



PATENTED SYSTEM FOR THE REDUCTION OF THE THERMAL STRESS OF THE MILCH COWS AND BUFFALOES WITH SELECTING DEVICE FOR EVERY ANIMAL



1. Among the several animals concerned by zootechnics, the production of the milch cows is more negatively affected by high local temperatures.

Actually, contrary to pigs and poultry which are able to keep the homothermia by regulating mainly the heat production, cows like horses count chiefly on the heat loss by means of the evaporation.

On the one hand, this allows to benefit from a thermoneutrality zone (the temperature range within which the cow feels comfortable and its productive potential is at best), but on the other hand, when the environmental conditions exceed certain temperature thresholds, this exposes the cow to change in the blood acid-base ratio, with development of alkalosis phenomena that can be remedied by a correct renal activity only. Processes used to fight against the hyperthermia can be referable to:

1. Increase of the perspiration.

The sudoriferous glands (on the flanks of the body) eliminate water, mineral salts and organic matter;

2. Heat emission through the skin.

Thanks to the greater skin perspiration caused by the lesser pressure in the blood vessels and a faster heart rate, the peripheral blood circulation can increase up to 50 times its regular value;

3. Elimination of water through the respiratory tract (polypnoea) and the digestive ducts (salivation).

It is mainly the result of the capillary vasodilation of the mucous membranes of the first respiratory tract and the contemporaneous increase of the respiratory rate (up to 200 breathing movements per minute).

The above processes are differently activated, according to the local temperature. It should be noted that, just over 25°C, the heat loss through the skin prevails and, if this is not enough to eliminate all the produced heat, the animal carries out processes to reduce the heat production, e.g. the reduction of the food consumption.

This is widely known and the food intake is actually used as the index to define, within the different situations, the upper critical temperature threshold marking the thermoneutrality zone. Actually, this threshold depends not only on the temperature (minimum, maximum), but also on many other parameters, such as the relative humidity, the air speed and the sun radiation. The animals' comfort depends therefore on these different factors and their values.

The direct consequence of the thermal stress is a lesser food intake, while, in the long run, it is possible to notice various changes in the hormone balances with negative after-effects on the fertility; it is therefore necessary to avoid the thermal stress beforehand by modifying the ration quality as well as the environmental conditions – as far as possible – and by helping the cows' heat loss.



2. The current cooling systems.

At present, the most common solutions for the reduction of the thermal stress are essentially referable to the increase of the air speed and to the water atomization and to animals' wetting. In practice, these solutions are often combined, but they show many sanitary and environmental disadvantages. Let's consider these solutions.

2.1 Increase of the air speed.

It is the most widespread solution (often combined with the water atomization and/or the animals' wetting) and it is usually carried out by means of axial fans with large diameter (1.00÷1.40 m), installed over the feeding area with a longitudinal air flow. As a rule, one fan is installed every 15 – 20 m.

The more evident disadvantage is the huge difference in the air speed between animals near and far from the fans. Practically, the nearest animals can suffer from excessive air speed and negative effects on their health, while the farther animals derive no benefit.

Like in summer, when you use a desk fan pointed to you: you can get satisfactory conditions by carefully adjusting the speed or the distance only. And, anyway, you risk catching something.

Recently, a decided improvement, in particular in rooms for many people, comes from ceiling fans that assure a more uniform vertical flow thanks to the relatively slow rotation.

Another well-known disadvantage when using this system is that cattlesheds are crammed.

2.2 Water atomization.

This system exploits the process called "evaporative cooling" that assures a drop in the local temperature thanks to the heat eliminated by the water evaporation.

The most evident disadvantage of this system is the excessive increase of the relative local humidity that can make the animals' conditions worse as it makes the perspiration hard.

In case of high air speeds, the relatively cold airstreams can cause respiratory problems.

2.3 Animals' wetting.

The wetting of the animals' coat, followed by or at the same time as an increase in the air speed round the animals, is certainly the most effective solution for the control of the high summer temperatures, thanks to the direct cooling of the animals' skin by means of the water evaporation. The basic condition to benefit from this system is that the skin is really wet and that water filters through the coat to the skin. It is therefore necessary that water is sprayed through nozzles with relatively high flow and large drops. (These conditions are opposite to those necessary for the atomization, where high-pressure nozzles are used to spray minute

drops).

In this case too, the increase in the air speed round the animals is crucial.

The most evident disadvantage is related to the high flow required to assure the wetting of the cows' skin in the feeding area, involving serious environmental problems for the disposal of the sewage. Other important issues are related to the airstreams generated by the fans that can be excessive for nearest animals, with negative effects on their health.

3. Our proposal.

Our solution as a whole allows to avoid the aforesaid disadvantages and to optimize the comfort and the behaviour of the cows by directing it to better yields. In particular, the system provides for many nozzles for the water spraying over the rack, as usual, but also for an on/off valve for every nozzle, whose opening and shutting is directly operated by the cow when reaching the fodder-trough. In particular, a lever system assures the opening when the cow puts its neck in the rack and lowers its head to the fodder. The same system assures the shutting when the cow walks out of the rack.

During the fixed wetting cycles, only the nozzles near the rack stalls actually occupied by cows are operated, thus avoiding waste of water.

Another advantage of this system is that cows are led to occupy the rack and to get closer to the fodder-trough in order to take refreshment, thus opposing the animals' tendency to reduce the food intake during the summertime.

(The animal feels the feed as the decisive factor to be "awarded" the cool breeze).

As an alternative to the traditional horizontal-flow fans, the system is provided with large fans (diameter of about 7.00 m) with vertical flow, capable of assuring a more uniform diffusion of the air flow – thus avoiding the difference in the air speed – and slower air speeds on both flanks that avoid the negative "stream" effect.

4. Advantages of our solution.

As already mentioned, the advantages of our solution can be summarized as follows:

- a) Considerable reduction in the water consumption for the wetting, as it is targeted to animals that really occupy the rack only;*
- b) Daily programmed wetting cycles being equal, reduction in the sewage produced with a sure improvement of the environmental impact and the costs for the waste disposal;*
- c) Induction of an unconditioned reflex connecting "the pleasant refreshing feeling" with "the access to the fodder-trough" and, consequently, a potential higher feed intake by animals;*
- d) More uniform distribution of the animals within the cattleshed, thus avoiding crowding phenomena;*
- e) Better health conditions thanks to improved environmental salubrity, to the elimination of excessive airstreams and to the environmental uniformity;*
- f) Better comfort for cows which are reached by a down draught on both flanks, contrary to the current situation with the horizontal-flow fans;*
- g) Wetting with single nozzle for every animal, pointed to the rear so as to keep the mammary apparatus perfectly dry, thus reducing the transmission of pathogenic phenomena.*



The system proposed is a special wetting system allowing to optimize the comfort and the behaviour of the cows by directing it to better yields. In detail, the system provides for many nozzles for the water spraying over the rack, as usual, but also for an on/off valve for every nozzle, whose opening and shutting is directly operated by the cow when reaching the fodder-trough. In particular, a lever system assures the opening when the cow puts its neck in the rack and lowers its head to the fodder. The same system assures the shutting when the cow walks out of the rack.

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Our innovation has the following advantages:

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