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Patterns of Drinking Water Use in Pork Production Facilities

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Summary and Implications

The amount of drinking water needed daily by the pig depends on numerous influences, including temperature, diet, stage of production and health. Within a 24-hour period under thermal-neutral conditions, grow-finish and gestating swine demonstrate a peak in water usage in late afternoon while lactating females consume water more consistently throughout the day. In times of heat stress, grow-finish pigs alter their water usage pattern with a peak between 8 to 9 a.m. and second peak around 5 to 8 p.m. Daily drinking water needs for pigs range from less than 0.5 gal/pig/day for newly weaned pigs to greater than 1.5 gal/pig/day for grow-finish pigs using nipple drinkers. Water requirements for breeding swine range from 3 to 4 gal/day for gestating females and 6 gal/day for lactating swine. Knowledge of the daily water needs of pigs, and the patterns of water usage within the day allow for the appropriate sizing of delivery devices and prediction of the impact of pork production on available water supplies. Daily charting of drinking water usage can serve as a predictor of the on-set of swine health challenges such as swine influenza. As more sophisticated methods become available to record water usage, other predictors of performance may be developed depending on the patterns detected.

Introduction

With the on-going drought in central and western Nebraska and the controversy surrounding the environmental impact of pork production facilities, a basic understanding of the water usage patterns in pork production facilities is important. In addition, deviations from normal patterns may be a predictor of health and future performance.

How much water does a pig drink?

Daily drinking water needs for pigs range from less than 0.5 gal/pig/day for newly weaned pigs to greater than 1.5 gal/pig/day for grow-finish pigs using nipple drinkers in warm conditions. Grow-finish pigs using bowl/cup drinkers or wet/dry feeders use less water, generally averaging just over 1.0 gal/pig/day. Water requirements for the breeding herd range from 3 to 4 gal/day for the gestating female to 5 to 6 gal/day for the lactating female.

Using the above numbers, it is possible to predict the yearly water usage by various pork production facilities. For example, a 1,000 head grow-finish facility typically has a pen space utilization rate of 85-90%. That is, there are pigs occupying pen spaces 310 to 330 days per year. If the facility has nipple drinkers and a 90% facility utilization rate, total drinking water use for the facility will be:

1,000 spaces x 330 days/year x 1.5 gal/space/day = 495,000 gal

While 495,000 gallons of water seems like a big number, when compared to the water used for irrigated crop production, it is minor. An acre-inch of water (an inch of water covering an acre of ground) is equivalent to 27,154 gallons of water. This means the example finisher will use just over 18 acre-inches of water.

If drinkers that have been proven to waste less water are used such as bowl drinkers or wet/dry feeders, total drinking water use for the facility is estimated to be:

1,000 spaces x 330 days/year x 1.05 gal/space/day = 346,500 gal

This equates to 12.8 acre-inches of water.

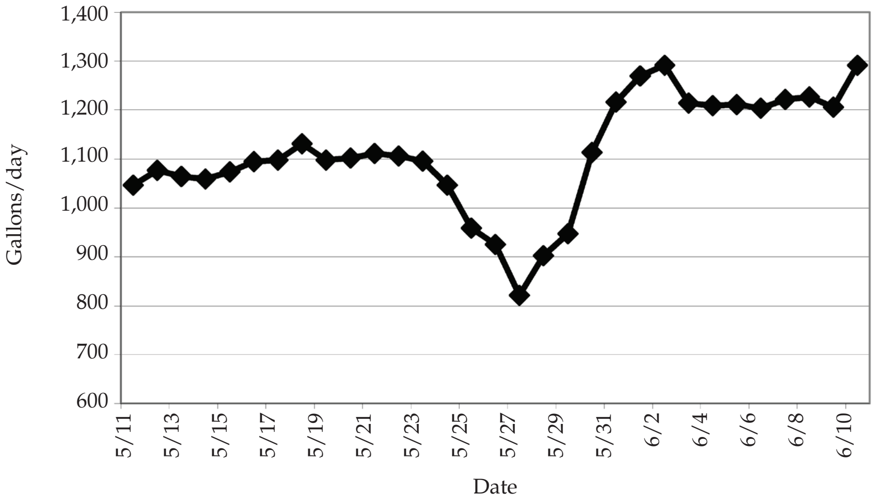

Figure 1. Impact of swine flu on daily water usage in a 860-head fully slatted finishing facility in Nebraska. Data courtesy Dicamusa.com.

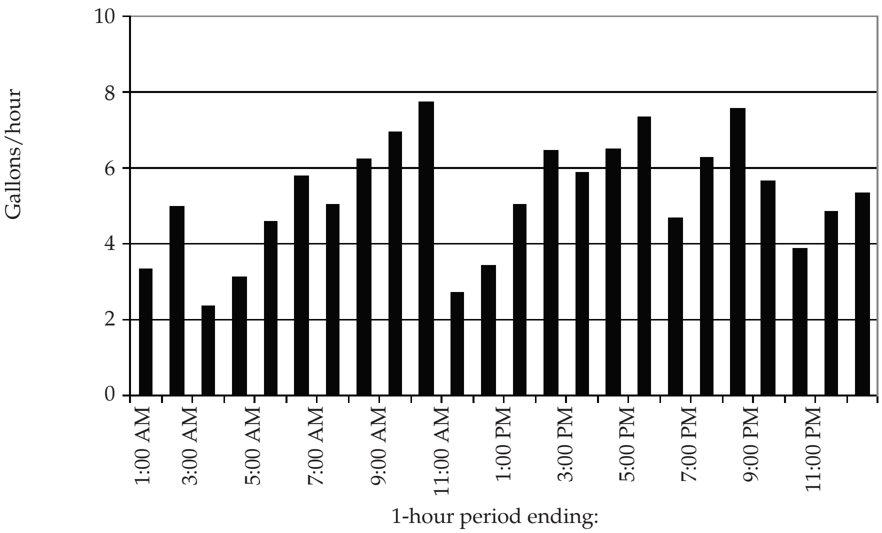

Figure 2. Hourly drinking water use in a 24-crate farrowing room for one 18-day lactation period beginning March 5. Data courtesy Dicamusa.com.

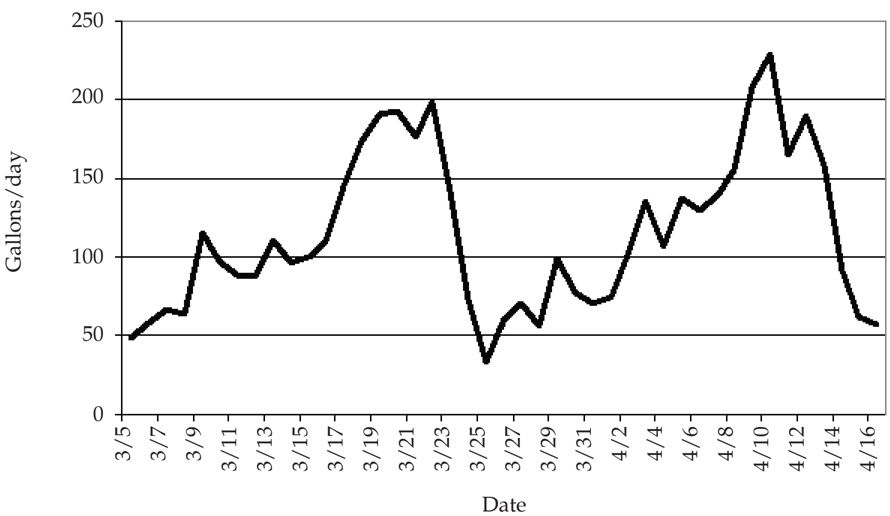

Figure 3. Daily drinking water use in a 24-crate farrowing room over two lactations. Data courtesy Dicamusa.com.

To put this amount of water in perspective for rural communities, consider that corn production typically requires 22 to 25 acre-inches of water per year. Of this, some is supplied by rain with the remainder supplied by irrigation for much of Nebraska's production. In central and western Nebraska, irrigators often supply 12 to 15 acre-inches of water to maximize yield and prevent drought stress. This suggests that a 1,000 head swine finishing facility using drinkers that are known to waste water uses less water than the amount of water used to irrigate 2 acres of corn per year.

Is there a relationship between daily water consumption and pig health?

Producers are becoming aware of the relationship of drinking water usage and pig health. Figure 1 depicts the impact of swine flu on daily water disappearance in a fully slatted 860-head finishing facility in Nebraska six weeks after pig placement. The advantage of recording daily water use versus trying to record daily feed disappearance is that water meters are readily available and if water delivery devices are well-maintained, water will generally always be available to pigs.

Which changes in the pattern of daily water usage are the best predictor of pig health and performance is still unclear. Based on producer and veterinarian observations, when daily water usage drops for three continuous days, or drops more than 30% from day to day, this may indicate that a potential health challenge is occurring in the production facility. These changes in usage pattern should serve as an indication to the caregiver to look more closely at the pigs for signs of illness or discomfort. A spreadsheet to create barn sheets for the purpose of charting daily water patterns is available online at: *http://porkcentral.unl.edu.*

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When do pigs drink?

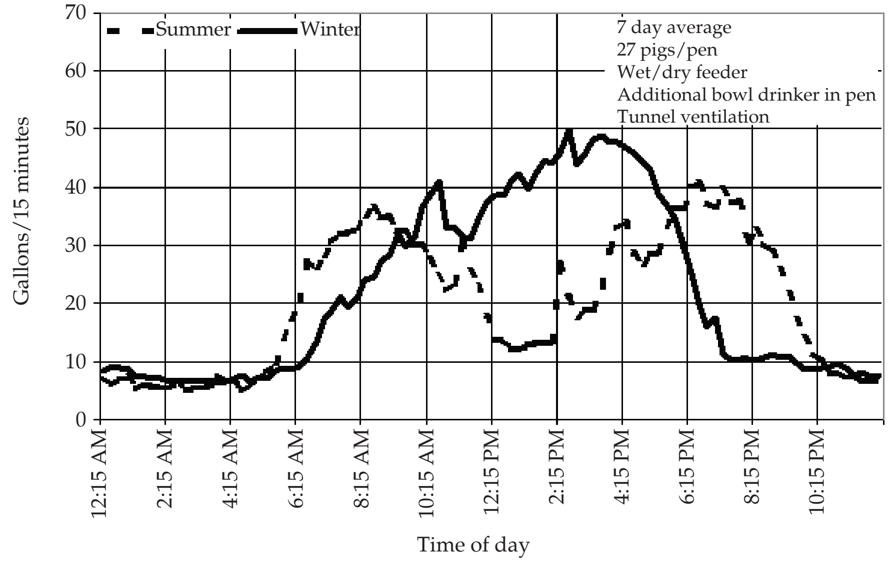

Figure 4. Effect of season on 24-hour water usage pattern in a 1200-head wean-finish facility five months after weaning in central Nebraska. Data courtesy Dicamusa.com.

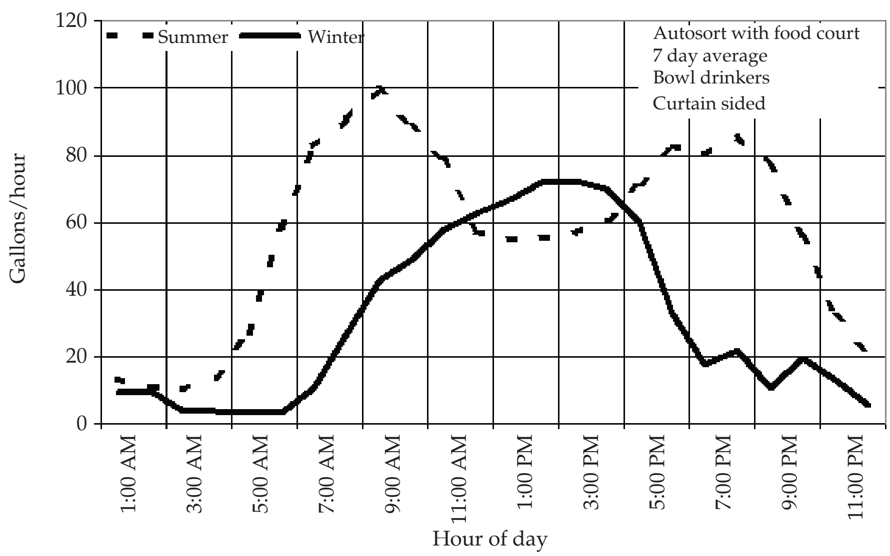

Figure 5. Effect of season on 24-hour water usage pattern in a 600-head fully slatted wean-finish facility in Southeast Minnesota when pigs averaged 195 to 210 lb body weight. Data courtesy Herdstar.com.

Water usage patterns in farrowing facilities do not show a distinct pattern within a 24-hour period. Milk let-down (lactation) occurs every 40 to 60 minutes so it is logical that the sow will consume water multiple times during the 24-hour day if water is continuously available (Figure 2). Sow's milk is primarily water, and milk yield generally increases until a peak at approximately three weeks post-farrowing. Daily water usage during lactation parallels this pattern (Figure 3).

Water consumption by nursery and grow-finish pigs has a distinct pattern within a 24-hour period. While there is very good evidence that a majority of water consumption is associated with eating activities in research settings, there are limited data on patterns of water usage in commercial facilities. Figures 4, 5 and 6 document the pattern of water use in wean-finish facilities at three locations in Nebraska and Minnesota. These facilities vary in the number of pigs per pen, the type of feeder and drinker, the type of ventilation, relative pig health, etc. The patterns were recorded over a seven-day period 4.5 to 5 months after weaning. The similarities between the winter and summer patterns at the three sites suggests two patterns of water usage exist, depending on the temperature in the facility (i.e. time of the year). In thermal-neutral conditions (generally air temperatures in the pig zone <80°F), grow-finish pigs begin drinking water around 5 to 6 a.m., with a peak in drinking water disappearance in early afternoon and a gradual decline the remainder of the day. This pattern is in agreement with published literature.

However, when pigs are growing in warm to hot conditions (air temperatures in the pen exceeding 80°F for one or more hours per day), they appear to alter their pattern of drinking water usage. Pigs begin drinking earlier in the day, with a morning peak from 8 to 9 a.m. There is a decline in drinking water use midday with a second peak in drinking water use from 5 to 8 p.m. followed by the decline into the night hours.

It is interesting to note that pigs shift to this pattern of drinking water use on the first day of air temperatures in the pig zone >80°F or so and maintain the pattern for three to five days, even if these subsequent days have temperatures considered to be thermal-neutral. This adaptation is often maintained for several days in anticipation that the heat stress event will be longer than a single day. This suggests that a shift in eating and drinking behavior is one of the first adaptations of the growing pig to heat stress. In the future, it may be possible to use this shift in drinking water usage as a predic-

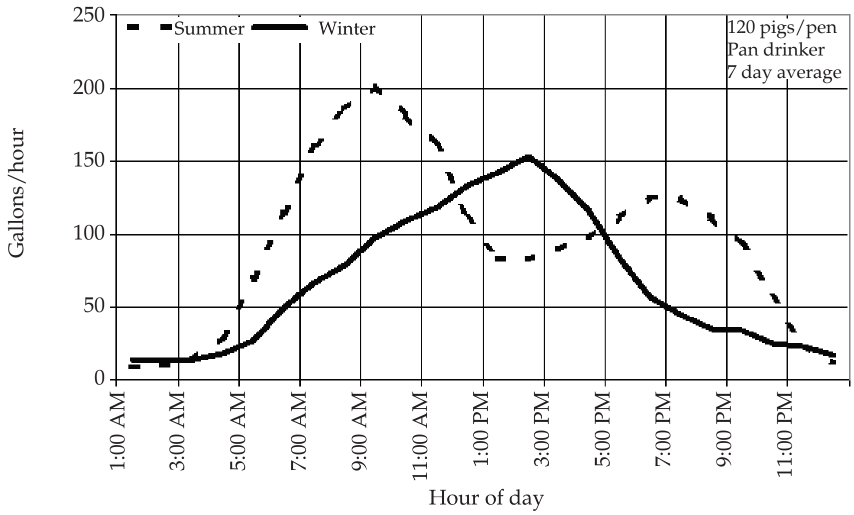

Figure 6. Effect of season on 24-hour water usage pattern in a wean-finish facility in eastern Nebraska 4.5 months after weaning. Data courtesy Dicamusa.com.

tor of a performance reduction due to heat stress in grow-finish pigs.

In addition to detecting of heat stress and potential disease outbreaks, automatic logging drinking water usage every 15 minutes has allowed for the detection of water leakage from drinkers in nursery and grow-finish facilities. That is, if drinking water usage is being logged every 15 minutes, there should be one or more 15-minute periods each day (generally midnight to 2 a.m.) when there is no water usage logged. If water usage is logged for every recording period, it is likely that one or more drinking devices are leaking, resulting in wasted water going into manure storage devices.

Conclusion

Knowledge of the daily water needs of pigs, and the patterns of water usage within the day, allow for the appropriate sizing of delivery devices and prediction of the impact of pork production on available water supplies. Daily charting of drinking water usage can serve as a predictor of the onset of swine health challenges such as swine influenza. As more sophisticated methods become available to record water usage, other predictors of performance may be developed depending on the patterns detected.

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