Evaluation of Individual Systems for Cooling Pregnant Sows in Collective Pens

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Introduction

Showering systems can be effective in reducing heat stress of pregnant sows housed in collective pens during summer. In previous studies, different showering systems for dry sows were tested, such as specific equipment individually controlled by the sows themselves (Barbari, 1998; 2005).

Materials and Methods

During summer 2004 and 2005 different cooling techniques for pregnant sows were compared. The research was carried out in a pig farm located in the Po Plain in Italy. Figure 1 shows the compared solutions.

Figure 1: Compared cooling solutions: a) automatic showering cage with mobile plate; b) automatic showering cage with photocell; c) cooling point with button on the wall.

In cage "a" the shower starts when the sow gets into the cage and places itself on a mobile plate: the pressure on the plate by the feet causes the water supply. In solution "b" the shower is activated by a photocell placed on the side of the cage. These cages were made of metal tubes and had dimensions of 1,90 m length and 0,55 m width; they were able to distribute water through a pierced pipe placed on the upper part. Both cages were equipped with a gate in the front side, in order to force the sows to effect a required course, with entrance to the station on one side and exit from the opposite. In both cooling stations, placed in the external feeding-dunging area, the water distribution time was regulated by an electronic controller: the shower time was fixed in 6 s, while the water consumption was on average 3,6 l / shower.

In summer 2004 (from 10th July to 9th August) cages "a" and "b" were installed in a dynamic group of 193 pregnant sows, with a minimum of 169 and a maximum of 211. The animals are usually introduced in the group after the pregnancy diagnosis, about 28 days from the insemination, and they remain in the pen until one week before farrowing. Moreover the gilts at their first pregnancy are not introduced in the dynamic group.

Solution “c” is given by a big button placed on the wall. The water starts when the sow presses the button with the snout. The arrangement was made by two wooden panels (0,60 m x 1,20 m) placed at a distance of 0,80 m one from the other. Between the two panels, installed in the wall, there were two water nozzles and a push-button, placed approximately 0,80 m high from the floor. During the trials the device was modified a lot of times. The shape of the push-button was changed; underneath it a nipple drinker was added in order to make the sows use the system; finally the water was supplied through a system of shower and not for nebulization.

The equipment was installed in a static pen of 5,42 m of length for 4,20 m of width; 8 groups of 8 sows were introduced for a period of two weeks. Therefore 64 different sows were housed in the experimental pen during the summer 2005 (from 27th June to 24th August). In the last part of summer the system was moved into the dynamic group near the two showering cages.

The analysis of the sows’ behaviour was carried out using close circuit infrared cameras with a time-lapse recorder. An electronic system, able to transfer information from the tested equipment to a PC, was also installed to collect individual data on the use of the cooling solutions. This system was based on the arrangement of an antenna in the showering station (“a” and “b”) or around the big button on the wall (“c”), and on the transfer of the signal by cable from the station to a PC. For the solution “c” the device marked the presence of the sows when these stopped close to the push-button at least 5 s; subsequently the set up of the device was changed into 3 s in order to record all the presences of the animals. A software collected the information and stored the data on a file. Thus it was possible to control the use of the solution for the entire experimental period.

Results

The results of the use of the two automatic showering cages are very positive. Figure 2 shows the results of the percentage of use of solutions “a” and “b” by the dynamic group of sows during the 26 examined days. During the trial the average temperature was 23,64°C, with daily maximum values of 29,10°C. The maximum temperature in the whole period was 33,93°C; therefore the thermal conditions were not very high and worrying as in previous years.

The percentage use of the automatic showering cages, that is the number of sows taking at least a shower during the day on the total number of sows in the group, was 50,39% on average (± 15,89). On the hottest day (i.e. 23rd July) the number of sows taking showers considerably increased up to 76,9%. However on the coldest day (i.e. 12th July) the percentage of sows taking showers decreased to 23,71%. Therefore it was possible to show the positive correlation (r = 0,86) between daily maximum temperature and the percentage of animals making use of the cooling stations.

Further considerations concerning the employment of the stations are the following: the total number of showers in the hottest day was 788; in six consecutive hot days the percentage of sows using the automatic cages reached 86.3%. A single shower had an average length of 59 s, but this value fluctuated in relation to outside temperature, arriving at a daily value of 80 s on average.

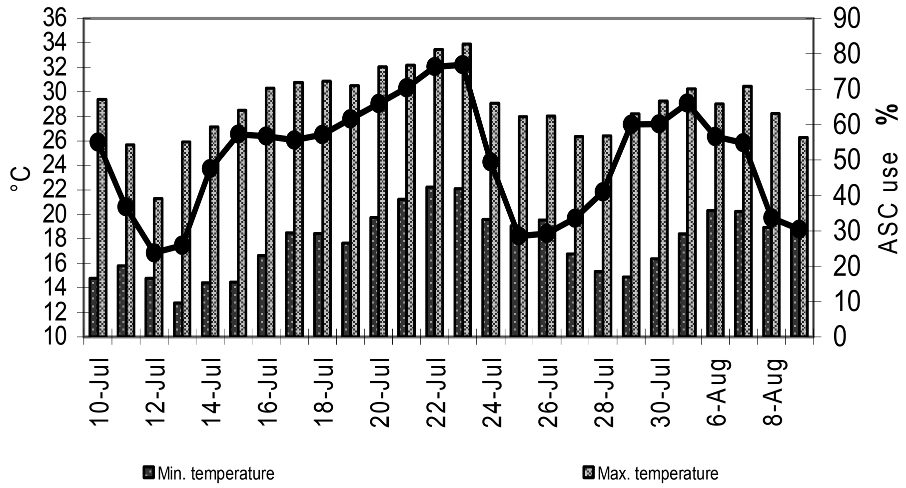


Figure 2: Use of the automatic showering cages during the 26 days (black unbroken line).

Figure 3 shows the distribution of the total number of showers in the warmest day, when 140 sows (76,92% of sows) went under the shower at least once. On this day 22 sows took just a shower, 61 took from 2 to 5, and 57 took 6 or over. With lower daily maximum temperatures the number of sows which went to the automatic showering station at least 6 times was strongly reduced: for example, on the 11th of July only 2 animals (on a total of 62) took more than 6 showers.

Table 2 reports the different use of the cooling stations during the 26 days of test. The solutions "a" and "b" were used by 40% of the sows, but approximately 60% of the sows preferred one station rather than other. The solution "a" with mobile plate was preferred (4,73%) in comparison with solution "b" equipped with photocell.

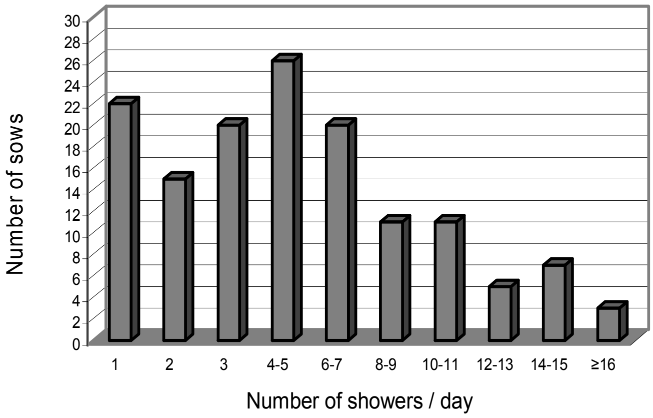


Figure 3: Distribution of total number of showers in the hottest day (23rd July 2004).

Tab. 2. Use of the cooling stations by the sows during the experimental period

Cooling station	*Average number / day*	*%*
Solution “a”	30.27	31.81
Solution “b”	25.77	27.08
Solution “a”+”b”	39.11	41.11
Total	95.15	100.00

The use of the two automatic showering stations changes in relation to the age of sows and number of farrowing. The older sows of the group certainly preferred solution ”a”, that is the station provided with mobile plate in the middle of floor. The sows probably remembered this device from the previous years, when this kind of station was installed in the experimental box. Another possible reason for the preference of the older sows towards solution “a” could be due to an obvious "cause-effect". When the sow pushes on the plate, it immediately feels the noise generated by the movement of the plate that comes associated to consequent water supply. On the contrary, younger sows, at their second or third pregnancy, are more attracted by solution “b”, because it is simple to activate. In this way the photocell sets the device for the water going when the animal enters the station. However often the sow remains inside the station, but the shower does not start because the body of the animal is not enough close to the photocell. Therefore the sow cannot understand the working mechanism of the shower according to solution “b“.

On the contrary, solution “c” provided completely negative results. The big button was never used by the sows during the trials, both in static pen and in dynamic group, in spite of the different changes executed (button size and colour, water flow) and some expedients, such as the nipple drinker placed just below the button (Figure 4). Nevertheless the sows showed a moderate interest in the structure itself: curious animals repeatedly approached the panels, in order to scratch their body, and lay down with the head between the panels. The use of the cooling area increased when the nipple drinker was placed under the push-button. In this way the sows got familiar with the structure, without pressing the button though.

The system of recording the sows showed good results: in particular, the reliability of the electronic identification system of the animals was confirmed by the comparison of collected data on PC with the TV images.

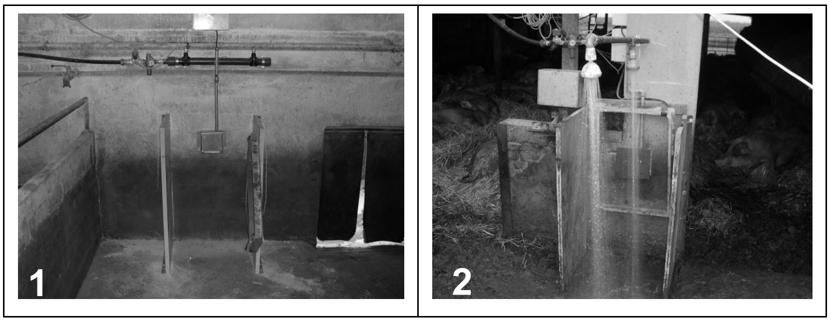


Figure 4: different solutions for button on the wall: 1) button with nebulized water supplied by nozzles; 2) big button with water distribution by shower.

Conclusions

Some interesting conclusions can be drawn from the present research on different cooling systems. Useful information can be used to plan cooling systems for sows in static and dynamic groups.

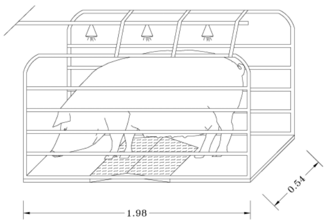
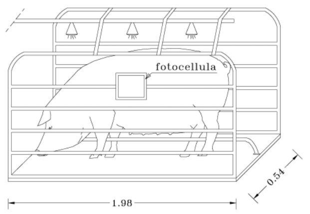
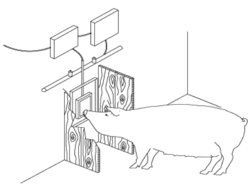
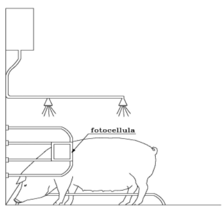
- The sows clearly appreciate the cooling system with shower, based on the free access to the cage and on the possibility of taking showers round the clock, for more times consecutively.
- The sows show a remarkable ability to learn the use of automatic showering cage, however they seem to prefer the system based on water distribution through pressure of the mobile plate on the floor.
- The individual showering cages can be used to cool the sows in large dynamic groups. With an average number of 190 sows (as in the examined case), three stations could be installed (ratio cages-sows 1:60), since two are not enough and often cause a great crowding of animals in limited areas.
- The use of cooling point with push-button starting by pressure of sows with snout did not give good results. The sows did not link the pressure of the button with the water outlet. The animals were not able to make the device for water distribution work, even when it was installed outside in dinamic group of sows.
- The electronic identification system of sows gave remarkable results in both the

experimental trials. In fact the system allowed to make an individual identification of animals inside the cages or near the button. The electronic identification system can be used whenever it is necessary to record particular behaviours, such as the presence of the animal in a certain area or the passage in a point of the pen.

According to these considerations a proposal for a static pen has been provided. This solution could consist of a cooling point where the water supply is activated by a photocell (enabled by the crossing of the animals), rather than by pressure of buttons. In this way a cheap equipment could be realized, suitable for both dynamic and static groups of dry sows.

Table 3 shows the new structural arrangement with the other solutions for cooling systems, analyzed in the present research.

Tab.3. Summary of the cooling systems described in the present experimentation

YES		• **Solution "a"**: shower starting with pressure on the **plate**; • system appreciated by the sows, particularly pluriparous; • suitable system for dinamic groups of sows.
YES		• **Solution "b"**: shower starting with **photocell**; • system appreciated by the sows, particularly young ones (after first farrowing); suitable system for dynamic groups of sows.
NO		• **Cooling point with push-button**, started by the animal; • working system not understood by the sows; • unsuitable system.
PROPOSAL		• **Cooling point with photocell;** • system not tested through experiments; • new experimental proposal, suitable for static and dinamic groups of sows.

References

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