

SANITARY AND HYGIENIC SUBSTANTIATION OF THE USE OF IMMUNOSTIMULANTS FOR DIFFERENT METHODS OF PIGS KEEPING

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INTRODUCTION

Uninterrupted, cost-effective production of a safe and high-quality product is possible only with compliance with a set of requirements for veterinary prevention and prophylactics in matters of feeding and care, which will contribute to maintaining the health, productivity of animals and their reproductive ability.

The implementation of the concept of guaranteeing the safety of livestock products at all stages of production can be attributed to extremely important principles and approaches implemented in the EU countries and in our country.

The fundamental basis of the system of supervision and control over product safety, which is implemented in practice, is HACCP. It covers all chain stages «from farm-to-table» and, in particular, to the production of the so-called primary product at the farm level.

Ultra-intensive (industrial) technologies, in particular in pig farming, do not always take into account the basic biological needs of the animal organism. Everything natural that was taken from animals by industrial technologies, specialists were forced to add artificially. But such hygienic approaches could not reduce the increased sensitivity of the animal organism to diseases^{1, 2, 3}.

¹ Коженко О. В. «Добробут тварин» у програмі навчання студентів та спеціалістів ветеринарної медицини, біотехнологів. Добробут продуктивних тварин у контексті гармонізації законодавства України та Європейського Союзу. (Біла Церква, 27 листопада 2015 р.). Б. Церква, 2015. С. 47-51.

² Лясота В. П., Малина В. В, Гришко В. А. та ін. Добробут свиней (якість і безпека продукції) : навчальний посібник для підготовки фахівців ОР «Бакалавр» ветеринарного та біолого-технологічного факультетів денної та заочної форм навчання. Біла Церква, 2018. 40.с.

³ Чорний М. В., Ткачук О. Д., Жилина В. М., Щепетільников Ю. О. Гігієно-технологічне забезпечення на фермах – основа профілактики хвороб і високої

A decrease in environmental safety, insufficient and imperfect monitoring of territories have a negative influence on the production of livestock products.

Therefore, it is advisable to review the used technologies^{4,5}. Scientists and practitioners are searching for alternative technologies and methods for eliminating critical situations in the technological process. Considerable attention is given to the selection of more stress-resistant animals, strengthening of hygienic and veterinary-sanitary requirements for keeping and growing pigs, and meat production. The requirements for elimination or minimization of the imbalance between the conditions of keeping and the adaptive capabilities of the animal organism, therefore, taking into account their biological needs, are being updated. Neglect of this factor leads to a decrease in the functional capabilities of the organism and the development of pathology⁶.

It should be noted that the search for effective systems of preventive and prophylactic guidance, sanitary and hygienic control over the state of health of animals, and hence ensuring sustainable health and the appropriate level of productive and reproductive properties of sows, as well as the healthy and viable young got from them, is actual in modern pig farming.

1. Characteristics of modern technologies and pig welfare

The maximum manifestation of genetically determined productivity, satisfactory state of health and high quality of the got livestock products are found under relevant conditions of retention and feeding, when all physiological and ethological needs of animals are taken into account and implemented. Therefore, the decisive factor in the production of high-quality safe products, in addition to the selection of the breed, is the choice of animal breeding technology, high-quality feed and balanced rations,

продуктивності тварин. Науковий вісник ЛНУВМБ імені С.З. Гжицького, 2016. Т. 18, № 4(72). С. 86 – 91.

⁴ Баско С. О. Резистентність і продуктивність свиней за дії абіотичних факторів. Автореф. дис. на здобуття наук. ступеня канд. ветеринарних наук : 16.00.06. Львів, 2016. 22 с.

⁵ Блайда І. М. Використання пробіотичної кормової добавки «Пропіг» у годівлі свиноматок, ремонтного та відгодівельного молодняку свиней. Автореферат дисертації на здобуття наукового ступеня кандидата сільськогосподарських наук : 23.00.02. Львів, 2018. 24 с.

⁶ Демчук М. В., Чорний М. В. Гігієна тварин та концептуальні принципи профілактики хвороб. Збірник наукових праць ВНАУ, 2011. № 8(48). С. 109–114.

and mandatory compliance with sanitary and hygienic requirements for retention.

Today, pig farming is one of the most profitable and promising branches of animal husbandry, the priority of which is the year-round conveyor-flow production of pork and the use of the principle "everything is busy – everything is empty", which ensures a continuous output of products.

For this purpose, industrial (ultra-intensive), intensive, extensive and intensively-integrated technologies of keeping are used in compliance with ecological, traditional animal welfare requirements. Among the retention systems, the loom (walking, with the use of camps, pastures, or no-walking) and without loom (in large sections or in individual houses) are used. As for the method of keeping, they use: individual, group machines, fixing machines (for keeping sows, boars), tethered keeping of sows in sections, large fattening sections or platforms. As for the methods of keeping, the following are used: litter-free, on a continuous, partially slotted or fully slotted floor, with heating and with the use of bedding (straw, sand, sawdust), peat floors.

However, using the above-mentioned technologies, systems, methods and methods of pig breeding actually do not take into account the ethological, physiological and psychological needs (features) of animals⁷. In such conditions, the physiological and nervous load on their organism increases significantly, it gradually exhausts its resources, there is a threat of a decrease in the level of natural resistance and productivity, and accordingly, the life span of highly productive animals is shortened.

Technological solutions of individual variants of industrial pig breeding provide for three ways of keeping piglets: one-phase, two-phase and three-phase. One-phase involves keeping piglets in one room from birth until reaching technological meat conditions. The advantages of this method are the complete absence of movements, regroupings, fewer fights and morbidity among the young. The two-phase method is characterized by the fact that piglets, after the end of the suckling period, are left in the piggery until they reach the age of 3-3,5 months, and then they are transferred to the fattening room, where they stay until they reach a live weight of 100-120 kg⁸. For three-phase keeping, piglets are kept in a sow

⁷ Волощук В., Ремізова Ю. Етологічні особливості свиней при різних технологічних режимах утримання. Тваринництво України, 2015. № 5. С. 18–20.

⁸ Лихач В. Технологічні особливості вирощування поросят. Тваринництво України, 2015. № 6. С. 11–13.

house until weaning. Then they are transferred to the rearing shop where they stay for 90-120 days or until they reach a live weight of 35-40 kg. Next, the animals are moved to feedlots, where they stay until they reach the required marketable weight of 100-120 kg. With this system of rearing and fattening, young animals are repeatedly exposed to the harmful action of stress factors associated with movement and regrouping. A change in the premises, microclimate, regime and type of feeding leads to a decrease in the productivity of animals, the energy of growth of young animals slows down, the probability of the spread of infectious diseases and the consumption of feed per unit of growth increase. As practice shows the advanced farms, the use of one- and two-phase keeping makes it possible to significantly increase the productivity of young animals, to reduce feed costs and the departure of young animals in all age periods, and save up to 20-26 % of feed, to reduce the cost of income, compared to a three-phase system of keeping.

The term "optimal housing conditions" should be understood as conditions that contribute to strengthening the health and increasing the productivity of animals⁹. This is possible only if the sanitary and hygienic norms and requirements for raising pigs are followed, starting with the construction (reconstruction) of the premises, ending with providing them with optimal microclimate parameter.

In modern conditions of industrial animal husbandry, the organism of pigs is constantly exposed to natural-climatic, technological, operational, fodder, veterinary-prophylactic and other stresses, which negatively affect the functional state of animals. Therefore, when choosing a technology, method, system and method of keeping animals, it is necessary to take into account the issue of animal welfare¹⁰. Guided by the EU Directive "On minimum standards for the protection of pigs", such options for raising pigs should be chosen, which would be as close as possible to natural ones and ensure the animals' realization of five freedoms: freedom from hunger and thirst – constant (free) access to water and feed, that ensure the health and activity of animals; freedom from discomfort – ensuring of appropriate environmental conditions that meet the needs of the organism; freedom from pain, injuries, diseases – ensuring their prevention or treatment; freedom from fear, stress and

⁹ Бондарська О. Світовий ринок свинини: тенденції та перспективи. Прибуткове свинарство, 2015. № 3(27). С. 32 – 33.

¹⁰ Волошук В., Фидря М. Етологічні особливості поросят у критичний період відлучення. Тваринництво України, 2015. № 8. С. 16 – 18.

suffering – ensuring of conditions that prevent the psychological stability of animals; freedom to realize natural behavior – ensuring of sufficient space, appropriate conditions and means for realization of physiological needs.

The decision of the European Union 2008/120/EG dated December 18, 2008 defines the minimum criteria for the protection of pigs at all stages of keeping for different age categories of animals (piglets before weaning, sows and boars, young animals in fattening). This document provides for group housing of animals, with the exception of boars, as well as sows at the time of farrowing and lactation. It is forbidden to wean piglets earlier than at 28 days of age. Such conditions for keeping sows foresee a ban on restricting their movement (machines, harnesses) and recommend creating rooms for farrowing in order to ensure the realization of the ethological and welfare needs of these animals^{11,12}.

Providing comfortable conditions for keeping animals is one of the main components of profitable pig breeding technologies. The better the conditions for keeping and operating animals, the less energy animals will spend on overcoming adverse environmental factors (low or high air temperature, lack of ventilation), the more energy will be used for growth and development and growth of live weight gains, correspondingly, feed costs will decrease¹³.

The best technological option for growing pigs should be the one that will make it possible to create conditions as close as possible to natural ones, reduce the number of technological operations and the negative action of stress. Such requirements are best met by intensively integrated technology with ecological, traditional approaches and welfare requirements¹⁴.

¹¹ Богачик О. Г., Козенко О. В., Двилюк І. В., Магрело Н. В., Сус Г. В., Вороняк В. В. Основні аспекти законодавства Європейського Союзу щодо добробуту продуктивних тварин. Науковий вісник ЛНУВМБ імені С.З. Гжицького, 2015. Т. 17. № 1(61). Ч. 2. С. 205 – 212.

¹² Волощук В., Фидря М. Етологічні особливості поросят у критичний період відлучення. Тваринництво України, 2015. № 8. С. 16 – 18.

¹³ Волощук В., Коваль Ю. Відгодівельна здатність свиней залежно від технології утримання. Тваринництво України, 2014. № 10. С. 6 – 9.

¹⁴ Решетник А. О., Смоляк В. В., Лайтер-Москалюк С. В. Стан добробуту свиней у промисловому свинарстві. Науковий вісник ЛНУВМБ імені С.З. Гжицького, 2016, Т. 18, № 4(72). С. 66 – 71.

2. Economic and biological characteristics of pigs

Pigs favorably differ from other agricultural animals in a number of biological and economic features, the most characteristic of which are the early period of sexual and reproductive maturation, a short gestation period, multiple fertility, a high level of milk production, fast growth rates, precocity, relatively low feed costs per unit of income, high adaptive properties, slaughter yield, excellent nutritional and taste qualities of meat.

Pigs are omnivorous animals and, having a high level of digestion and utilization of energy and nutrients of feed, are an effective conveyor of feed to meat. The organism of pigs assimilates a third of the entire mass of feed, while, for example, a chicken assimilates only one fifth. Therefore, to get a unit of growth, a pig needs less feed than any other farm animal. When fattening from 40 kg to 90-105 kg, using only 1,5 kg of feed, you can get 1 kg of income from a meat pig. In 180-190 days, with an average daily income of 700-800 g, animals can reach a live weight of more than 100 kg.

Pork is characterized by a high slaughter yield and the content of edible parts in the carcass, it is a complete food product. In the system of food products for the population, meat and lard have a special place. The nutritional value of pork is determined by its content of complete proteins and essential amino acids that are easily absorbed, fats, carbohydrates, macro- and microelements, and high energy value. In medium-fed animals, the nutritional value of 1 kg of pork is 12,770 kJ, while beef has 6,280 kJ. The digestibility of pork meat is 95 %, lard is 98 %. Depending on fattening, the slaughter yield of pigs is 85 %. Pork lard is rich in essential polyunsaturated fatty acids, vitamins of groups A and E and belongs to dietary products. Pork can be preserved well, it is most suitable for the production of sausages and smoked meats. In addition, bristles and skin are got from pigs – raw materials for light industry.

Sows reach sexual maturity at the age of 9-10 months, and at 13-14 months they get their first litter. Under favorable conditions of keeping, exploitation and full feeding, up to 14 piglets weighing 1300 g can be got from one farrowing sow. The gestation period is 112–116 days. With a balanced organization of production and early weaning of piglets at the age of 26-35 days, each sow receives 2,2-2,3 farrowings per year¹⁵.

¹⁵ Лихач В. Відтворні якості свиноматок залежно від конструктивних особливостей станкового обладнання. Тваринництво України, 2015. № 8. С. 32–35.

Pigs are herd animals, a fattening piglet without peers will grow poorly, because, firstly, loneliness is depressing in itself, and secondly, the presence of competitors encourages more active feed consumption. In group housing, when piglets are selected according to age, live weight, sex, physiological state, taking into account the purpose of rearing, they will grow faster, and feed costs will be lower.

3. The influence of sanitary and hygienic conditions of keeping on the organism of pigs

In the complex of zoohygienic factors of production conditions of a pig farm, a complex of environmental factors constantly acts on the organism of animals, the most powerful of which is the influence of the microclimate. It is determined by the combination of physical and chemical properties of the air environment and is characterized by such indicators as: temperature, humidity, speed of air movement, its gas composition, amount of dust and microorganisms.

As noted by M.V. Chorny and other researchers, non-observance of optimal microclimate parameters can contribute to the spread of diseases, reduction of natural resistance and productivity of animals. In turn, compliance with optimal parameters contributes to the normal course of all physiological processes of the animal's organism, supports its homeostasis, promotes the strengthening of adaptive capabilities, prevents the occurrence of climatic stress, extends the life of animals and ensures maximum productivity from them. This is directly related to the preservation of animal health, their productivity and profitability of the industry.

The leading place in the formation of strong immune protection and the growth of the productive capacity of the animal organism belongs to hygiene. After all, providing optimal parameters of the microclimate, observing the appropriate sanitary and hygienic level contribute to increasing the productivity of sows by 18-20 % and reducing the morbidity and mortality of piglets by 25-30 %.

The organism of productive animals, especially young animals, is extremely sensitive to fluctuations in microclimate parameters and reacts to this with changes in both the humoral and immune systems and the level of productivity.

Among all microclimatic factors that have an influence on the efficiency of keeping and fattening pigs, one of the leading places belongs to the temperature and humidity regime, the maintenance of which contributes to better growth, reduction of animal morbidity, reduction of

feed costs per unit of income and improvement of the economic efficiency of production of animal husbandry products.

The stability of their body temperature is ensured (carried out), mainly, by the thermoregulation system, for which the animal's organism its own energy is spent. At optimal air temperature, these costs are minimal. Changes in temperature indicators in the downward direction lead to a doubling or even tripling of energy costs. An increase in air temperature above the norm, in addition to a decrease in appetite, leads to a deterioration of the reproductive capabilities of sows, the survival of piglets in the nest. Because thermoregulation in newborn piglets is very poorly developed and begins to work only at the end of the first week of life, the provision of local heating is a very important condition for their preservation and growth. The comfort zone for pigs is considered to be a temperature of 14-22 °C¹⁶.

Although air humidity is determined by a wide range of indicators, in particular absolute, maximum and relative humidity, relative humidity is the most widely used to characterize the humidity of livestock premises – the level of air saturation with water vapor, which depends on its temperature: these two factors are inseparable and have an influence on the exchange substances and thermoregulation of the animal body. Pigs are extremely sensitive to changes in air humidity, which for young animals should be 60-70 %, and for adult pigs – no higher than 85 %. When the relative humidity drops below 50 %, dry air causes drying of the mucous membranes of the eyes and respiratory tract, reduces appetite and feed digestibility. Humid air, in addition to a negative influence on equipment, contributes to a high level of heat consumption, a decrease in productivity and an increase in animal morbidity. In order to effectively struggle with excessive humidity in livestock premises, in addition to providing a ventilation system, it is necessary to ensure that the premises are cleaned in a timely manner from manure and slurry.

In addition to air temperature and humidity, the speed of air movement is an important factor in ensuring the microclimate, which largely influences on the heat transfer of the animal's body. The speed of air movement depends on the ventilation system, in particular, the direction of air flows, the volume and temperature of the supply air. The optimal indicator for pigs of different age categories is the speed of air movement from 0,1 m/s to 0,6 m/s. When the speed of air movement increases,

¹⁶ Расмуссен К. Система опалення в свинарниках – вирішальний фактор оптимального мікроклімату. Прибуткове свинарство, 2015. № 4(28). С. 110 – 111.

conditions arise for hypothermia of the organism, and when it slows down, air stagnation zones (aerostasis) occur, which leads to the accumulation of harmful gases at the place of their formation and poisoning of animals.

As a result of the vital activity of pigs, a large number of harmful gases are formed, including carbon dioxide, hydrogen sulfide, and ammonia. The main part of CO₂, which is in the livestock premises, is released by animals during breathing, the rest is formed during the decomposition of feces, urine and feed residues. The source of hydrogen sulfide in livestock premises is the decay of sulfur-containing organic substances. However, the most harmful for animals is ammonia, which is usually formed as a result of decomposition and decay of organic substances, urine, with insufficient work of the sewage and ventilation system. The maximum permissible concentration of this gas for adult animals is up to 20-25 mg/m³, for young animals – up to 15 mg/m³. A significant accumulation of ammonia has a negative influence on animals: they become aggressive, metabolism is disturbed.

Solar radiation is a biologically active and constantly acting factor that is of great importance in the formation of a whole range of functions of the animal organism. The biological action of radiant energy is related to the length of its waves: the shorter the waves, the more frequent their oscillations, the more energy, and the stronger the organism's reaction to their action. Thus, the action of infrared radiation mainly shows a thermal effect, during which the temperature of tissues increases, metabolic processes and phagocytosis increase. Light or visible rays have a weak thermal action and influence the visual analyzer and skin, control conditional and unconditional reflex reactions, seasonal periodicity of the sexual function of animals. Both light and ultraviolet rays significantly influence the growth and development of eggs cells, desire, duration of the mating period and pregnancy. Ultraviolet rays accelerate metabolic processes, strengthen homeostasis, immunogenesis, and the organism's natural resistance.

The hygienic value of dust lies in its direct and indirect action. Direct action is caused by exposure to the skin, eyes and respiratory tract. Contamination of the skin with dust, together with sweat, secretions of sebaceous glands, remnants of exfoliated epithelium, creates a nutrient medium for the reproduction of microorganisms and skin parasites. As a result, this leads to irritation and the development of inflammatory processes on the skin, thermoregulation and its excretory functions are disturbed. Long-term exposure to dust on the organs of vision can cause conjunctivitis, but the main harmful action of dust is the influence on the

respiratory tract, which depends on the depth of penetration of dust particles.

Together with dust particles, the air of livestock premises can contain a large number of both pathogenic and opportunistic various microorganisms. They are attached to dust particles or included in small droplets of water vapor suspended in the air, retained, carried by air currents and deposited. The source of dust infection is sick animals that infect the environment with their own secretions. Droplet infection is the result of sick animals spraying infected saliva, nasal mucus, and exudate in the air. The presence of microorganisms in the air largely depends on compliance with hygienic requirements and the implementation of sanitary rules: proper operation of sewage and ventilation systems, operation of premises, compliance with the technology regime, in particular, disinfection measures. The causative agents of many diseases are usually spread by air currents, therefore, in addition to carefully observing the internal regime of the livestock enterprise, effective measures to reduce their concentration will be the creation of protective strips of green vegetation on the territory of the farm.

4. Hygienic aspects of feeding and watering of pigs

In order to realize the genetic potential of highly productive animals, it is necessary to organize balanced complete feeding using rations that, in terms of nutrition and biological value, would meet the physiological needs of animals in energy, protein, amino acids, minerals and vitamins. Complete feeding of agricultural animals with good-quality feed is the basis for the manifestation of high genetically determined productivity and effective transformation of feed nutrients into products¹⁷.

The mandatory basis for the effective use of feed means is a sufficient level and completeness of the rations of pigs under optimal zoohygienic conditions of keeping.

Pigs are omnivorous animals, which ensures their ability to adapt to different types of feeding: from concentrated to voluminous, from plant to animal. The efficiency of assimilation of nutrients and energy largely depends on the age, live weight, physiological state and type of feeding of pigs.

Pigs are particularly demanding regarding the content and quality of protein in the ration: one feed unit should contain 100-110 g of digestible

¹⁷ Фазова годівля свиней упродовж дорощування та відгодівлі. Прибуткове свинарство, 2015. № 5(29). С. 52 – 54.

protein, and for weaned piglets 110-120 g. Pigs' need for protein largely depends on its composition, especially on the content of essential amino acids. Protein nutrition provides the animal's organism with such amino acids as lysine, methionine, tryptophan, and threonine. Pigs' need for lysine ranges from 4,2 to 5,0 %, methionine from – 2,8 to 3,2 %, tryptophan – from 0,7 to 1,2 % (relative to the total protein content in the ration). Protein is a kind of building material that replaces used cells and synthesizes new cells and biologically active substances.

The animal's organism's need for energy is met mainly through the oxidation of fats and the breakdown of carbohydrates. In general, in the world, the most popular source of energy in pig feed is corn grain, wheat, barley and oats are among the other most commonly used grains.

Carbohydrates, as the main part of feed nutrients, include sugars, starch, glycogen, cellulose, and organic acids. In the organism of animals, feed carbohydrates are broken down into glucose and used to form animal starch (glycogen), fat needed to maintain normal organism temperature. Feeding of feed rich in carbohydrates contributes to obesity in pigs. Carbohydrate consumption by pigs is to some extent manifested by the need for fiber, which is chemically close to carbohydrates, but is difficult for pigs to digest and makes up 5-6 % of the total feed for young animals and 8-10% for adult animals. With a high content of fiber in the ration of pigs, the digestibility of all feeds is getting worse and the efficiency of using their nutrients is decreasing¹⁸.

Mineral substances are part of bones, cells, tissues, fluids and participate in metabolic processes. Mineral substances must be present in the organism of pigs in appropriate quantities and ratios. The lack of minerals in the diet leads to slow growth of animals, indigestion, and rickets. It is desirable to control rations for pigs by their content of phosphorus, calcium, iron, copper, cobalt, zinc, manganese and iodine.

In addition to the main nutrients of the ration, the functional state of the organism is influenced by those that are commonly called life factors, or vitamins. The animal's need for vitamins is determined by the level of productivity, physiological state, and detention conditions.

With the transition of the pig breeding industry to an intensive industrial basis, the pig feeding system has changed radically. In the conditions of modern pig farms, they are fed with dry concentrated fodder, in particular, cereals, legumes, cake, bran and grain production waste.

¹⁸ Титаренко О. Годуйте своїх свиноматок відповідно до їхніх виробничих потреб. Тваринництво та ветеринарія, 2019. № 6. С. 44 – 46.

Barley, corn and oats are most often used in pig feeding. These feeds have high nutritional value, have good taste, high digestibility and assimilation. They contain 40-70 % starch, 10-12 % protein, but they are poor in minerals, especially calcium. Complete ration compound feed, enriched with vitamin and mineral additives, provides a high level of nutrition and intensive growth of animals with low feed costs per unit of live weight gain. When using dry concentrated feeds, the availability of high-quality water and free access to it is a prerequisite.

Feeding of pigs is carried out according to established norms according to live weight, age, sex, production purpose, physiological state.

The efficiency of feed use, fattening and the health status of animals largely depend on the frequency, place and time of feeding and drinking, the density of animals in the machine, the size of feed groups and the feeding front. Feeders must be convenient, accessible, be maintained in proper sanitary condition.

Together with the increasing pace of production intensification, the problem of raising healthy animals and getting high-quality, safe products from them is also increasing. Very often, in order to stimulate growth, animals are fed with antibiotics for therapeutic or prophylactic purposes¹⁹. According to the results of research by a group of scientists, including the former head on sanitary supervision of the quality of food products and medicines of the US Food and Drug Administration (FDA), the abuse of antibiotics in animal husbandry is becoming a catalyst for a health crisis. In particular, this has already led to the emergence of antibiotic-resistant microorganisms that cause significant damage both in the field of veterinary and humane medicine²⁰.

Considerable attention should also be paid to watering animals, because water takes part in all biochemical reactions that occur in the organism. Only by full supply of animals with water can create optimal conditions for the implementation of physiological processes in the organism, to maintain the genetic productivity and health of animals. The hygienic value of water is determined by its quality. Water for animals must be impeccable in terms of sanitation. Its quality is determined by organoleptic properties, chemical composition, and the presence or absence of pathogens of infectious and invasive diseases in it. According

¹⁹ Штейнер Т. Антибиотики, пробиотики или пребиотики? Свиноводство України, 2012. № 1(08). С. 22 – 25.

²⁰ Блах Т. ЕС: Защита животных – залог безопасности и качества мяса. Тваринництво України. 2016. № 3. С. 21 – 23.

to organoleptic indicators, chemical composition and biological properties, water must meet the requirements of the standard. The chemical properties of water are mainly determined by its chemical composition. Natural water always contains various mineral elements. When carrying out a sanitary evaluation of water, special attention should be paid to the presence of nitrogen-containing compounds of organic origin: their increased content may indicate water pollution or its inappropriate preparation for drinking. At the same time, it should be taken into account that these substances can be of mineral origin. For the possibility of water consumption, their content in natural waters should not exceed the MPC. Therefore, when determining water pollution, the presence of nitrogen-containing substances should be associated with many physical, chemical, and biological indicators²¹. The amount of consumed water is also an important factor. This is influenced by climatic and microclimatic factors and the type and amount of feed. If we take as a basis the ratio of feed dry mass consumption by animals to the need for water, then it can be stated that pigs need the most water (7-8 l/kg of feed). Animal health and productivity depend to a great extent on the way of feeding. In general, animals should be provided with drinking water in sufficient quantity and have free access to it. Animals which are watered enough at the same level of feeding grow better. This is explained by the fact that there is a clear relationship between the amount of drunk water and the amount of consumed feed, which is directly adjusted by the microclimatic conditions of keeping.

Highly productive animals and young animals are especially sensitive to uninterrupted water supply. It has been proven that even with minor violations in the supply of water to the organism, productivity is sharply reduced, the growth and development of a young organism slows down, which needs twice as much water per 1 kg of live weight as an adult. Water consumption depends on the species, age, productivity and use of animals, as well as on the type of feeding, physical condition of the feed, meteorological conditions, and water quality.

The quality of water intended for watering animals (transparency, color, absence of smell, taste, absence of pathogenic bacteria) should not deviate from the norms generally accepted for water intended for humans. The temperature of water for watering adult animals should not be lower than the temperature of the room where they are kept. For adult animals,

²¹ Свтушенко М. Ю., Дудник С. В. Водна токсикологія: Підручник. Херсон: ОЛДІ-ПЛЮС, 2016. – 564 с.

it is 8-14 °C. It is recommended to feed suckling piglets with boiled water with a temperature of 25-30 °C. They should be gradually accustomed to colder water, so that after a few weeks they can drink water with a temperature of 15 °C. Animals that are watered with cold water spend a lot of energy to heat it up to their body temperature. The level of water consumption by animals is strongly influenced by the ambient temperature. Non-observance of the physiological principles of drinking is often the cause of serious diseases.

5. Production stresses and their influence on the animal organism

Modern technologies for keeping and operating pigs in industrial complexes involve keeping animals in conditions that are radically different from the natural environment of these animals and usually do not take into account their ethological and welfare requirements. Overcrowding in a closed space, especially in the absence of bedding, too high or low air temperature, constant noise, lack of exercise, monotonous, mostly unbalanced ration, make it impossible to realize natural instincts, and this significantly increases physiological and nervous stress. In addition to environmental factors, the organism is affected by a large number of planned zootechnical and veterinary measures, due to which a special state of adaptation – stress – develops in the organism of animals.

From the point of view of physiology, stress is a state of tension or a natural reaction to an irritant or a collection of stimuli that mobilizes the organism's protective and adaptive mechanisms. The main signs indicating the development of stress in farm animals are atypical behavior and a decrease in productivity. Normally, a healthy animal successfully overcomes stress and adapts to new living conditions. But from the middle of the last century, specialists began to notice that more and more pigs react inadequately to stress. Early weaning of piglets from sows, formation of technological groups for rearing and fattening, transportation of animals are extreme stimuli that exceed the level of protective and adaptive reactions of the organism, as a result of which a stressful state occurs, which is accompanied by growth retardation, an increase in the level of morbidity and mortality of young animals, and a decrease in reproductive capacity sows. The meat of animals that were under severe emotional stress is of low quality, in particular: PSE-meat (pale, soft, watery) and DFD-meat (dark, dense, dry).

Due to the effects of stress, sows lose their ability to mate or give birth to offspring with a low level of viability. Cases of the pathology of metritis-mastitis-agalactia (MMA), which is based on a disorder of the

function of the pituitary gland, thyroid gland and ovaries of the sow, have become more frequent. In boars, the quality of sperm decreases. Pig stress syndrome (p.s.s.) develops in animals of precocious breed, and cardiac weakness and myodystrophy syndrome, including white muscle disease, in animals of precocious breeds. The action of stress factors has a negative effect on the resistance of the animal's organism, they often get sick with internal non-contagious diseases, the digestive system is especially affected (gastritis, enteritis, colitis, ulcer syndrome). Farmers suffer significant losses during the weaning period of piglets, at this time their gastrointestinal tract is adapted to digest liquid food – milk, the enzymatic system is not yet sufficiently developed, and modern pig breeding technologies involve the use of only dry fodder, which often leads to food stress. Animals that are under the influence of constant stress are more susceptible to infections, and even a banal change of feed can cause an acute reaction in them. Behavioral changes appear in some pigs: the animals assume the posture of a sitting dog, a tendency to cannibalism appears, and cases of pig death occur.

Stresses in pig farming are divided into 4 main groups:

1. Climatic:

- deviation from the optimal air temperature;
- deviation from optimal air humidity;
- violations in the ventilation system and an increase in the level of dust;
- violation of the light regime;
- increased noise level.

2. Fodder:

- mycotoxicosis and diseases caused by xenobiotics;
- oxidized fats and trans fats;
- imbalance of amino acid metabolism;
- imbalance in the ratio of various vitamins and minerals in feed and the animal's organism;
- low quality of drinking water.

3. Technological and social:

- conditions of transportation;
- weaning;
- formation of technological groups;
- dominant form of relations in the group;

4. Internal stresses:

- non-infectious diseases;
- viral diseases;

- vaccination;
- intestinal dysbacteriosis.

Many scientists are working on the issue of the negative action of stress in modern animal husbandry, who convincingly prove that this problem can be solved in various ways: breeding, technological, and pharmacological^{22,23}. However, the best way to solve this problem in such a way that would not harm the health of animals and provide the consumer with high-quality and safe products.

6. General veterinary prevention in modern technologies of pig breeding

In animal husbandry, industrial technologies work effectively as long as the animals remain healthy. Very often, entrepreneurs without scientifically based analysis use antibiotics and various medicines either as preventive measures or as growth stimulants, as if to maintain the health of animals²⁴. However, the prevention of the disease involves the prophylactic of an imbalance between the animal's organism and the environment in which it is located. For this purpose, research is being conducted and measures are being developed that would allow activating and maintaining the organism's defenses, ensuring a high level of animal health. In addition to breeding means, active work is being done to find new methods of correcting pig breeding technologies.

Currently, the issue of the welfare of productive animals is extremely relevant, the maintenance and exploitation of which in conditions that do not ensure a good life negatively affects their physical and mental health. Using intensive technologies in animal husbandry, entrepreneurs usually do not take into account the issues of ethology and welfare, as a result of which animals suffer, the level of their productive capabilities decreases, and the quality of products deteriorates. Therefore, as early as 2002, the international charitable organization Compassion in World Farming,

²² Бурлака В. А. Біологія продуктивності сільськогосподарських тварин: підручник. ЖДАУ ім. І Франка, 2012. 191с.

²³ Решетніченко О. П. Швидкість розвитку та особливості перебігу обмінних процесів у організмі молодняку свиней за використання в годівлі Анальцимосорбента. Науковий вісник ЛНУВМБ імені С.З. Гжицького, 2016. Т. 18. № 4(72). С. 72 – 77.

²⁴ Блайда І. М. Використання пробіотичної кормової добавки «Пропіг» у годівлі свиноматок, ремонтного та відгодівельного молодняку свиней. Автореферат дисертації на здобуття наукового ступеня кандидата сільськогосподарських наук : 23.00.02. Львів, 2018. 24 с.

realizing the relevance and complexity of the problem, began cooperation with Ukrainian scientists and agricultural higher education institutions in order to highlight this problem and prevent it. In December 2014, the Ministry of Agrarian Policy and Food of Ukraine held a round table on the topic "The welfare of productive animals in the context of the association agreement between Ukraine and the EU and beyond", the purpose of which there was a contribution to improving the situation with modern animal husbandry, including pig farming.

According to M.V. Demchuk and other leading hygienists, ensuring the stability of the health of highly productive animals that are intensively exploited is possible only if the requirements of the general veterinary prevention plan are met, and this requires a clear understanding of preventive measures: veterinary prevention, permanent prevention and preventive therapy, which are based on compliance with sanitary and hygienic and veterinary rules and animal welfare requirements during their cultivation and exploitation²⁵.

The production process of pig products requires constant monitoring in order to control its compliance with the technological plan, and this is possible only with ongoing prevention, in particular, control of compliance with the requirements of the technology thanks to the study of all its stages. This is compliance with the functioning of buildings and equipment; operation of machines and mechanisms; feed quality and feeding level; the possibility of providing animals with insolation and exercise; ensuring appropriate sanitary and hygienic parameters of the air environment (temperature, humidity, air movement, dust and microorganisms, harmful gases); regular farrowing, rearing of young animals and renewal of the breeding stock; veterinary and sanitary passporting certification and dispensation of the enterprise, licensing; implementation of GMP and HACCP quality and safety control systems for pig farming products.

Preventive medicine is based not only on the possibility and method of disease prevention, but, first of all, on the doctrine of the state of health of a specific animal, which can be characterized by a high level of adaptive

²⁵ Козенко О. В. «Добробут тварин» у програмі навчання студентів та спеціалістів ветеринарної медицини, біотехнологів. Добробут продуктивних тварин у контексті гармонізації законодавства України та Європейського Союзу. (Біла Церква, 27 листопада 2015 р.). Б. Церква, 2015. С. 47-51.

capabilities of the organism to the action of environmental factors, and this makes it possible to realize its genetically determined potential²⁶.

The action of the plan of general veterinary prevention (GVP) provides for the possibility of regular monitoring in order to search and analyze both the entire complex of factors of the environment in which animals are kept, as well as the selection of the most stressogenic factor and, if possible, its elimination or adjustment of the influence in order to minimize it. This preventive approach allows you to maintain the adaptive capacity of the animal organism throughout the entire technological cycle and increases the term of exploitation of these animals.

The stages of the general veterinary prevention plan include various prevention issues that must be searched, understood and implemented as they will be provided or already operate according to the production technology. It is best to develop this plan simultaneously with the beginning of planning, site selection, construction and exploitation of a particular enterprise (farm) or its reconstruction.

In the case of the need to implement a plan of general veterinary prevention at an already operating enterprise, if it is impossible to change the adopted technological decisions, it is necessary to develop and implement a plan of general veterinary prevention of retroactive action. So then the initial stage of the work will be the 3rd stage of the general veterinary prevention plan – preventive therapy. This will make it possible to clearly distinguish the stages of general veterinary prevention in a specific, already adopted and working technology, to determine risk points and control points for choosing an effective method of preventive and permanent preventive approach. It is necessary to establish the causes of the occurrence and development of disease in animals and, in accordance with the requirements, to introduce preventive measures.

According to the work developed by Professor Demchuk M.V. the scheme of the plan of general veterinary measures, especially in the event of production complications (morbidity, low growth rates, death), it is necessary to start work with animal hygiene certification of the farm: to study the conditions of keeping, the level and quality of feeding, rearing and exploitation of animals. In order to find out the depth of influence of these factors on the functional state and physiological capabilities of the animal organism, planned or forced dispensation is carried out. They carry

²⁶ Козій В. І., Соколюк М. В., Козій Н. В., Черняк С. В. Біоетичні основи превентивної ветеринарної медицини у молочному тваринництві. Науковий вісник ЛНУВМБ імені С.З. Гжицького, 2016. Т. 18 № 4 (72). С. 27 – 31.

out clinical, laboratory, hematological searches of the state of animals health, search the state of reproductive and productive capabilities, the level of natural resistance of the animal organism. After analyzing the results of the conducted research, it is possible to make corrections or additions to the adopted production technology – actually preventive therapy.

7. The action of immunostimulating agents on the resistance, metabolism and clinical state of the animal organism

The need for food production is constantly growing, especially for pig farming, the priority of which is to grow precocious breeds of pigs. The intensification of the industry, namely the technology of keeping and feeding of pigs, does not always meet their physiological, ethological and welfare needs. Accordingly, the influence of combined action of such technological factors as high density of housing, formation of technological groups, inconsistency of microclimate parameters, unbalanced rations leads to a slowdown of adaptation processes and a decrease in the resistance of the animal organism.

Therefore, an alternative to overcoming the action of these factors is the use of immunostimulants, which have a multifactorial action: normalization of the immune status, maintenance of homeostasis at the proper level, change of metabolic and energy processes, which contributes to the activation of enzymes. A change in the activity of enzymes leads to a restructuring of the endocrine system: the level of formation of pituitary hormones increases, increasing the secretory function of the adrenal glands, thyroid gland, and pancreas. Maintaining the immune system at an appropriate level leads to the activation of metabolic processes and an increase in the organism's general resistance, which makes it impossible or significantly reduces the likelihood of many diseases, increases hematopoiesis, and stimulates productivity^{27,28}.

The research of many domestic and foreign scientists is aimed at stimulating the natural protective properties of the animal organism,

²⁷ Кремпа Н. Ю., Козенко О. В. Вплив технології утримання на морфологічні, біохімічні та імунологічні показники крові поросят в період відлучення Науково-практичний журнал ХДЗВА. Ветеринарія, технології тваринництва та природокористування, 2018. № 2. С. 87 – 92.

²⁸ Чорний М. В., Мачула О. С., Вороняк В. В., Лясота В. П., Решетніченко А. П. Продуктивність і резистентність молодняку свиней за дії імуностимуляторів. Науковий вісник ЛНУВМБ імені С.З. Ґжицького, 2017, Т. 19. № 79. С. 83 – 86.

capable of reducing the negative influence of the technological process and strengthening the organism's immune functions. As can be seen from the review of the literature, researchers show considerable interest in the use of immunostimulants of various origins, which include not only pharmacological forms, but also biologically active feed additives, probiotics^{29,30}.

Immunostimulants are substances capable of stimulating the organism's non-specific resistance (NRO) and enhancing immunity (humoral and cellular immune reactions). The key feature of immunostimulants is their immunotropic activity, which, in appropriate therapeutic doses, can enhance or suppress (hyperstimulation) immune reactions. The ability of immunostimulating preparations to increase the general resistance of the organism, to accelerate regeneration processes became the basis for the search and development of new preparations, because the modern production of livestock products requires their wide application, because the state of resistance of the immune system is one of the main and sensitive links of many diseases of infectious and non-infectious genesis.

The immune system must ensure the stability and homeostasis of the organism, its protection from exo- and endogenous pathogens, but due to the action of various factors, it can adjust its functions. A decrease in the functional activity of the main components of the immune system causes a violation of the organism's protection against microorganisms and causes increased infectious vulnerability.

The appearance of an immune response is due to the need to recognize the so-called own and someone else's. For this, there is a reliable system of recognition and effector mechanisms that provide various types of immunity. Mechanisms of a nonspecific immune response are activated almost immediately after the appearance of a foreign agent in the organism, the antigenic composition of the pathogen is not important for the implementation of the response. The main factors of nonspecific immunity include complement: granulocytes (including basophils), monocytes, macrophages, NK lymphocytes, and mast cells. The immune response is carried out by B- and T-lymphocytes, in particular B-

²⁹ Білянцева В. В. Ефективність використання БВМД «Енервік» при вирощуванні свиней на м'ясо. Аграрна наука та харчові технології. Вінниця, 2016. № 3(94). С. 18 – 28.

³⁰ Tremetsberger L., Winckler C. Effectiveness of animal health and welfare planning in dairy herds : a review. *Animal Welfare*. 2015. Vol. 24. № 1. P. 55-67.

lymphocytes produce antibodies, T-lymphocytes act as auxiliary (T-helper), cytolytic (T-killer) and regulatory (T-suppressor) cells. They not only provide a normal immune response to infection and autoimmune disorders, immunoglobulin molecules located on the surface of B-lymphocytes play the role of receptors and are able to recognize a huge number of antigens. The cells of each clone of T- and B-lymphocytes have the same receptors for a certain antigen, during the activation of which lymphocytes begin to proliferate rapidly, releasing cytokines and playing the role of regulators of the immune response. It should be noted that antigen-specific and non-specific factors act in a close relationship, their contribution to the formation of the immune response is sometimes difficult to distinguish.

The need to use preparations with an immunotropic influence in animal husbandry arose due to insufficient formation of the immune defense system, especially in young animals, when the action of colostral immunity decreases and the number of technological stresses increases.

An important component in solving this problem is the use of various methods, means, preparations, feed additives capable of influencing immunobiological reactivity, which plays a decisive role in the development of adaptive and adaptable reactions of the organism.

Some immunostimulants are characterized by vitamin-forming properties, others have the ability to synthesize Ig A, natural antibodies, cells of the phagocytic series.

According to scientific data, both natural and synthetic components are used to strengthen immune protection: echinacea, ascorbic acid, humic additives (Kolesnyk M., 2004; Rybalko V., 2006; Buchko O.M., 2016), probiotics (Blayda I.M., 2018; Kucheryavy V.P., 2009; Bereza F., 2012; Kotlyar O.S., 2013; Kokarev A.V., 2016).

Therefore, the validity of the development of effective ways and methods that will allow to get livestock products of high quality and safety predetermines further research on new scientific approaches to their use and management of the industry as a whole.

CONCLUSIONS

The profitability of the livestock industry, in particular pig farming, depends on several factors that do not always have a favorable effect on improving the health and growth of productive qualities of animals. Usually, in the production of livestock products, in addition to the choice of animal breed, the technology and conditions of keeping, compliance

with sanitary and hygienic requirements, and feeding standards are of great importance.

Due to several technological solutions, pig farming is accompanied by many stresses, which can be divided into four groups: climatic, fodder, technological and social, and endogenous stresses (non-communicable diseases). Thus, a significant crowding of animals in a closed space, high or low air temperature with not always appropriate humidity, lack of litter, unbalanced diet, violation of sanitary and hygienic requirements, vaccination, and veterinary manipulations cause physical and emotional overload, which leads to a decrease in the level of adaptive protective reactions of the body. Sows lose their ability to farrow or give birth to piglets with a low level of viability due to long-term exposure to stress factors, to fertilize ability decreases in boars, and gastrointestinal tract diseases develop in young animals, which are later manifested by growth retardation and the death of piglets. Meat from animals that were raised under stress is of low quality, in particular: PSE meat (pale, soft, watery) and DFD meat (dark, dense, dry).

One of the options for solving this problem is the use of immunostimulating drugs. Research analysis by many scientists indicates that using immunostimulants in modern animal husbandry is appropriate and scientifically justified. Thanks to these substances, the process of erythropoiesis is more active, the indicators of protein metabolism are normalized, the indicators of non-specific resistance are increased, and have a positive effect on maintaining the homeostasis of the animal body. And this has a positive effect on growth and development, an increase in live weight gain, and an increase in animal preservation and growing intensity.

SUMMARY

This work highlights the feasibility of finding new methods of influencing and adjusting the immunobiological reactivity of animals, particularly pigs, which plays a decisive role in the development of the body's adaptive reactions. The problem of increasing the industry's profitability, as one of those that gives a quick return, is solved mainly by reviewing and improving approaches to feeding conditions and filling and balancing rations. The conditions of raising and keeping animals, particularly hygienic and sanitary, are of great importance. However, very often, the hygienic factor is either not taken into account by product manufacturers, or they do not focus on it, considering it insignificant. The search for effective systems of preventive and preventive guidance,

sanitary and hygienic control of the health of animals, and hence ensuring sustainable health and the appropriate level of productive and reproductive properties, as well as healthy and viable young animals obtained from them, is relevant in modern pig farming.

The rationale for developing effective methods that will allow obtaining livestock products of high quality and safety dictates further research into new scientific approaches to their application. An essential link in solving this problem is the possibility of using immunostimulants of various origins, including pharmacological forms, biologically active feed additives, and probiotics, which are characterized by the ability to synthesize vitamins, immunoglobulins, and cells of the phagocytic series.

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