Effect of an in-shed sprinkler cooling system on temperature, relative humidity, water usage, litter conditions, live weight and mortality

by Mark Dunlop
August 2018

AgriFutures™ Chicken Meat

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Foreword

Chicken meat production uses evaporative cooling in the grow-out sheds to cool the birds during warm weather. It is an effective method of cooling, but uses a lot of water and also increases the relative humidity in the shed. High relative humidity negatively affects the bird's ability to deal with heat and may also contribute to increasing the litter moisture content, which by association may affect some aspects of flock health and welfare. A recently developed technology that reduces the need for conventional evaporative cooling, with evaporative cooling pads or high pressure foggers, is in-shed sprinkler systems, which intermittently apply relatively small quantities of water directly onto the birds at regular intervals. Previous studies have shown that these low-pressure sprinklers are effective for cooling birds and improving litter conditions, while using much less water. This study is the first for trialling this in-shed sprinkler system on Australian meat-chicken farms.

In this study, sprinkler systems reduced cooling water usage. When consistently used, cooling water usage was reduced by 56% over a one year period. The sprinklers had practically no effect on litter moisture content, bird live weight or mortality. When sprinklers were operating, in-shed temperature was warmer compared with the control sheds, but relative humidity was lower. Birds appeared equally comfortable.

In-shed sprinklers may not be suitable or desirable at all meat chicken farms, but may be beneficial for farms with limited water supply, or where water is difficult or expensive to treat. This sprinkler system is less expensive than other methods of evaporative cooling and uses robust and readily available components, which may make it desirable for a secondary or back-up cooling system.

This project was funded from industry revenue, which was matched by funds provided by the Australian Government. This report is an addition to AgriFutures Australia's diverse range of over 2000 research publications and it forms part of our Chicken Meat RD&E program, which aims to stimulate and promote RD&E that will deliver a productive and sustainable Australian chicken meat industry that provides quality wholesome food to the nation.

Most of AgriFutures Australia's publications are available for viewing, free downloading or purchasing online at: www.agrifutures.com.au.

John Harvey
Managing Director
AgriFutures Australia

Acknowledgments

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The author would like to thank Jim McAuley (DAF, QLD) for technical assistance during installation and sampling, and also thank Dr. David Mayer (DAF, Qld) for statistical analysis.

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Executive Summary

What the report is about

This report is about an on-farm study of an in-shed sprinkler system that can be used in meat chicken sheds for cooling and also to promote regular bird activity. This was the first trial of this sprinkler system in Australia. The trial provided an opportunity to evaluate the system in Australian meat chicken sheds and demonstrate the use of in-shed sprinklers to the chicken meat industry. The sprinkler system used in this study applies relatively small quantities of water at regular intervals, depending on the temperature within the shed, which makes it different from sprinkler systems that may have been used decades ago.

Who is the report targeted at?

This report is targeted at meat chicken farmers and integrator staff who are responsible for managing and optimising the environment within meat chicken sheds.

Where are the relevant industries located in Australia?

The Australian chicken meat industry involves the participation of around 700 farms and 40,000 employees. Chicken meat production occurs in all Australian states, and typically in close proximity to major metropolitan centres. According to Australian Bureau of Agricultural and Resource Economics, chicken meat currently makes up 25% of meat production in Australia, and that figure is expected to rise to 28% by 2018–19.

Background

High humidity in meat chicken sheds reduces the ability of the birds to cool, which they achieve primarily through respiratory evaporation. High humidity is also known to be a contributing factor to wet litter, which by association has been linked to adverse health and welfare outcomes. High humidity occurs when evaporative cooling pads are used because of the addition of water vapour and simultaneous reduction in temperature. We sought an alternative method of cooling that didn’t rely solely on evaporative cooling pads.

We identified low-pressure sprinklers a possible alternative approach to using evaporative cooling pads. These have been previously used in meat chicken sheds, and recently developed sprinkler systems offer precise sprinkler control that has prompted low-pressure sprinkler systems to be reconsidered as a means of keeping meat chickens cool.

Published information describes the development and testing of sprinkler cooling systems, and the use of surface wetting as a means of cooling meat chickens. Some of the reported differences between direct surface wetting using low pressure sprinklers compared to evaporative cooling pads include:

- Significantly less water used for cooling (50-85% less water)
- Lower in-shed humidity during cooling
- Similar litter conditions, tending towards drier litter
- Slightly more electricity use for ventilation fans (about 4-5% more)
- Similar bird growth, FCR, mortality
- Lower capital and installation costs.

With some of these being potentially beneficial, there was a need to see if similar outcomes could be achieved with sprinklers in Australian meat chicken sheds.

Aims/objectives

The objectives of this project were to:

1. Demonstrate the application of a water sprinkler cooling system in tunnel-ventilated meat chicken sheds.
2. Quantify and communicate the benefits/challenges of using the sprinkler cooling system in commercial meat chicken production in terms of growing conditions (bird 'comfort' temperature), improved litter conditions and water savings.

Methods used

A commercially available sprinkler system was purchased and installed at two farms in south-eastern Queensland. Sheds that had the sprinkler system installed were paired with control sheds, which used only evaporative cooling pads. The sprinkler system was operated regularly to promoted bird activity, and for cooling. Operation of the sprinkler system was managed by the farmer in consultation with the research team. Monitoring equipment was installed to measure temperature, relative humidity and water usage. Litter samples were collected at regular intervals during each grow-out to assess if the direct application of water increased litter moisture content. Production statistics including live weight and mortality were collected from the farmer and integrator to assess these parameters.

Results/key findings

This study was the first time that this sprinkler system has been used in Australian meat chicken sheds. We found the sprinkler system to be relatively easy to install, although we suggest there are opportunities to alter the sprinkler layout to improve spray coverage and improve location of sprinklers relative to ceiling baffle curtains. Farm managers successfully coordinated the sprinkler and ventilation controllers, although it's likely that further optimisation will improve outcomes. Farm managers found that cooler temperature set-points were required to maintain bird comfort compared to what the manufacturer recommended (based on the use of the sprinkler system overseas).

This study was conducted on commercial meat chicken farms and the sprinkler system was not used consistently at one of the farms during the one year study period. This affected our ability to confidently measure the effects associated with the sprinkler.

The sprinkler system had virtually no effect on the shed environment for approximately 85% of the time because no evaporative cooling was required at all. When there was a need for evaporative cooling, the primary difference between the sprinklers and evaporative cooling pads was warmer air temperature in the sprinkler shed (frequently 3–4 °C), but lower relative humidity (frequently 10–15%, for example 65% compared to 80% relative humidity). The increase in temperature should not be related to thermal comfort, because the lower relative humidity and direct cooling effect on the birds have previously been found to compensate for higher air temperature. Critically high temperatures were avoided because the evaporative cooling-pad were still used in the sprinkler sheds, but their use was reserved for high temperatures. When used consistently, the amount of water used for cooling the sprinkler sheds was 50–60% less than the control sheds. There was practically no effect on litter conditions, live weight, or mortality.

Dust accumulation on shed surfaces (drinker lines, feeder lines, support cables and fan grills) was slightly higher with regular use of the sprinklers. Feathers on the birds' backs occasionally appeared dirtier (which in conventional sheds may be associated with wet litter conditions), even though the litter was dry and friable.

Implications for relevant stakeholders

For industry, this low-pressure sprinkler system offers flexibility in managing the shed environment. Extended periods of high relative humidity due to the use of evaporative cooling pads are able to be reduced with the use of the sprinklers. When used appropriately, in-shed sprinklers reduce the use of evaporative cooling pads and save substantial quantities of water per shed (200,000–300,000 L/shed/annum).

In-shed sprinkler systems may not be suitable or desirable in all meat chicken sheds, but may be a sound investment on farms with limited water supply, or where treating water is expensive.

The sprinkler system may also be beneficial as a backup or emergency cooling system. For this purpose it has the benefits of low cost ($4000–$8000 per shed), it operates at low pressure (345 kPa, 50 PSI), uses an independent control system, is constructed using readily available components, is easy to maintain, and uses sprinklers that don't readily clog. Additionally, overseas research has demonstrated that direct surface wetting combined with air speed (i.e. tunnel ventilation) is able to significantly reduce heat-stress related mortality during extreme conditions.

Recommendations

We recommend the chicken meat industry support further investigation into direct surface wetting sprinkler systems. Investigations needs to be conducted in controlled facilities (i.e. research farms) to quantify the following:

- The effect of the sprinklers on feed conversion ratio (FCR)
- The effect of regular water application on bird welfare and behaviour, including behavioural time budgets and aversion/preference tests
- Growth, FCR, skeletal development, muscular development by using the sprinklers to promote regular activity at much younger bird age (e.g. 5 days old) than was tested during this study (14 days old)
- The effect of using the sprinklers on core-body temperature at critical times of the day (e.g. early evening), by promoting regular activity to reduce trapped heat as well as directly cooling the birds
- Determine the effect of using sprinklers on fan activity (is more ventilation required?) and drinking water intake.

List of communication materials resulting from this project

This non-technical report has been prepared to summarise the practical findings of this study. It includes information from conference papers, presentations and draft journal manuscript.

Conference/meeting articles

Dunlop, M. 2017. In-shed sprinklers for cooling and activity promotion: a trial in progress. AVPA Scientific Meeting, 15-17 November 2017, Geelong, Victoria. The Australasian Poultry Veterinary Association. pp. 43-44.

Dunlop, M. 2018. Using in-shed sprinklers in poultry sheds. Poultry Information Exchange (PIX2018), 4-5 June 2018, Gold Coast, Australia. PIX Committee. pp. 86-90.

Draft Journal manuscript

Dunlop, M.W. and McAuley, G. (draft August 2018) Direct surface wetting sprinkler system to reduce the use of evaporative cooling-pads in meat chicken production: indoor thermal environment, water usage, litter moisture content, live market weights and mortalities.

Abstract

An overhead sprinkler system that directly applies water onto the meat chickens in tunnel ventilated houses was evaluated and compared to a conventional evaporative cooling-pad system at two commercial farms in south-eastern Queensland, Australia. The sprinkler system was used to reduce the use of evaporative cooling-pads as the primary cooling system, but not replace evaporative cooling-pads altogether. The sprinkler system used low water pressure and was comprised of evenly spaced sprinklers and a programmable controller. Water was applied intermittently based on house temperature and a temperature program that was related to bird age. The study was conducted over six sequential grow-outs during a one year period. Air temperature, relative humidity, litter moisture content, cooling water usage, live market weight and mortality were assessed during the study. The effect of the sprinklers on these measured parameters was complicated by interactions with farm, batch, bird-age and time-of-day. We found that, in general, the houses with combined sprinkler and evaporative cooling-pad systems used less water, while having similar litter moisture content, live market weight and mortality compared with the control houses that were fitted with conventional evaporative cooling-pads. When evaporative cooling was required, the sprinkler houses had warmer air temperature but lower relative humidity than the control houses. Bird comfort due to the direct cooling effect of water evaporating off the birds was not assessed during this study, but was inferred from live weight and mortality data. This was the first study in Australia involving this sprinkler system, and we suggest that the sprinkler system design and operation may require some adaptation to better suit Australian poultry house design and climatic conditions, including the need for additional sprinklers to improve coverage, lower set-point temperatures, and altering sprinkler spacing to suit ceiling baffle curtains (if fitted).

Background

High relative humidity affects thermal comfort of the birds and is likely to contribute to wetter litter. One source of high relative humidity in tunnel-ventilated meat chicken sheds is the use of evaporative cooling pads. We went looking for another method of cooling poultry sheds that would complement current shed design and husbandry practices, but not increase the relative humidity.

We found information about an in-shed sprinkler system that had been developed and tested at the University of Arkansas' commercial poultry farm (Arkansas, USA) (Liang et al., 2010; Liang et al., 2012; Liang et al., 2014; Tabler et al., 2008). The effect of direct surface wetting to cool meat chickens has also been investigated (Czarick and Fairchild, 2017a, b; Tao and Xin, 2003a).

Fundamentally, low-pressure, in-shed sprinkler systems use several rows of sprinklers that are suspended from the ceiling and run the length of the shed (Figure 1). The sprinklers are activated for very short periods of time (5–30 seconds) at regular intervals (5–60 minutes) when cooling is required, based on shed air temperature as well as bird age and density.

Figure 1. Sprinklers suspended from the ceiling in a meat chicken shed

Some of the reported differences between direct surface wetting using low-pressure sprinklers compared to evaporative cooling pads included:

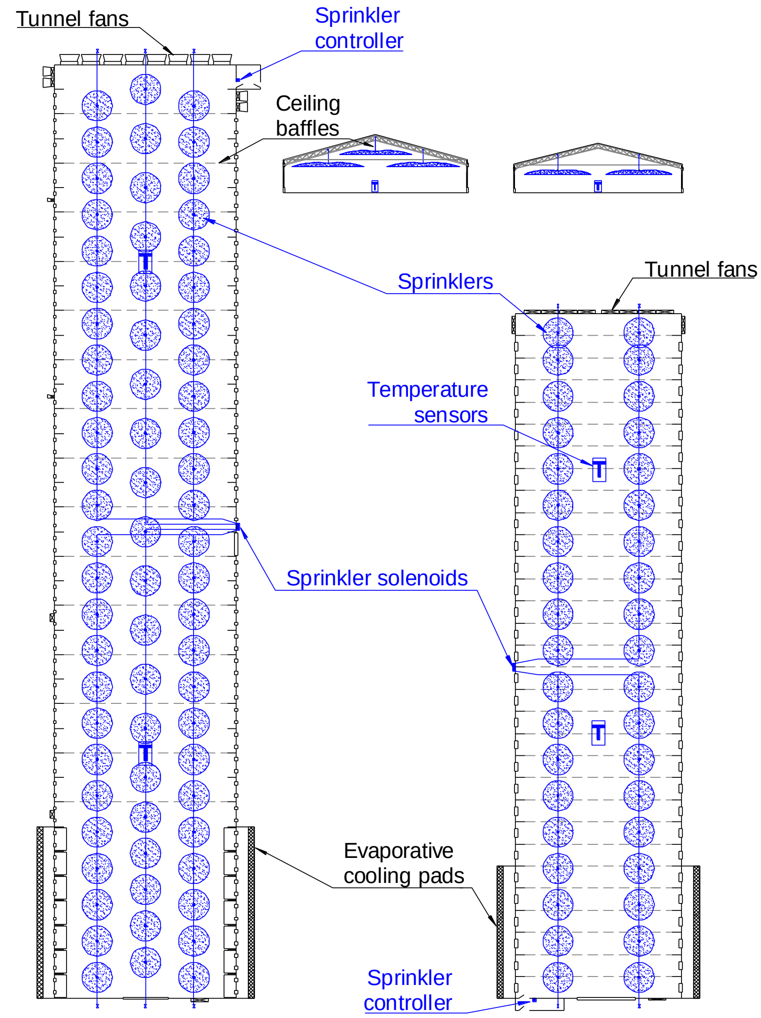
- Significantly less water used for cooling (50–85% less water)
- Lower in-shed humidity during cooling
- Similar litter conditions, tending towards drier litter
- Slightly more electricity use for ventilation fans (about 4–5% more)
- Similar growth rate, feed conversion ratio, mortality
- Lower installation cost.

With the hope of realising some of the reported benefits, we set out to install a sprinkler systems and get practical experience with installation, configuration and operation.

Methods

Installing an in-shed sprinkler system

We installed low-pressure, overhead sprinkler systems (Weeden Sprinkler System®, Weeden Environments®, Canada) on two meat chicken farms in southeastern Queensland. Installation cost approximately $4000–8000 per shed and required 1–2 days for a couple of workers to install.



Shed with 3 sprinkler lines **Shed with 2 sprinkler lines**

Figure 2. Schematic layout of a sprinkler system in a meat chicken shed

The sprinkler systems were installed as per the manufacturer's instructions (**Error! Reference source not found.**). In summary, two PVC pipes were installed along the ceiling, running the full length of the shed, approximately 3.5–3.7 m from the side walls. Sprinklers were suspended every 6 m along these pipes. At one of the farms, a third line was installed along the centreline of the shed, in the roof apex, with sprinklers installed mid-way between ceiling baffles, approximately 8 m apart. We decided to add this third line to improve spray uniformity along the middle of the shed during tunnel ventilation, when the higher airspeed narrows the width of the spray patterns. The systems were installed with two independent temperature sensors and solenoid valves in the front and back halves of the shed. This enabled the temperatures at both ends of the shed to be monitored and sprinklers in each zone activated according to the conditions.

Operating the sprinkler system

The sprinkler system was operated for promoting bird activity and for cooling (**Error! Reference source not found.**).

Activity promotion started after day 14 and provided regular application of water regardless of air temperature. This application of water has been shown to stimulate bird movement. In this mode, sprinklers were activated for 10 seconds every 60 minutes during daylight hours. Each application used 10–15 L of water.

The controller automatically changed to **cooling** mode when the in-shed air temperature increased above a 'main set point' (MSP, approximately 31 °C on day 21, decreasing to 25 °C on day 42). For cooling mode to be effective, the shed must be in tunnel ventilation mode with at least 2.5 m/s wind speed. Cooling mode was only allowed between 9 am and 10 pm after day 21. As air temperature rose above the MSP, frequency of water application by the sprinklers automatically increased through three levels of cooling:

- Level 1 started at the MSP, applying water for 20 seconds every 30 minutes. (each 20 second application used 20–30 L of water).
- Level 2 started at 1.0–2.0 °C above the MSP, applying water for 20 seconds every 15 minutes.
- Level 3 started at 2.5–4.0 °C above the MSP, applying water for 20 seconds every 7 minutes. When air temperature continued to rise to 4–6 °C above the MSP, evaporative cooling-pads were then used.

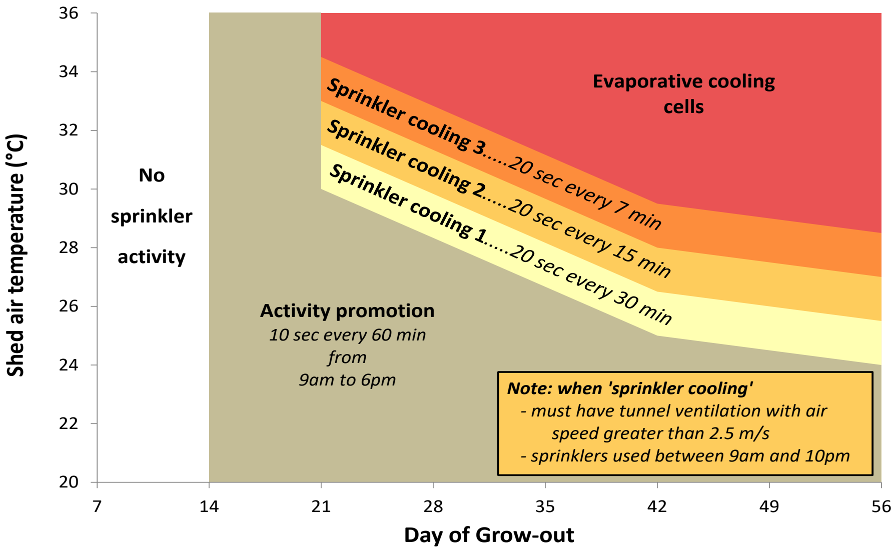


Figure 3. Example sprinkler controller program in activity promotion and cooling modes when used in conjunction with cool pads.

During the trial, farm managers were encouraged to adjust the settings based on their assessment of bird thermal comfort, weather, and litter conditions. All settings within the sprinkler controller were adjustable by the farmer (days, times, temperature set points, sprinkler duration and frequency). Farm managers found that lower temperature set-points were required to maintain bird comfort compared to what the manufacturer recommended (based on the use of the sprinkler system overseas).

In addition to the sprinkler systems, we installed temperature and relative humidity sensors to measure in-shed conditions, and water meters on the cool pad and sprinkler systems to record water use. Sensors and meters were also installed in neighbouring sheds ('Control' sheds) and used as a comparison to the sheds with the sprinklers ('Sprinkler' sheds). Our focus with this trial was to measure potential water savings, litter conditions, temperature, relative humidity and how the birds respond to direct water spraying based on observations by farm staff.

Results

How sprinklers affect the air temperature and relative humidity and water usage

Operating the sprinklers for activity promotion (10 seconds application every hour) had no noticeable effect on temperature or relative humidity.

For 85% of the year, no evaporative cooling was required (sprinklers or cooling-pads). During these times, the sprinklers had virtually no effect on temperature, relative humidity or water usage.

During extreme heat conditions, when evaporative cooling-pads were used in all sheds, there were few differences in temperature, relative humidity or water usage.

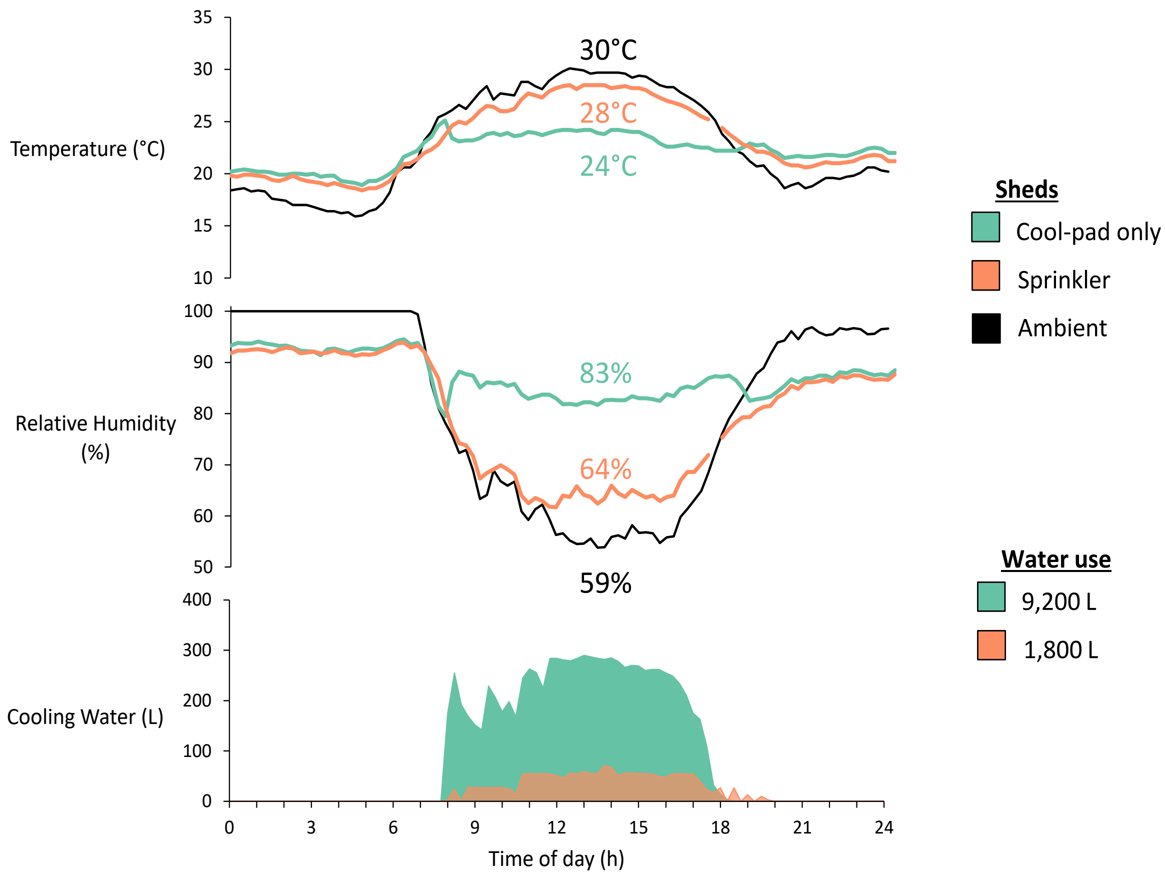


Figure 4. Example of when the sprinklers were solely relied on for cooling in the sprinkler shed, while evaporative cooling-pads were active in the other shed

The most obvious effect of the sprinklers was evident when moderately warm weather called for the sprinklers to be used instead of evaporative cooling pads (Figure 4). At these times, temperature in the sprinkler shed was warmer (for example by 3–5 °C) but the relative humidity was lower (for example by 10–20 relative humidity percentage units). Water usage in the sprinkler shed under these conditions was also much lower than the cool-pad shed.

Cooling effect on the birds

Warmer temperatures should not be related to thermal comfort, because the lower relative humidity and direct cooling effect on the birds have previously been found to compensate for higher air temperature (Liang et al., 2014; Tao and Xin, 2003a, b). We used thermal imaging to observe the direct cooling effect of water spray on the bird's feathers (Figure 5). In thermal images, the visible temperature is not the bird's core temperature, but the feather temperature. As the water evaporates, the cooling effect reduces until the sprinklers are activated again. By comparison, cool pads reduce the temperature of the air entering the shed, and this may help to avoid heat accumulating in shed surfaces.

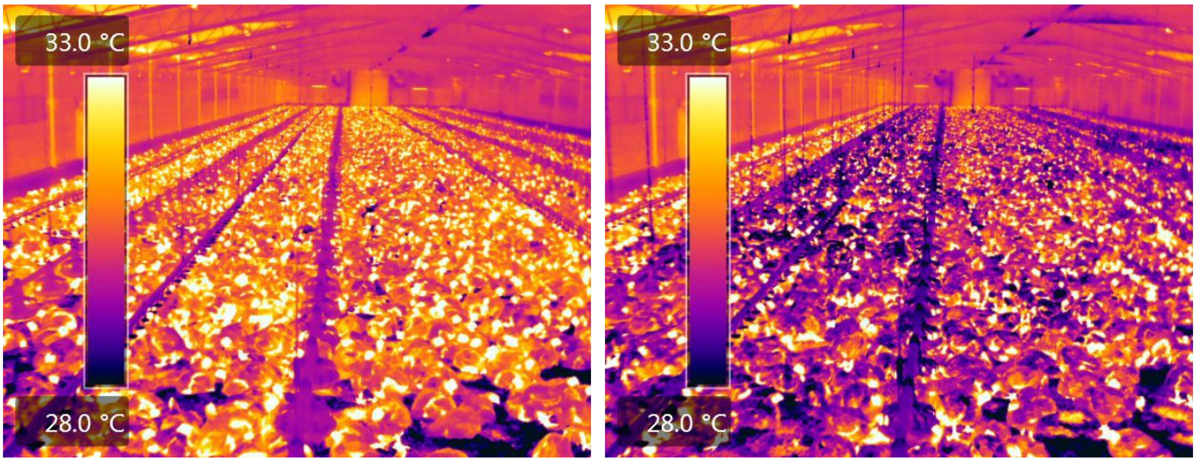


Figure 5. Thermal images taken before (left) and after (right) using the sprinklers (three rows).

When only two rows of sprinklers were used in the shed (15 m wide), spray coverage in the middle section was less than it was directly underneath the sprinklers (**Error! Reference source not found.**). W e believe that the high air speed during tunnel ventilation caused narrowing of the sprinkler spray patterns. Observing this is what prompted us to install an extra row of sprinklers in the middle of the shed.

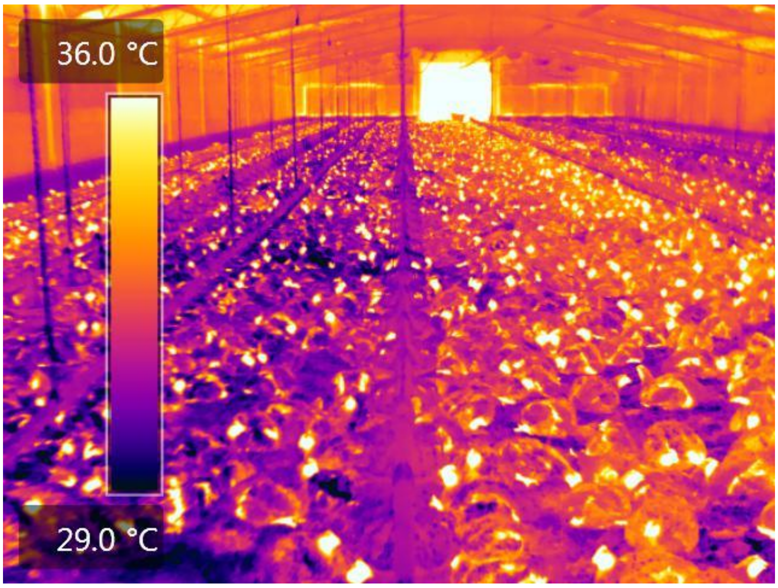


Figure 6. Thermal images taken after sprinkler application with two rows of sprinklers. Note the reduced cooling effect in the middle section of the shed

Cooling water usage

Water savings were inconsistent between the two trial farms (Figure 7). At one farm, where the sprinklers were consistently used, average water saving over the one year period was 56% (approximately 300,000 L saved in the sprinkler shed). At the other farm, our understanding of water usage was confounded by inconsistent use of the sprinklers. During the first grow-out (placed late October 2016), 34% water saving was achieved. In subsequent grow-outs, staggered placement and pickup dates in the trial sheds, heat-waves and damp litter meant that the sprinklers were not used in the manner described above. Over the year, there was effectively no water saving at this farm.

There was an annual trend in water usage and savings. Due to minimal evaporative cooling required during the cooler months, very little water was used for cooling in any shed. The majority of cooling water was used over summer, and this is when the greatest water savings occurred with the sprinklers.

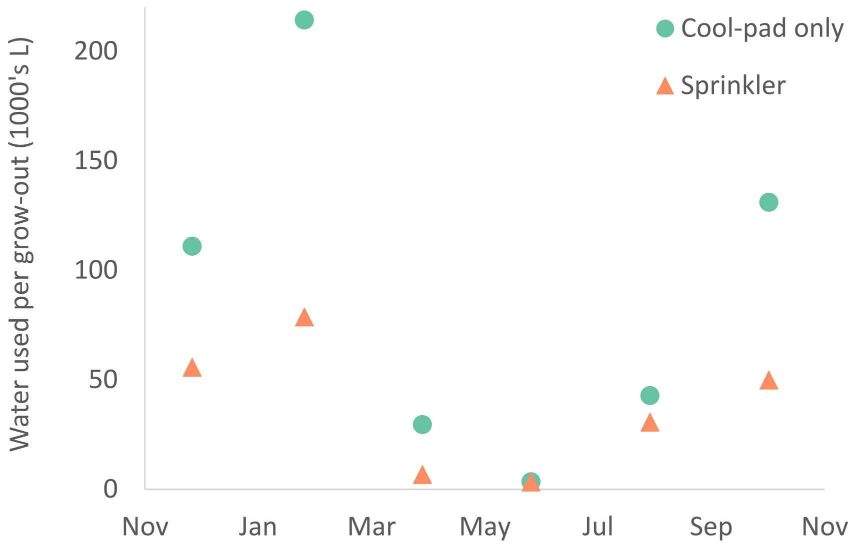


Figure 7. Water usage at one of the farms. Dates represent the middle of the grow-out

Litter conditions

We did not observe any consistent differences in litter conditions with the use of the sprinklers for activity promotion and cooling (Figure 8). We believe this was due to several factors:

- The sprinkled water evaporated before the next application. This was based on visible observation of droplets on shed surfaces.
- Bird coverage of the floor reduced the amount of water landing on the litter. One exception was after thin-outs, when large areas of the floor may be exposed.
- Farmers at both farms paid attention to their litter conditions, and altered sprinkling times if they thought the sprinklers were adding water unnecessarily to the litter. ***Neither farmer considered the sprinklers to be the cause of damp litter***, instead pointing to other causes (e.g. damp bedding deliveries, seepage, drinkers, watery droppings and humid weather). At one farm, the farmer regularly turned off the sprinkler systems, sometimes using them for only a part of the grow-out (e.g. days 14-28 and then after day 40), and in one grow-out the sprinklers were not used at all.

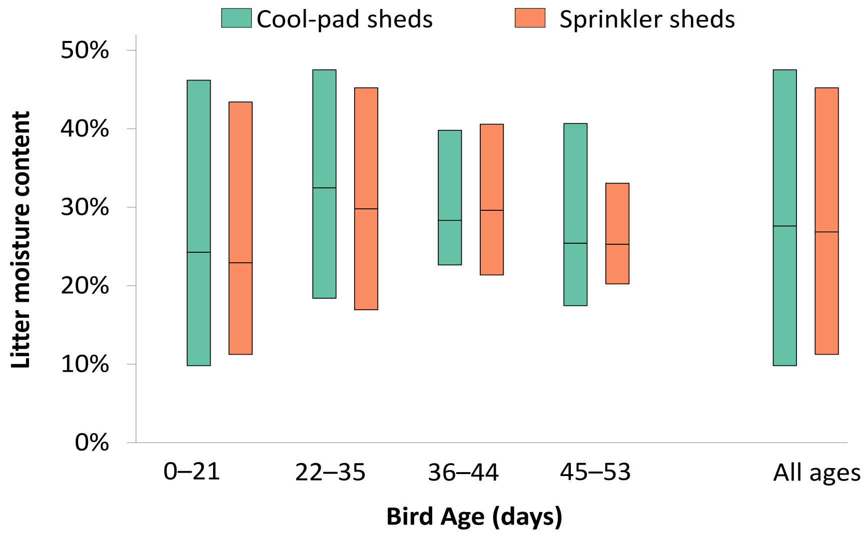


Figure 8. **Average shed litter moisture content (the centre horizontal line is the average and shaded boxes show the range from minimum to maximum)**

Mortality

Mortality varied between the two farms, but there was no difference in mortality due to the sprinklers (Figure 9).

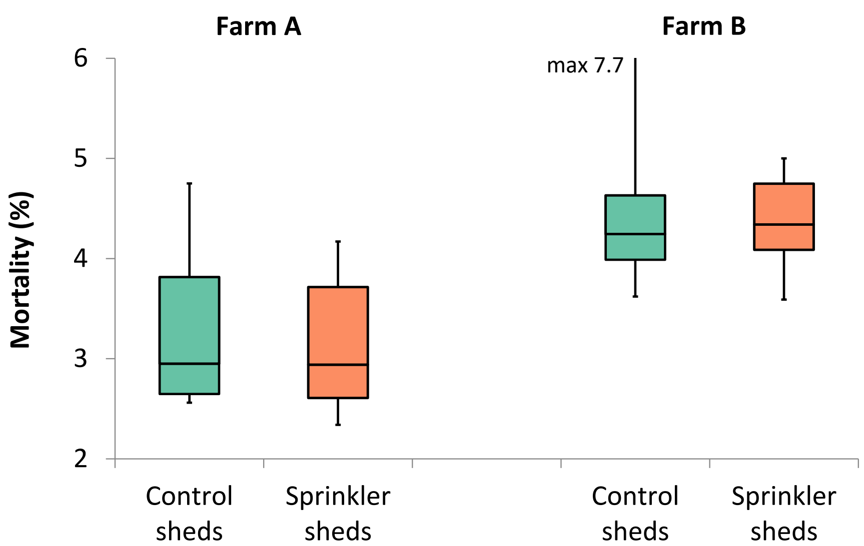


Figure 9. **Mortality for each grow-out. (The centre horizontal line is the median; the shaded boxes represent the range of data between the 25th and 75th percentiles; and the whiskers represent the highest and lowest values).**

Live weight

Live weight data was obtained from farm and processing records. As well as live weights, we also considered the ratio between the live weight at the time of processing and the 7-day live weight ('live weight ratio'), in an attempt to account for effects relating to the parent flock, hatchery and brooding conditions.

Considering firstly the measured live weights, we found that the farms were significantly different, but the there was no statistically significant effect of the sprinklers at either farm (Figure 10). Despite the lack of significance, we observed that live weights in the sprinkler shed tended to be slightly lower than in the control sheds.

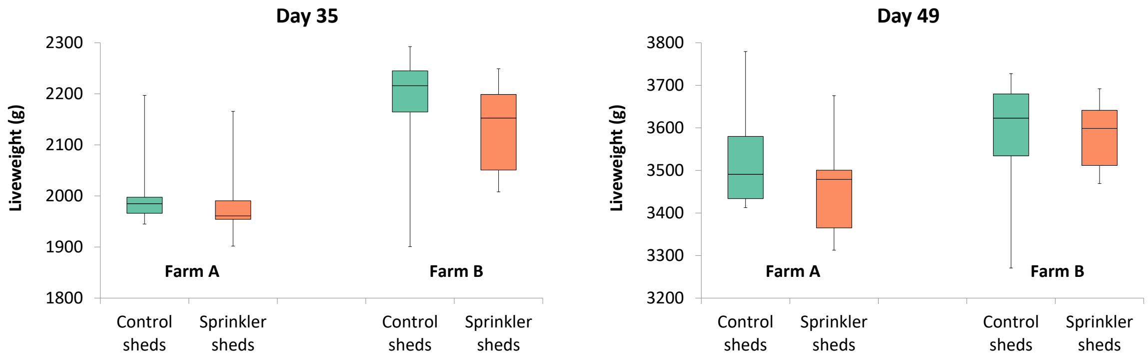


Figure 10. Live weight at 35 d and 49 d for each grow-out. (The centre horizontal line is the median; the shaded boxes represent the range of data between the 25th and 75th percentiles; and the whiskers represent the highest and lowest values).

The result was different when we consider the live weight ratio, because at one farm, the sprinkler sheds had a higher live weight ratio than the control shed. At the other farm, the sprinkler shed had slightly lower live weight ratio (Figure 11).

When we considered the live weight data for all sheds on the farm, we noticed that the control sheds involved in our trial tended to have the highest live weight on the farm. We decided to compare the sprinkler sheds to *all* the other sheds on the farm, because they all relied on evaporative cooling pads and were managed in a similar way to our 'control' sheds. There was no statistically significant difference due to the sprinklers, but in terms of live weight ratio, the sprinkler sheds appeared to out-perform other sheds on the farm.

We concluded that the sprinklers had no consistent effect on live weight. There are many factors that contribute to live weight and more data is needed to be able to confidently conclude if the sprinklers affected live weight or not.

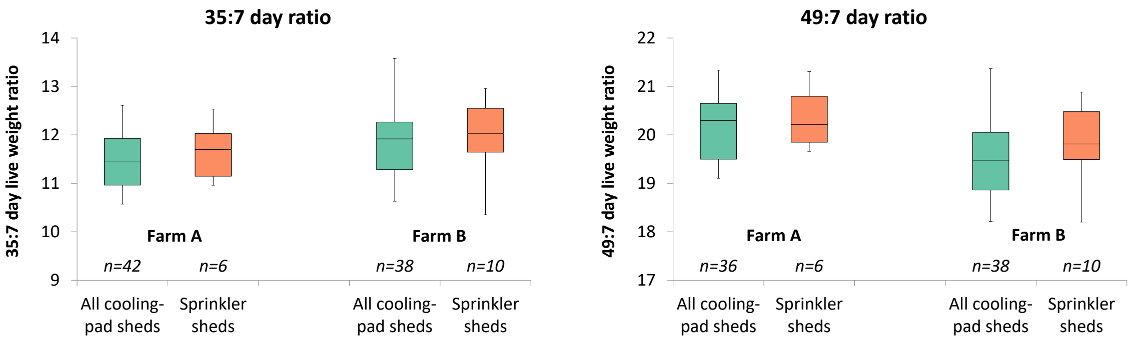


Figure 11. Live weight ratio—35:7 days and 49:7 days—comparison of the sprinkler sheds to all other shed on the farm that relied on evaporative cooling pads. (The centre horizontal line is the median; the shaded boxes represent the range of data between the 25th and 75th percentiles; and the whiskers represent the highest and lowest values; *n* is the number of values in each category).

Dust accumulation

Intermittently sprinkling water on shed surfaces increased the amount of dust that accumulated on some shed surfaces and bird feathers. This was most noticeable on drinker and feeder line surfaces and fan grills. Additional dust accumulation on surfaces may require additional cleaning between grow-outs. Extra dust on fan grills may require more frequent brushing to remove dust. At the start of this trial, dust was found to accumulate on the fan grills at one farm. We blocked-off the sprinklers that were nearest the fans and this substantially reduced dust accumulation in subsequent grow-outs.

Figure 12. Dust accumulation on day 45 of a grow-out in control sheds (left) and sprinkler sheds (right) on feed pans and fan grills. Sprinkler position were later changed near the fans to reduce dust accumulation

Conclusions and recommendations

- When using the sprinklers for cooling, relative humidity was lower and air temperature was higher compared to cooling-pads. Farmers commented that, on average, birds appeared equally comfortable; however, birds near the tunnel inlets at times appeared warmer, presumably due to low airspeed and warm/hot incoming air. Conversely, birds close to the tunnel ventilation fans at times appeared cooler with the use of sprinklers compared to cooling-pads.
- Farm managers found that cooler temperature set-points were required to maintain bird comfort compared to what the manufacturer recommended (based on the use of the sprinkler system overseas).
- Water savings depend on how much the farmer wants to rely on the sprinkler system for cooling. Water savings varied throughout the year, with 56% annual average water savings (300,000 L) at one farm when the sprinklers were used consistently.
- Litter was not consistently wetter with the use of the sprinklers.
- Mortality was unaffected with the sprinklers.
- Live weight was not consistently affected by the sprinklers.
- When the sprinklers were turned on, the birds stood up and appeared to use the drinkers and feeders.
- Regular water application increases the amount of dust sticking to some shed surfaces, including cables, feed lines, drinker lines and fan grills. Fan grills, in particular, may need more regular attention, but it may be possible to reduce dust accumulation by adjusting or relocating the closest sprinklers to reduce spray drifting into the fans.
- Feathers on the birds' backs occasionally appeared dirtier (which in conventional sheds may be associated with wet litter conditions), even though the litter was dry and friable.
- In sheds with ceiling baffles, we suggest there may be a need to consider installing sprinklers mid-way between baffles, assuming they are not too far apart, rather than keeping with 6 m spacing. More than two lines of sprinklers should be considered in wider sheds to improve cooling uniformity.

We weren't able to measure the effect of the sprinklers on all aspects of chicken meat production in this study. There are opportunities to assess the effect of the sprinklers on:

- feed conversion ratio (FCR)
- drinking water intake
- core body temperature (especially in heat stress situations)
- fan run-times and ventilation requirements
- skeletal and muscle development due to regular activity
- bird behaviour and affect
- younger birds (how young can sprinklers be used, and does regular activity promotion during brooding improve gut or physical development?).

Implications

So why might meat chicken farmers consider installing in-shed sprinkler systems? In-shed sprinkler systems may not be suitable or desirable in all meat chicken sheds, but may be a sound investment on farms with limited water supply, or where treating water is expensive. The most obvious benefit that we observed with the sprinkler system was water savings. Any farm with limited water, or where accessing or treating the water is expensive, should consider the potential value of installing in-shed sprinklers.

Another possible reason to install in-shed sprinklers might be for use during extremely hot conditions, to provide additional evaporative cooling and encouraging regular bird activity to release heat that is trapped between the bird and the litter. In further support of this use, overseas research has demonstrated that direct surface wetting combined with air speed (i.e. tunnel ventilation) is able to significantly reduce heat-stress related mortality during extreme conditions.

The sprinkler system may also be beneficial as a backup or emergency cooling system. For this purpose it has the benefits of low cost ($4000–$8000 per shed), it operates at low pressure (345 kPa, 50 PSI), uses an independent control system, is constructed using readily available components, is easy to maintain, and uses sprinklers that don't readily clog.

Any farmer with a motivation to use the sprinklers (for water saving or additional cooling) will be able to successfully incorporate the sprinklers into their farm to complement the existing infrastructure and management practices. We have shown in this study that sprinklers can be used to save water without negatively affecting litter conditions, live weight or mortality.

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Chicken Meat

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by Mark Dunlop

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