

Justification of Choice of Heating System for Pigsty

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Summary. The article analyzes the types of heating systems for heating the pig farm.

The specific weight of heat supply processes and microclimate provision in the total expenditures of fuel and energy resources in the premises for keeping pigs is given.

The necessary temperature regime for sows, piglets weeks from birth and pigs for fattening was determined.

The factors that have a significant influence on the selection of the system of heating and ventilation of the pig farm are determined.

The shortcomings and advantages of systems using open energy sources when burning gas or other fuels and systems using a water heat carrier are given.

The advantages and disadvantages of infra-red heating, fan convectors, "dark radiators", "aquisolar", "warm" floor, heating of pigsties with a solid concrete floor with plastic or metal pipes laid in it, along which the coolant circulates, are analyzed.

Equipment for water heating in premises with weaned piglets is considered: delta pipes, twin tubes, butterfly pipes - with two, three or four plates.

Key words: pigsty, microclimate, heat supply, heating system, ventilation system, advantages and disadvantages, infrared heating, coolant.

important component is to support the heat-humidity air Pigsty parameters [4, 5].

THE ANALYSIS OF RECENT RESEARCHES AND PUBLICATIONS

The role of microclimate and its impact on the performance of pigs covered in scientific studies [3, 6, 7], which states that extreme conditions adversely affect their body. Some studies indicate that keeping the average temperature in the mother liquor at 15,4°S, lower relative humidity leads to an increase in serum pigs like gamma globulin and indicators bactericidal activity. In keeping pigs at 8...13°S a reduction of live weight to weaning, increased frequency of disease, reduced bactericidal, complementary and lizotsymna activity. Adversely affect the physiological state and the high temperature and humidity. However, minor daily fluctuations in temperature (under optimal values of other climatic parameters) do not affect the health of piglets and their stress reactivity, as noted by M. Black, O. Dudnik and D. Bulba [8]. Creating optimized temperature and humidity conditions of pigs [9] promotes better growth, reduce morbidity, reduce costs and increase feed to improve the economic efficiency of pork production.

INTRODUCTION

Modern pig farms today are more like working intensively industry. Pigsty equipped with sophisticated technological systems preparation and distribution of feed, automatic climate control and ventilation. In small areas there are thousands of animals. As in nature there is a natural balance for improved performance paid a price. Selection of increased production figures bahatoplidnosti, but also significantly reduced the resistance of animals to adverse external factors [1-3].

Perfectly matched parameters of air temperature and constant air exchange rules dotrymuvani optimal climate should compensate for these adverse changes in the biological properties of animals [4-21]. The importance of investment in safe and efficient working automatic ventilation system demonstrates the following: the pig can live without food - two weeks without water - 2 days without air - 2 minutes. To achieve high efficiency pig must provide them with optimal climatic conditions. One

OBJECTIVE

The aim of this work study is the choice of piggery heating.

THE MAIN RESULTS OF THE RESEARCH

For industrial pork production in terms of farms and complexes characterized by high concentration of livestock production facilities, resulting in dramatically increased air content of the metabolic products of animals (harmful gases, water vapor), dust and bacterial contamination of air, resulting affects the physiological state and productivity of animals.

Create an optimal microclimate in the premises for swine only on condition of rational use of heating and ventilation systems based on highly efficient technical means.

Table 1. Proportion processes in total costs of energy resources%

Processes	The consumption of pig farms and complexes	
	electricity	fuel
Heat and providing microclimate	40...65	60...90
Preparation and distribution of fodder	12...28	5...35
Cleaning and preparation of manure for use	8...15	2...3

At the same time, we know that providing the necessary microclimate is one of the most energy intensive processes, along with the preparation and the distribution of feed, manure cleaning and preparation for use (Table. 1).

Special heating systems require farm where pigs are raised, because the breeding of these animals in the first place is to achieve the required weight, which also conducted intensive fattening. Keeping pigs in the wrong temperature conditions lead to unfavorable consequences, because the cold will have to increase the quantity of food, and when the air is too hot in animals reduced appetite and weight loss begins. Therefore, it is important to follow the necessary treatment that is keeping temperatures:

- sow - about 16-20 ° C;
- piglets weeks of age - 28-30 ° C. Further reduction of 2 degrees per week;
- growing pigs feel best at 14-20 ° C.

In order to perform proper heating pig, select this type of heating system that would meet all necessary requirements. The optimum temperature for pigs is such, where they spend a large amount of energy to maintain their body temperature. The process of weaning piglets from sows is very painful for them, they have to quickly adapt to the new environment, near absence of the mother. At the same time respond to such stress changes around them pigs are quite different. Usually piglets begin to behave nervously, disputes among animals in new groups may have different diseases - all of which reflected negatively on their development and subsequent weight gain. Therefore, weaning piglets from sows should be conducted as careful with them except for the extra stress or any anya discomfort. It is important to create a piglet rearing on the first day following conditions to be self-adjusting to life was as simple as possible. It must be remembered that the variety of new situations for themselves they face and create the most favorable conditions of piglets in the group regardless of the size of the group.

In the first couple of weeks after the transfer of rearing pigs on the temperature in their places of rest should stay approximately the department was as farrowing. Particular attention should be paid to the absence of a draft, to which pigs are very sensitive and even distribution of heat throughout the unit.

Especially in cold areas pigs not spend much energy on the development and weight gain, and on their heating. In areas with a hot climate decreases appetite in animals and there are signs of heat stress. Numerous practical observations have confirmed that a significant deviation of ambient temperature from the optimum leads to a marked decrease in performance of pigs (15-30%) and fodder overrun by 25-50%. Modern automatic heating

systems of pig farms can maintain the temperature regime at a given level without human intervention. It is important to determine what advantages and disadvantages of having different systems and methods, and which is best suited for a particular pig farm.

Heating systems for pignens. To create the optimum temperature microclimate necessary to provide a quality heating and ventilation pig. The use of certain methods is largely dependent on natural conditions of the region, flooring, location of rooms and of course the age of the pigs. However, remember that that would not system was chosen heating have to be synchronized with the ventilation system. Both systems should operate smoothly, this is what will ensure maximum efficiency microclimate created without unnecessary expenses.

The heating system should only heat to compensate the losses that may occur due to insufficient tightness walls, door openings and the introduction of fresh cool air from the ventilation system. Typically, an established violation of ventilation and heating occurs in cases where ventilation is at too high a level against the background of normal operation of the heating system; regulation of the temperature increase due to the heating and ventilation equipment operation are set in ranges with a difference of less than 5 °C; and non-compliance with the ratio between the maximum and minimum range regulation of heating and ventilation systems, accepted as 1:20. These violations do not allow this system to perform its basic function in maintaining maximum temperatures in summer and winter with minimal collateral animals fresh air. The choice of heating system, in addition to the configuration of the room, providing a significant impact in the household presence of various energy sources used equipment and manpower availability.

For space heating in pig farms for rearing pigs in the global market offers a number of different heating systems. Although now often organize piggery heating by direct combustion of gas or liquid fuel, general section of heating systems can be characterized by two types.

The first ones include heating, releasing energy source which is located directly in the room, which should be heated. They just include systems operating on gas or other fuels that make selection of heat energy occurs in the processing of pigs. The second type of system include the deployment of energy sources outside the pig. In this case, the energy carrier usually the water which brings heat to the system elements to locations animals.

Comparing the two groups of heating necessary to mention their significant advantages and disadvantages. Thus, the key disadvantage of using open sources of energy by burning gas or other fuels is the allocation of the air in the room by-products of combustion. If you use this gas is carbon dioxide and steam, and the application of oil to gas is added soot. It is clear that to maintain

animal health, these gases must as soon as possible removed from the premises, which means more ventilation intensity with a corresponding decrease in heating efficiency, resulting in that part of the heated air immediately goes to the ventilation and lost.

These aspects clearly indicate the great advantages of the second type using a water medium heat. Thanks to them in a room where pigs are kept, no additional forms of harmful gases and therefore it does not require complex control devices microclimate. But the use of equipment, pumping water requires management high cost of installation and adjustment settings, greater attention to uniform heat distribution in compliance with the relevant conditions of the installation of the heating system and the allocation of a separate room in which to place the heat exchange between the main energy source of heating equipment and water. Also, in systems of the second type unlike the first heat passes through a water pipe system much longer path through its transportation losses can significantly increase.

An important factor in choosing the right heating system for pig serves fuel used. In this regard it should be noted that the need to expand the livestock buildings greatest opportunities to increase coverage area heating allows the use of oil, which can rise to new premises at a distance of 30 m. If the distance is greater still need to build additional heating which, in turn, requires additional space that meets all the requirements *pozhezhostiykosti* with good ventilation for fuel storage. Compared with the use of any carrier gas eliminates the need to install them in separate rooms. This compact gas heaters can easily be installed in the central aisles.

Infrared gas radiator long enough period considered basic equipment for heating in sections rearing. This is due to their reasonable price and ease of installation and reinstall if necessary. In addition, it is very important for young pigs, they do not create drafts that could affect the health of animals. Infrared emitters are indeed very well suited for heating recreation areas piglets. This contributes to targeted feeding radiation in the form of a wave that just hitting the surface of the skin of the animal turns into a tangible warmth. Typically, the installation of infrared emitters held near the feeders, which can significantly increase the number of approaches to food. When using this equipment for general heating, it is advisable to direct the heat wave to another carrier,

In many cases the most energy efficient type of heating is an infrared (Fig. 1). In traditional heating first heats the air, then heat comes to biological objects. Warm air naturally goes to the ceiling, creating convection currents that move the dust in the room, and in the cold season - to the floor. As a result, most of the heat is spent on heating useless to the consumer space. Thermal energy from infrared heaters is not absorbed by air, so all the heat from the radiator with almost no losses reaching biological objects. This warm air is not concentrated almost to the ceiling, making these devices effective in problem solving energy-efficient heating rooms with high ceilings. The use of infrared heating provides a 40% energy saving. Importantly, infrared heating - this is the only method that allows a local heating zone workplace or in the room. With infrared heating is possible to maintain different temperatures in different parts of the room and

partially reduce the energy to work traditional heating systems in some areas of the room. For example, if the jobs are at a considerable remove from one another, the room in general should not have the same temperature [10-12].



Fig. 1. Infrared heating in Pig.

Even in terms of comfort different work situations involve different temperatures. Infrared heaters provide accelerated in comparison with traditional systems, warm room. The transfer of heat from infrared heaters object is no inertia, so there is no need for preheating or permanent office space. Emitter does not dry the air without burning oxygen raises dust and no noise. The infrared heater unlike traditional way of heating, which must first warm air reduces the temperature difference zones in floors and ceilings as heat rays heat the surface, falling, thus it is possible to maintain the temperature in the room below normal. IR does not use air as a heat carrier and therefore provides optimal temperature balance in all areas. Infrared heating acts directly on biological objects, so when temporary loss of heat in the room caused by, for example, open doors, infrared heaters quickly restore the desired temperature [13].

Typically, the IR emitters system very easy to use and its cleaning and inspection is conducted no more frequently than once a month. Still not completely forget about the shortcomings of this technology. Not to mention the air pollution combustion, gas emitters significantly increase the space dust, which increases the cost of maintenance equipment. In addition, an important drawback acts difficulty regulating their work, namely the inability to set parameters for automatic start setting heating after a full shutdown.

Accordingly, if the working Pig climate control system, gas emitters must always be in operation at least a minimal mode. This causes additional financial costs. In the worst case, to align the temperature conditions may need to involve more and ventilation system, further increasing unwanted heat loss.

The advantages of infrared heaters is the possibility of a uniform distribution of heat radiation and power control unit from 10 to 100%. Moreover, the lack of air filter allows water to wash the unit if necessary, outside and inside. Two-emitting surface in the shape of cones usually provide very good heating and are like two *teploobihrivachi* one. Fan coil can operate completely independently of the movement of heat flow. At the core

of their work is also burning gas, but to spread the heat they need additional supercharger air. It is important to monitor the need for heating to avoid overheating.

An important feature of this system is that the heated air is not in the machine and in the central aisle, which is much less dust. As a result, the equipment is much less clogged and deteriorate. Usually blower heaters are not used for rearing as a current of air blown into the room, creating excessive air movement that piglets flukes harmful. A huge advantage of using such a system can be achieved by sending warm air in a separate section through the feed passage at an angle. The result will be reached undulating movement reached its air and more even distribution of the section.

Significant progress to prevent accumulation of warm air from the ceiling and his loss of ventilation is achieved by using so-called "dark emitters." In such systems, the air is also heated by burning gas passes through a thick tube (two inches), which are welded plates that give warmth to the space. As a result, the heat goes directly to the pig and the best heats it. The best effect is achieved even heat distribution width section to 6 m, large areas is necessary to establish additional emitters. At last it is also possible to use gas guns that are usually not recommended for small sections through venting to atmosphere of combustion products and the formation of additional drafts. Among the advantages of air guns include relatively low energy consumption, ease of use and maintenance, easy cleaning and maximum heat efficiency. In addition, the use of teploharmati multyhazovoyi wiring allows the heater to work as methane and propane or butane.

As water heating equipment in the premises of weaned piglets often use delta pipes, twin-pipe trubny-"butterfly" - with two, three or four plates, respectively - 2.5-inch heating pipes, radiators heating elements in the floor .

The basic material from which made Delta pipe, tube and twin-tube butterfly is aluminum with heat dissipation of 150 to 200 watts. The main disadvantage of aluminum as a material for heating in the location of animals, is its high susceptibility to corrosion, especially in the presence of ammonia. For the installation of this equipment usually choose a place in the perforated channel feed passage during or at the height of 60 ... 80 cm in the middle section along the wall. As a result, there may be various problems. When placing were selected place under the perforated channel or feed passage, heated air immediately ventilation channel, rising up, and partially lost. If warm air to exit adequate insulating plate, it becomes possible to avoid unwanted heat loss. Twin tubes, unlike other have less horizontal surfaces simplifies cleaning them no matter where in the room they are installed. Due to a rather slow current of water in the system, water heating makes it relatively easy to adjust the desired temperature, but if the length of the pipe will be more than 12 m, to achieve the desired heat transfer at the end of the system fail because of the large heat loss by way of its passage. After 2.5 inch larger diameter pipe is passed through a unit of time more heated water

An important advantage of this type of pipes is their high resistance to external conditions, compared with aluminum. This allows you to build up heating directly in

the area of animal placement at a height of about 20 cm from the floor. Typically, 2.5-inch pipes cheaper than other types of pipes, but with their installation should significantly greater financial investment. Flat radiators or heaters should be fixed at a height of about 80 cm from the floor.

For optimal heat distribution in stalls must use long radiators. This will prevent the normal lifting of warm air near the ceiling and the formation there of a thermal layer in which the temperature can sometimes be 10 ° C higher than at the location of piglets. In addition, short and tall radiators in any case will contribute to local heating, not heat distribution throughout the volume.

As one of the options for water heating market are also so-called "akvasolyary" performing quality zonal heating of piglets after weaning they relate to energy saving technologies.

The most effective teplosystemoyu, which has been successfully applied to heat just a room with weaners are "warm" floor (Fig. 2). In turn, the system is almost never used by itself, because its heat is not enough to effectively heat the entire volume. However, as an additional source of heat, especially at the initial stage of rearing, floor heating is very important. Underfloor heating is often used together with infrared heaters. This floor heating can be both electric and water. The biggest drawback is its pollution. Most exposed to this system of open top tubes with triangular profile below the slot floors. In the slot floor with triangular steel profile heating efficiency is increased through better heat conductivity and its more equitable distribution. Dung pigs significantly pollute the system heating, and increased evaporation of ammonia and other harmful gases at high temperatures significantly degrade air quality. Enabling faster ventilation raises polluted air in the warm zone placement pigs than it creates only more discomfort. Use closed heating system is also associated with a greater risk of contamination. Therefore, the longitudinal walls are hardly used. Enabling faster ventilation raises polluted air in the warm zone placement pigs than it creates only more discomfort. Use closed heating system is also associated with a greater risk of contamination. Therefore, the longitudinal walls are hardly used. Enabling faster ventilation raises polluted air in the warm zone placement pigs than it creates only more discomfort. Use closed heating system is also associated with a greater risk of contamination. Therefore, the longitudinal walls are hardly used.



Fig. 2. Application of "warm" floor combined with infrared heaters.

Heating with solid pigpens concreted floor is done by laying it in plastic or metal pipes, which will circulate coolant.

Heating pipes are characterized by maximum efficiency of heat, minimal power consumption and no need maintenance. This type of heating is often used for heating rooms and corridors of weaned piglets. The only difficulty it may cause conversion or repair of embedded pipes.

It is important to calculate the heating area that the size of the area for heating is determined depending on the number of pigs in stalls. One should bear in mind that during the first week after weaning piglets each required to have its own warm place. Accordingly, when the content in one group at stall 100 heads, floor heating area must be at least 12...15 m².

CONCLUSIONS

1. Not always the cheapest option will fully justify the expectations of a fairly large investment. Even more difficult situation will look teplosystemamy that require significant financial costs and alterations in the Pig.

2. Inconsistency their requirements management or failure to set functions with incorrect calculation of the need for heating or unnecessarily high cost of operation, virtually not allow something significantly change.

3. Thus, an integrated approach to the needs of the pig objective assessment of its capabilities will help make the right decisions, and gap analyzes of various systems - to prevent the occurrence of side effects in the use of expensive equipment.

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ОБОСНОВАНИЕ ВЫБОРА СИСТЕМЫ ОТОПЛЕНИЯ СВИНАРНИКОВ

Аннотация. В статье проанализированы виды отопительных систем, для осуществления обогрева свинофермы.

Приведен удельный вес процессов теплоснабжения и обеспечения микроклимата в совокупных расходах топливно-энергетических ресурсов в помещениях для содержания свиней.

Определен необходимый температурный режим для свиноматок, поросят недели от рождения и свиней на откорме.

Определены факторы, оказывающие существенное влияние на выбор системы отопления и вентиляции свинофермы.

Приведены недостатки и преимущества систем с использованием открытых источников энергии при сжигании газа или другого топлива и систем с использованием водяного носителя тепла.

Проанализированы преимущества и недостатки инфракрасного отопления, вентиляторных конвекторов, «темных излучателей», «аквасоляриев», «теплого» пола, отопления свинарников со сплошной бетонированным полом с заложеными в него пластиковых или металлических труб, по которым циркулирует теплоноситель.

Рассмотрены оборудование для водяного отопления в помещениях с отлученными поросятами: дельта трубы, твин трубы, трубы- «бабочки» - с двумя, тремя или четырьмя пластинками

Ключевые слова: свинарник, микроклимат, теплоснабжения, система отопления, система вентиляции, преимущества и недостатки, инфракрасное отопление, теплоноситель.