

## **Grower's feedback**

- Dirtier fans and drinker/feeder line surfaces
- Dirtier feathers
- Wetter litter after thin-outs (only under drinkers)
- Warmer birds at (dry) cool-pad inlets
- Birds 'less stuffy' near the tunnel fans
- Good backup cooling option
- Good in very hot weather to get release heat

## Wrap up

Before the trial, predictions were...

- Litter would be wet 
- Birds would be hot 

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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 ?)**

## Opportunities

### Effects of activity promotion

- Regular feeding ?
- FCR & growth rate ?
- Gut health ?
- Younger birds ?
- Bone / joint development ?

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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.