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# Evaporative cooling systems for swine


## Abstract

Two trials involving 168 finishing pigs were conducted to compare continuous fogging with intermittent wetting to reduce heat stress in swine. In the second trial, intermittent wetting by sprinklers (1 min. sprinkle, 29 min. dry) significantly improved (P<.05) average daily gain and average daily feed over control, yet no significant differences in feed to gain ratios were observed between controls and fogged pigs in the second trial.; Swine Day, Manhattan, KS, November 8, 1979



## Keywords

Swine day, 1979; Kansas Agricultural Experiment Station contribution; no. 80-136-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 371; Swine; Evaporative cooling systems

# Evaporative Cooling Systems for Swine

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## Summary

Two trials involving 168 finishing pigs were conducted to compare continuous fogging with intermittent wetting to reduce heat stress in swine. In the second trial, intermittant wetting by sprinklers (1 min. sprinkle, 29 min. dry) significantly improved (P<.05) average daily gain and average daily feed over control, yet no significant differences in feed to gain ratios were observed between controls and fogged pigs in the second trial.


## Introduction

During heat stress, swine must rely on evaporation for heat loss because their ability to sweat is limited, and they are inefficient panters. For evaporative cooling they rely on water from other sources (wallows, foggers, sprinklers, etc.). Wetting swine is a practical method of reducing heat stress, but it is imperative that the animals are permitted to dry because evaporation of water is fundamental to evaporative cooling. Ideally, hogs should be successively wetted and then given time to dry. We investigated various systems of wetting hogs to take maximum advantage of evaporative cooling. The following definitions should help one understand our procedures and interpret the results reported here.

Thermoneutral zone (TNZ)--The range in environmental temperatures where performance is maximized--also is described as the range in environmental temperature where animal heat production is minimal. The TNZ changes as animals vary in insulation, activity, and food intake. For swine, fatness (insulation) is perhaps the greatest variable affecting the TNZ.

Upper critical temperature (UCT) is the upper limit of the TNZ and the environmental temperature above which swine must rely on evaporative cooling to maintain body temperature.

Heat stress--Environmental temperature above the upper critical temperature.

Fogger--A low volume, small droplet nozzle. For swine cooling, a fogger is usually operated continuously with an output of approximately 1 to 2 gallons per hour.

Sprinkler--A high volume, large droplet nozzle. For swine cooling, a sprinkler is usually operated intermittently with an output of approximately

75 gallons an hour when operated continuously. With intermittent operation (i.e. 2 min. per hour), output is approximately 2.5 gallons per hour.

## Procedure

In a preliminary trial from June 29 to August 2, 1978, we compared constant fogging with intermittent wetting by sprinklers. The 42-day test involved 48 growing pigs weighing approximately 150 lb. Foggers and sprinklers used 1.7 and 2.5 gallons of water per hour, respectively. (Sprinklers, when operated continuously, had flow rates of 75 gallons per hour.) All systems operated when dry bulb temperature exceeded 80 F. Pigs with no wetting were controls. Mean daily maximum temperature was 91 F; mean daily minimum temperature, 68 F for the test period. Relative humidity averaged 40% at 4 p.m. daily.

In a second trial from June 18 to August 13, 1979, we used 120 pigs weighing approximately 140 lb. for a 56-day test. Continuous fogging was compared with intermittent wetting with sprinklers. Foggers and sprinklers had flow rates of 1.6 and 3.1 gal. per hour, respectively. All systems were thermostatically controlled to operate when dry-bulb temperature exceeded 80 F. Mean daily maximum and minimum temperatures were 87 and 67 F, respectively, compared with a 30-year average of 91 and 67 F. Average relative humidity was 43% for the trial.

Both fogging and sprinkling operated when ambient temperature exceeded 80 F in both trials. When activated, foggers operated continuously while sprinklers operated 1 minute followed by 29 minutes of drying. Figure 1 schematically shows how the foggers and sprinklers were activated and timed. Water lines for the sprinkler system were plastic, 3/4-inch in diameter, and line water pressure was 15 psi measured when operative. Total cost of the control system was approximately $70.

## Results and Discussion

Trial I (table 1) indicated foggers and sprinklers increase average daily gain compared with controls and sprinklers tend to be superior to foggers (P=.08). In trial I no significant differences in average daily feed or feed-to-gain ratios were observed.

We think that using few animals and basing average daily feed and feed-to-gain ratios on pen averages are reasons differences were not significant in the preliminary trial. Still the data indicated an advantage of wetting over controls and suggested increased feed intake by sprinkled hogs, so we used more pigs in the second trial this summer (1979).

Results of trial II (table 2) showed that sprinklers significantly (P<.05) increased average daily gain and average daily feed over controls, but feed-to-gain ratios were not significantly different between controls and fogged pigs.

Data indicate an advantage in average daily gain, daily feed intake, and feed-to-gain ratio for wetting finishing swine during heat stress, with sprinklers producing the best average daily gains and feed-to-gain ratios during summer of 1979. The 1979 test period was cooler than normal (30-year average temperature), so sprinkling should produce an even greater advantage during a hotter summer.

For evaporative cooling to be valuable, animals must be wetted and then dried, which gives an advantage to intermittent sprinklers over continuous foggers in addition to lower maintenance with fewer clogged nozzles. The advantage of wetting swine during heat stress is supported by our results with performance significantly improved by intermittent sprinkling compared with continuous fogging.

Table 1. Results of preliminary test conducted in summer 1978 involving 48 pigs[1]

| | Control | Fogger | Sprinkler |
|---|---|---|---|
| ADG | 1.44[a] | 1.56[b] | 1.74[b] |
| Intake | 5.88 | 5.85 | 7.08 |
| F/G | 4.05 | 3.94 | 4.06 |

[1]Values with different superscripts are significantly different (P<.05)

Table 2. Results of test conducted in summer 1979 involving 120 pigs[1]

| | Control | Fogger | Sprinkler |
|---|---|---|---|
| ADG | 1.15[a] | 1.28[b] | 1.54[c] |
| Intake | 4.31[a] | 4.89[b] | 5.22[b] |
| F/G | 3.75[a] | 3.84[a] | 3.39[b] |

[1]Values with different superscripts are significantly different (P<.05)

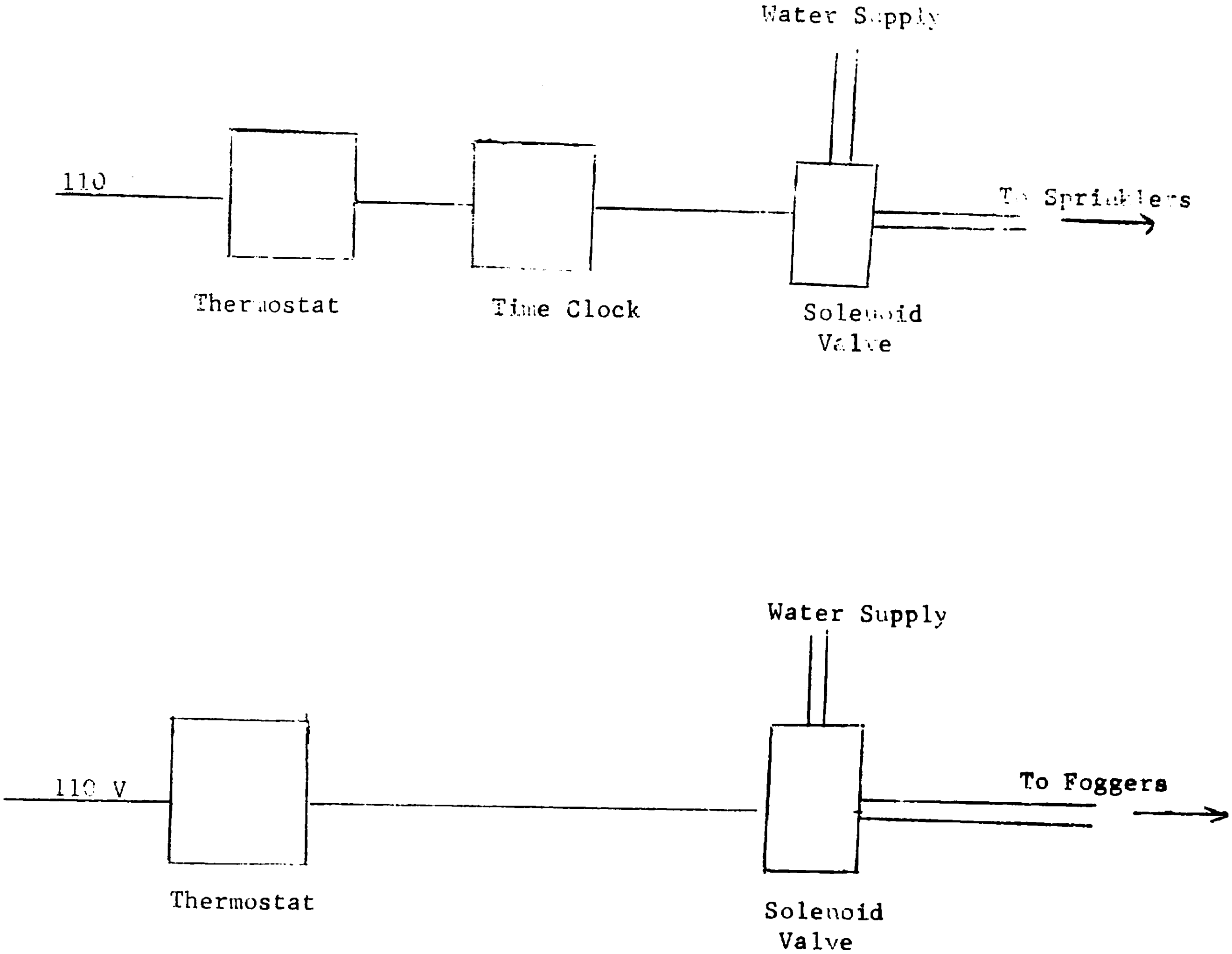


Figure 1. Control systems for sprinklers and foggers