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Features of microclimate in buildings of light type for growing lactating sows

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The purpose. To study daily oscillations of some zoo-hygienic parameters (humidity and temperature) in light resources-saving facilities (tents) built using new architectural-design solutions. **Methods.** Instrumental on-line monitoring by means of electronic remote complex EAAM (electronic analyzer of air medium). **Results.** It fixed that at growing lactating sows in light resources-saving buildings (tents) at range of external temperatures from 9 up to 34°C and humidity of 60 – 100% in the early- and middle-autumn periods indexes of microclimate did not exceed zoo-hygienic normative. **Conclusions.** Within the limits of the probed parameters of environment comfortable conditions for growing lactating sows with piglets in the offered planning and design solutions of buildings are ensured. For comfortable growing new-born pigs it is necessary to secure additional heaters.

Key words: *space-planning solutions, microclimate, pigs, buildings of the lightened type.*

Tendencies in the further development of the pig industry in Ukraine indicate at a significant reorientation of the main technology of housing from the large pig complexes to tens of thousands of housed pigs into the direction of small farms with a relatively small concentration of animals on farms. This process is conditioned, on the one hand, by the state support of the medium and small businesses, and on the other hand, the further spread and increase in the incidence of pigs by African plague, the fight against which requires the complete destruction of the entire livestock population in the centre of the disease. At large specialized pig farms losses from this reach tens of millions of hryvnias, while the elimination of the number of livestock of medium and small farms will bring minimal losses.

Therefore, the leadership of the National Academy of Agrarian Sciences of Ukraine outlined the task of priority attention to the issues of scientific support for the development of domestic and small farm pig farms, which in turn require the development and improvement of light-type premises for housing pigs.

An analysis of recent researches and publications on the topic under study. At the present stage, before the zootechnical science and practice, the urgent task is to develop and the large-scale operative introduction of new energy-saving, biologically-adapted, ecologically safe technologies for the production of high-quality pork, which would fundamentally differ from the traditional high-cost, biologically unadapted, ecologically hazardous industrial technologies of yesterday [1].

Along with the traditional pork production technology, new alternative systems for housing pigs are appeared, available for both small farmer and individual farms [2].

Scientists and practitioners of the pig industry have theoretically substantiated and developed highly effective and resource-saving pork production technologies based on improved methods of housing animals, feeding them and providing comfortable operating conditions through appropriate volumetric and planning decisions. At the same time, a number of issues were resolved concerning the creation of technological equipment, lighting, ventilation and manure utilization, and the production of ecologically pure products [3, 4, 5, 6, 7].

Research results of a number of scientists showed the benefits of growing pigs in structures of a simpler type [8, 9, 10, 11]. But some issues remain unclear, especially those concerning the provision of microclimate in premises of this type.

The purpose. To conduct a study of the daily oscillation of some zoo-hygienic parameters (humidity and temperature) in light resource-saving constructions, built by using architectural and planning solutions.

Materials and methods. The study of microclimate in different zones of the hovel-type premises in the early and late autumn period was carried out with the use of the multi-channel electronic remote EAM complex. Stand-alone multifunction sensors, switched with the central registrar using Wi-Fi communication, were located in three locations in the premise, namely: the top at a height of 160 cm from the floor, the average height of 70 cm, the bottom floor level and the fourth (external) sensor - at a height of 160 cm

During the day, sensors recorded data every 10 minutes and transmitted data to the central registrar, where they were recorded on a micro SD card as a CSV array. In the future, the results were processed by Excel to generate general statistics and plotting.

Research results. In the previous stages of the research, the authors developed and proposed the construction of a light resource-saving hovel-type premise for housing the lactating sows with piglets (Fig. 1). The basis of the heat and moisture insulating wall structure is a solid layer of 100 mm diameter reed tubes, which are located between the external hydrobarierom and the internal probobarierom.

Thin and partially (up to 110 cm) side wall power elements were shields of boards with 30 mm of the thick. The hovel has a ground, fenced by lateral and central sections.

On the ground there is a feeder and car washer, fixed on the lateral sections.

As a result of the study of the microclimate of the developed premises, a series of the indexes of atmospheric pressure, humidity and temperature conditions for different seasonal periods was obtained.

Fig. 1. Premises of the hovel type for housing the lactating sows with piglets

The presented data of fluctuations of interconnected indexes of atmospheric pressure and humidity and temperature in September and October indicate the following.

In the comparative analysis of temperature fluctuations both externally and in different zones of the hovel-type premises, it was found out the fact that a significant difference in daily external temperature regimes has a clearly expressed stabilization of internal temperature parameters. Thus, if in September (Fig. 2) the external temperature indexes fluctuate during a day in the wide range from + 33 ° C to + 15 ° C, then the temperature oscillation at the floor level occurs only in the range from + 17.5 ° C to +15 ° C, and at a level of 70 and 160 cm from the floor the oscillations occur almost synchronously in the segment from + 18 ° C to + 24 ° C with short-term peak in the hottest period up to + 25 ° C.

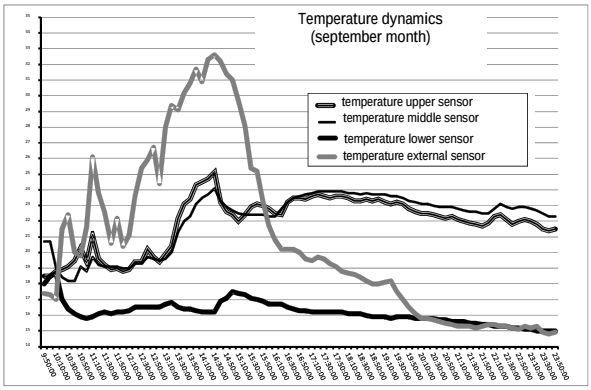

Fig. 2. Air temperature dynamics (September month)

The thermal stabilization of the constructions of the hovel-type building in this case reached the level of the floor from 16.5°C in the direction of cooling the peak hot loads to 0°C, that is, to coincide with the outside temperature at night. In areas of 70 cm and 160 cm from the floor, the level of stabilization was lower: 7.5°C in the direction of cooling peak hot loads in the daytime and 7°C in the direction of compensation for night cold reductions.

With regard to another important zoo-hygienic parameter of the microclimate, the graphs given in Fig. 3, shows the fluctuations of two correlating indexes: atmospheric pressure and humidity.

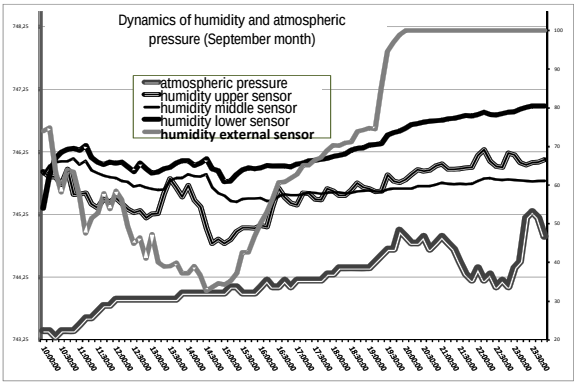

Fig. 3. Dynamics of humidity and atmospheric pressure (September month)

As can be seen from the reduced curves according to data in September, atmospheric pressure during the experiment fluctuated in the insignificant range from 743.25 mmHg. to 745.25 mm Hg Despite a permanent increase, the atmospheric pressure level was significantly lower than the normal atmospheric pressure of 760 mmHg. (101 325 n / m2 or 101325 Pa) at sea level indicating the presence of cyclonic atmospheric phenomena during the experiment, even taking into account the location of Poltava at an altitude of 156 m above the sea level. The dynamics of the indexes of all four moisture sensors has a generally different vector, although after the 14:30 mark time, a synchronous increase in humidity across all sensors began. The largest fluctuations had the sensor values located outside the premises. Since 14:30, its performance gradually began to increase, and in the period from 19:00 the curve of humidity of the external atmosphere showed a rapid growth and at 20:00 reached its peak at 100%, which indicated the beginning of rainy rainfall. As for the humidity indexes inside the premise, the range of their oscillations was much smaller than in the external atmosphere. The difference ranged from 0.5% to 40.9% humidity, and on average it was 21.4% of the difference in humidity between the external and indoor air. It is the degree of the stabilizing influence of constructions of an hovel to prevent sharp fluctuations of humidity which negatively influence on animals' health. A similar picture of the dynamics of air humidity indexes was recorded in the premises of the hovel type in October (Fig. 4, 5). The relationship between the atmospheric pressure curve and the air humidity outside the premises has a classical appearance: a rapid rectilinear pressure drop to a value of 745.8 mm Hg. is accompanied by a simultaneous increase in the humidity of the external atmosphere up to a mark of 100%, which testifies to the beginning of atmospheric rainfall. Similar to the pattern of humidity oscillation in September, and in

this study, it is observed a much lower amplitude of the air humidity fluctuations in the premise, unlike the external one, in the range of 50-75%, with a slight time indicating humidity within 40-50% of the sensor at the level 70 cm from the floor.

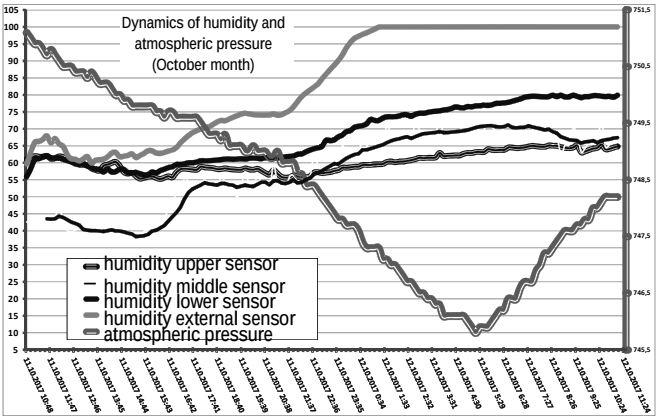

Fig. 4. Dynamics of humidity and atmospheric pressure (October month)

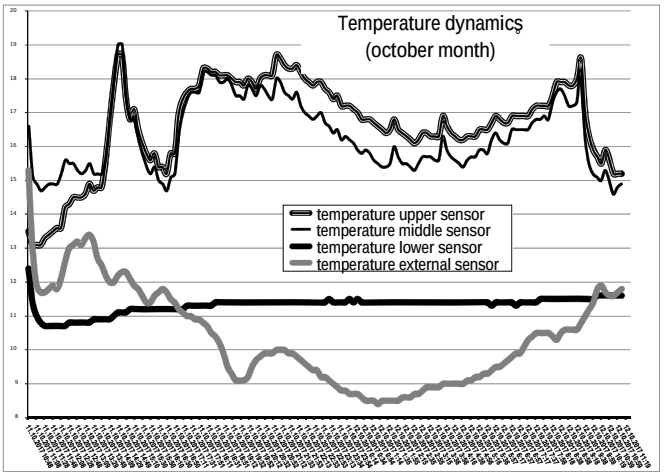

Fig. 5. Air temperature dynamics (October month)

During almost the entire experiment, both in September and October, humidity indexes of the lower sensor prevail over the indexes of two other internal sensors. Most likely, this is due to the close finding of animal bodies, which is the source of evaporation of moisture through sweat glands. In general, the indexes of internal humidity sensors did not exceed the level of 75-80%, which is within the limits of hygiene norms.

Conclusions.

It was determined the fact that at housing lactating sows in light resource-saving hovel-type premises in the range of external parameters of temperature from 9 C to 34 C and humidity from 60 to 100% in the early and middle autumn periods, the microclimate indexes did not go beyond zoo-hygienic requirements.

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