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THE BASIC PRINCIPLES OF THE FORMATION OF TECHNOLOGICAL PARAMETERS OF THE MICROCLIMATE WHEN KEEPING CHICKENS OF DIFFERENT AGE GROUPS

ANNOTATION

The poultry farming system has been and remains a serious problem for industrial poultry farming, reducing poultry farming rates and increasing economic costs. The microclimate was studied according to the following indicators: indoor temperature and relative humidity were determined at different times of the day (morning, afternoon and evening) at 3 different vertical points (at the height of birds (0.2 m), about 1.5 m from the floor and 0.6 m from the ceiling). These studies were carried out at the Department of Veterinary Sanitation, on the basis of NAO «KazNARU». Experimental studies on the cultivation of broiler chickens were conducted on the basis of «PRIMA KUS» LLP. The object of the study was broiler chickens of the Ross 308 cross. The main research methods are the effect of relatively high and low temperatures on the average daily weight gain of broilers at different ages (g/day). Research objectives: to conduct an experiment in which high and low air temperatures negatively affect the studied indicator, and, consequently, the productivity of the herd. «PRIMA KUS» is a specialized poultry enterprise engaged in a full production cycle: by raising broiler chickens, slaughtering and processing.

Key words: *microclimate, temperature, relative humidity, maintenance, broiler chickens.*

Introduction. In poultry farms with an unsatisfactory microclimate, the growth and development of young animals slows down, and poultry productivity and resistance to various diseases decrease. The deviation of the air temperature in poultry rooms from the thermoneutral zone affects feed consumption, nutrient absorption, body resistance and productivity of poultry, as well as the quality of eggs and meat. High humidity in poultry houses helps to reduce the digestibility of feed nutrients and reduce the hemoglobin content in the blood. Chickens staying in rooms with high humidity and low temperature often cause colds [1, 2].

Poultry farming is a branch of agricultural production, the main task of which is the breeding, feeding, and maintenance of poultry, the use of mechanization, automation of technological processes, and veterinary prophylaxis in order to obtain eggs, meat, and other products (down, feathers, fatty liver, etc.) at low labor and cost. Poultry farming is one of the world's leading producers of relatively cheap and biologically complete human food products (eggs and poultry meat). Due to the precocity and high quality of food products, it occupies a priority place among livestock industries in all countries [3, 4, 5].

It is known that poultry products are also valuable raw materials for industry. For example, down and feathers of birds are used to make feather beds, pillows, blankets, and warm jackets not only for general consumption, but also for clothing pilots, climbers, Arctic and Antarctic explorers. The main difference between poultry farming and other branches of animal husbandry is the precocity of poultry. In a short period of time, poultry provides a large amount of high-value food products - eggs and meat. Along with early productive and sexual maturity, agricultural poultry is characterized by high

reproductive qualities, intensive growth, high productivity and viability, as well as relatively low feed costs per unit of production.

There are bioenergy plants in the world for producing biogas (fuel) from chicken manure. It is not the manure itself that is used, but the methane that is released from it. After anaerobic fermentation, up to 75 liters of methane can be obtained from 1 kg of organic manure [6, 7].

Poultry farming is the most economically efficient branch of animal husbandry: the possibility of servicing a large number of poultry by one person, feed costs per 1 kg of live weight gain (poultry – 2.1 kg, pigs – 4-6 kg, cattle – 7-9 kg), low cost of production.

The global production of eggs and poultry meat is increasing every year. The annual growth rate of meat production in the world averages 4-6%, egg production – 1.5-2%. In the last decade, the global poultry industry has developed very dynamically.

Global and domestic poultry farming is the engine of animal husbandry in the production of animal protein. According to estimates by the Organization for Economic Cooperation and Development (OECD), the demand for animal protein sources in the world will grow by 2025, and for poultry meat it may increase by 2.4% per year. The most noticeable increase in meat consumption will be observed in regions with high population growth, such as Asia, the Middle East and Africa [8, 9].

Achieving these goals is possible with an integrated approach and systematic coordination of the work of geneticists, breeders, animal technicians and veterinary specialists of a wide profile.

The main problems in the development of poultry farming are the lack of poultry, in particular meat production breeds. In this regard, it is necessary to analyze the replenishment of day-old chickens in the poultry industry.

The leading role in the poultry meat industry of the Republic of Kazakhstan belongs to the broiler industry. The share of broilers in the total production of poultry meat is 80 %, ducks - 13.8 %, turkeys – 1.2%, geese – 0.19%.

A broiler is a hybrid meat chicken aged 5-6 weeks, characterized by high growth energy, low cost and high feed conversion per 1 kg gain, good meat qualities, tender and juicy meat. The Ross 308 broiler is an ideal meat hybrid. The bird was bred by Aviagen, a UK-based company that currently owns all the rights to distribute chickens and eggs in more than 100 countries. Successful crossbreeding, for which different breeds of chickens were purposefully selected, led to the production of the Ross 308 hybrid, which proved to be highly productive with respect to meat and even eggs and became in demand both in poultry farms and personal farmsteads. Many meat breeds were used to produce birds. Crosses of broilers grown in poultry farms of our Republic: Ross – 308 (England), Cobb – 500 (USA), Isa (France), Gibro-N (Netherlands), Smena 8 (Russia) They are able to provide live weight of chickens at the age of 42 days from 2.3 to 2.8 kg with feed costs of 1.6-1.8 kg per 1 kg of increase [10, 11].

Poultry population of the Republic of Kazakhstan as of March 1, 2025, compared to last year, the number of birds increased by 3.2% and amounted to 46 791,884 heads. Today in the Republic, eggs and poultry meat are produced by industrial enterprises, as well as all categories of farms. As of March 1, 2025, 15.5% of the total number are in households of the population; 1.3% in peasant or farm farms and individual entrepreneurs; 83.2% in agricultural enterprises. As of March 1, 2025, the volume of slaughter in all categories of farms in live weight amounted to 74,306.8 tons, and in slaughter weight 59,040.0 tons. Chicken production decreased by 0.4% and amounted to 661,121.5 thousand pieces.

Poultry population of the Republic of Kazakhstan as of March 1, 2025, compared to last year, the number of birds increased by 3.2% and amounted to 46 791,884 heads. Today in the Republic, eggs and poultry meat are produced by industrial enterprises, as well as all categories of farms. As of March 1, 2025, 15.5% of the total number are in households of the population; 1.3% in peasant or farm farms and individual entrepreneurs; 83.2% in agricultural enterprises. As of March 1, 2025, the volume of slaughter in all categories of farms in live weight amounted to 74,306.8 tons, and in slaughter weight 59,040.0 tons. Chicken production decreased by 0.4% and amounted to 661,121.5 thousand pieces.

At the same time, there are quite serious problems in the poultry industry of the republic, the solution of which will increase production and fully provide the population with poultry products. Among the main problems is the insufficient development of breeding farms and, as a result, the lack of a sufficient number of young poultry, especially meat breeds. There is also a low competitiveness of domestic products, due to the high costs of the feed component of animal husbandry. The main components of the feed (60% of its value) are wheat, soybean meal and corn. It should also be noted that there is almost no production of effective vitamin and mineral supplements and premixes in Kazakhstan.

Poultry producers have to buy these necessary additives from foreign manufacturers, which increases its cost by almost 10%.

Another significant problem is the use of physically and morally outdated technological equipment in existing poultry farms, including large ones, which are unable to provide the necessary optimal conditions for keeping poultry. Therefore, it is important to develop new approaches and improve technological complexes for existing life support systems for poultry farms.

Currently, there is no complete understanding of the veterinary and zoohygienic parameters of the Ross 308 cross in the conditions of «PRIMA KUS» LLP in the Almaty region, which makes this topic relevant for further study. In this regard, it is necessary to substantiate zoohygienic standards and develop basic principles for the formation of technological parameters of the microclimate for keeping chickens of various age groups in the conditions of this farm.

The purpose of this work is to optimize the technological parameters of the microclimate for keeping chickens of different age groups in the conditions of «PRIMA KUS» LLP in order to increase production efficiency.

Research objectives: to analyze the influence of technological parameters of the microclimate on the productivity and health of chickens of different age groups in the conditions of «PRIMA KUS» LLP. Evaluation of the technological characteristics and efficiency of the equipment used in «PRIMA KUS» LLP to create and maintain a normalized microclimate in poultry houses.

Materials and methods. The microclimate was studied according to the following indicators: indoor temperature and relative humidity were determined at different times of the day (10 a.m., 2 p.m., and 6 p.m.) at 3 different vertical points (at the height of birds (0.2 m), at a height of about 1.5 m from floor level, and at a height of 0.6 m from ceiling). The horizontal determination points were taken as follows: the middle of the room and two corners diagonally at a distance of 3 m from the longitudinal walls and 0.8-1 m from the end walls using a combined device «TKA-PKM -20». These studies were carried out at the Department of Veterinary Sanitation, on the basis of NAO KazNARU. Experimental studies on the cultivation of broiler chickens were conducted on the basis of «PRIMA KUS» LLP, located in the Almaty region. «PRIMA KUS» LLP is a specialized poultry enterprise engaged in a full production cycle: by raising broiler chickens, slaughtering and processing. The territory where «PRIMA KUS» LLP is located belongs to an agro-climatic region with a temperate continental climate in terms of average temperatures. According to the observation data, the average annual air temperature is +8 °C. The beginning of summer is considered the second half of May and the end is the second half of September. The growing season lasts an average of 207-220 days. The average amount of precipitation in the area of the farm is 520 mm. The terrain throughout the farm is flat. The groundwater in the main part of the territory lies at a depth of 15 m. Soil moisture occurs due to atmospheric precipitation. Soil and climatic conditions are favorable for growing major crops. Construction of the poultry complex began in May 2021, and in early 2023 the company produced its first products (Figure 1).

The essence of the technological process of broiler meat production is to ensure maximum poultry productivity and uniform production of meat products throughout the year. In «PRIMA KUS» LLP, broilers are raised using deep bedding, which is the most common breeding method. The experience of broiler farms has proven its high efficiency. According to this technology, the bird is placed in poultry houses in which the feeding and watering processes are mechanized, heating, lighting and ventilation are automated (Figure 2).



Figure 1 – General view of the production buildings of «PRIMA KUS» LLP



Figure 2 – Maintenance of young broilers inside production facilities

The system of keeping chickens at the poultry complex is outdoor on deep bedding. Chickens are planted on the litter at the age of 1 day after admission from the incubator, the planting density is no more than 18.26 heads/m², fattening of birds lasts 6 weeks. At the same time, approximately 46,000 «Ross-308» chickens of different age groups are kept in the premises of the poultry complex. For the period of slaughter, the live weight of the bird is approximately 2.6 kg.

The outdoor chicken keeping system used at the enterprise is considered worldwide to be the most humane, natural and careful way of industrial production. In such conditions, animals have the opportunity to move freely inside the room on the floor, covered with soft straw, at the slightest desire they can approach the drinkers and feeders. As a result, chickens have the opportunity for normal development, and their highly sensitive bodies undergo proper metabolic processes, which are necessary to ensure the normal state of health and immunity of birds. For bedding, dry (humidity does not exceed 26%) clean, well-crushed stalks of straw and corn, sunflower husks, wood shavings or sawdust are used. For the cultivation of broilers, up to 1.5 kg of litter is used, which is laid in a layer of 2-7 cm. Starting from the age of 18 days, excessive humidity can cause the bedding material to get wet and the microclimate to deviate from optimal parameters, which will necessarily have bad consequences. Humidity control is provided by a ventilation and heating system.

Insulated cross shafts are provided for air extraction (Figure 3), equipped with automatically controlled dampers. Due to the increased length of the shafts (4 m from the roof), they suck air out of the lower part of the room. For heating rooms in winter, gas air heaters with a closed combustion chamber are used, with a capacity of 80 kW. Each room is equipped with six air heaters (Figure 4).

When planting a bird, it is the intensity of ventilation and the light regime, the sex of the bird, the presence of stress and other factors that are taken into account.

Elevated temperature and low humidity, this situation is typical when a new batch is moved into a room. With this combination, the risk of dehydration of the bird due to evaporation of moisture during breathing is increased. The condition is normalized by additional humidification, or by limiting the air velocity until the indicators return to normal. Low temperatures and high humidity cause almost no change in bird behavior, however, gradual saturation with moisture worsens the quality of the bedding material and leads to a deterioration in air quality. The normalizing factor is the improvement of ventilation.



Figure 3 – Exhaust ventilation shaft mounted on the roof, with flap



Figure 4 – Gas air heater

Ventilation of the poultry house is especially important at the «PRIMA KUS» poultry complex. This is because chickens, especially at a young age, are very sensitive to the effects of carbon dioxide and other impurities in the air. Proper ventilation allows you to cool and dry the room in summer and winter by regulating the temperature and reducing humidity inside, constantly purging the territory with cool air. Therefore, even at the construction stage of the buildings, attention was paid to the ventilation system. Effective and well-designed ventilation helps protect the health of birds.

To implement research tasks on the basic principles of the formation of technological parameters of the microclimate when keeping chickens of different age groups in the conditions of «PRIMA KUS» LLP, we used a number of zoohygienic methods:



- measurement of air temperature and relative humidity inside broiler growing facilities using the combined device «TKA-PKM - 20». The «TKA-PKM - 20» device, shown in (Figure 5), is designed to measure the following environmental parameters: - air temperature (t, °C); - air relative humidity (RH, %).

Figure 5 – The «TKA-
PKM -20» device

The combined device is available in a compact, portable design. Structurally, the device consists of two functional units: a measuring head (MH) and an information processing unit (IPU) connected by a flexible multicore cable. When determining the relative humidity of the air, the device is maintained for at least 15 minutes in an environment with absolute humidity, which we are going to determine. Then the readings of the dry and wet thermometers were taken, making sure that the angle of view was perpendicular to the capillaries of the thermometers and the difference in the actual temperature readings of both thermometers was calculated. The readings were taken 2 times during the day – at 12-13 and 20-21 hours. All the data received was recorded and recorded, along with additional conclusions.

The results and discussion. One of the main factors that affects the development of poultry and the productivity of poultry houses is the normalized microclimate of poultry houses, which is characterized by parameters such as temperature and humidity, the content of infectious microorganisms in the air and the concentration of harmful gases (carbon dioxide, ammonia, hydrogen sulfide, etc.). Increased humidity in the air negatively affects the productive performance of poultry. When the air temperature in the poultry house is abnormal, incomplete assimilation of feed occurs, low egg production, as well as insufficient increase in live weight - all this indicates suboptimal poultry conditions and poor-quality microclimate on poultry farms. Relative humidity enters the air of the poultry house due to secretions during bird respiration, evaporation of moisture from droppings, drinkers, etc.

Maintaining the necessary microclimate parameters in poultry farms is an extremely important factor. A high concentration of poultry in a limited volume of the room, a decrease in the area and volume of rooms per unit of live weight leads to an increase in the concentration of harmful gases in the poultry house. The above factors make it necessary to create effective ventilation systems that regulate the necessary parameters of the microclimate and increase the productivity of poultry farms. The electrical complex of the ventilation system in the poultry house should ensure the maintenance of an optimal level of humidity and temperature, which determine the necessary conditions for keeping poultry to ensure high production productivity, and at the same time, the entire complex should increase the energy efficiency of the poultry house.

The determining factors of the microclimate include physical factors, including temperature (t) and relative humidity (φ) in the air, which characterize the quality of the air environment in the poultry house. The effect of bird body temperature on their development was studied [12,13], which determined that the optimal temperature values are in the range of 40-43°C [14], with the upper critical temperature being 45-45.5°C and the lower being 20-25°C [15]. Maintaining the body temperature of a bird at a constant level is possible provided there is a balance between the released biological heat of the bird and the release of excess heat into the external environment.

Figure 6 shows the effect of the indoor air temperature of the poultry house on the average daily weight gain of broilers at different ages.

The chickens of the *control group* were kept at optimal temperatures according to their age, the chickens of the *experimental groups* were kept at temperatures 5°C higher and lower than optimal, respectively. As can be seen from the diagram, high and low air temperatures negatively affect the studied indicator, and, consequently, the productivity of the herd. In the absence of sweat glands in the bird, the body's protection from overheating is carried out by sharply increasing the respiratory rate, which is accompanied by increased heat output when moisture evaporates from the air bags. Thus, when the air temperature (t) increases from 23 to 32°C, weight gain decreases by 26% or 2.9% for each degree. According to our research, when the temperature values (t) increase from 24 to 29-30°C, the productivity of poultry weight gain decreases by 16-45%.

Thus, our research has established that the permissible air temperature in the poultry house should be in the range of 10-33°C, and the optimal relative humidity for broilers should be from 50 to 70% if humidity leads to dust in the poultry house. The consequence of high relative humidity is the wetting of the litter, a high concentration of ammonia in the poultry house, and poor air quality. It is important to remember that the humidity level in the room strongly affects the temperature felt by the bird. *For example*, from 1000 chickens, 228 liters of moisture per day are released, of which 54 liters/day are released from respiration, 174 liters/day from litter (about 80% of all moisture). The optimal values of relative humidity in poultry houses have shown that relative humidity should not exceed 75-80% and be below 40-50%.

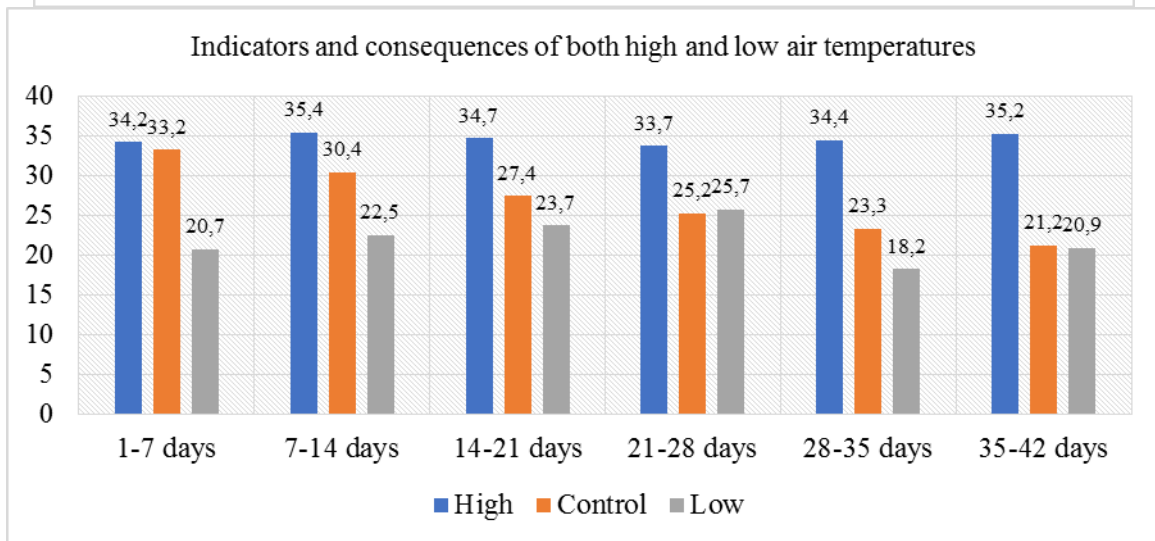
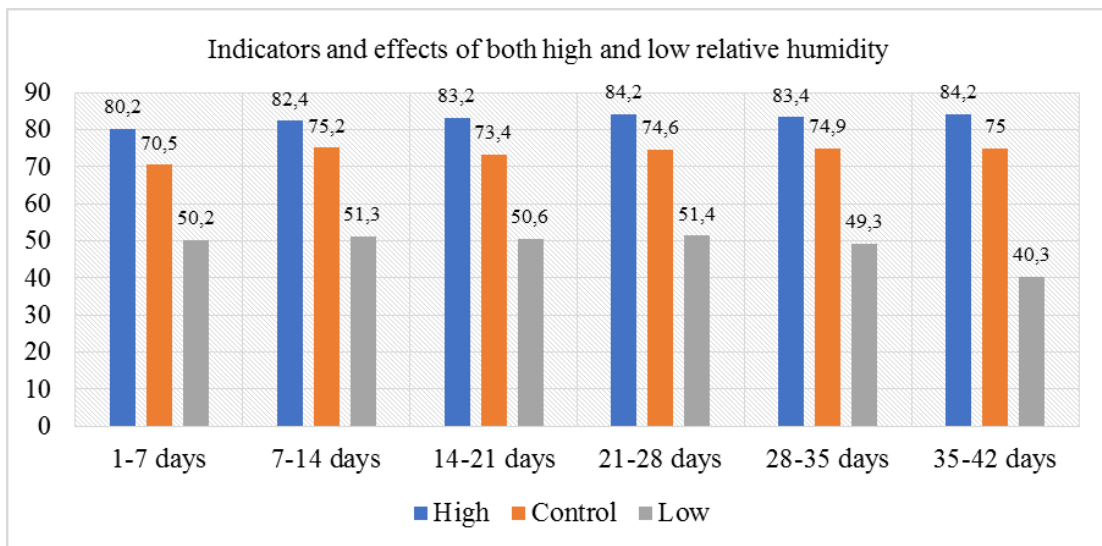


Figure 6 – The effect of relatively high and low temperatures on the average daily weight gain of broilers at different ages (g/day)

The studies we conducted in Figure 6 on the formation of technological parameters of the microclimate when keeping chickens of different age groups are particularly dangerous factors for broilers, a combination of high temperature and high relative humidity. These factors slow down the necessary heat transfer from the surface of the bird's body and can lead to heat stroke. Under such conditions, poultry air consumption increases 8-10 times [16]. Low temperatures (t) and high humidity (ϕ) lead to hypothermia of poultry, which can cause colds [17]. At low values of humidity (ϕ) from 60-70% to 30-40%, the dust content of the air in the poultry house increases, resulting in a decrease in poultry productivity by 5-8%. The harmful effect of dust concentration in the air on the bird's body depends on the size of the dust particles [18]. Fine dust is the most dangerous for the body. Specks of dust measuring 10 microns are released into the respiratory tract. Dust particles measuring 5 microns penetrate into the lungs. Dust particles 0.3 microns in size are trapped in large quantities in the respiratory tract [19]. Dust particles with a diameter of more than 10 microns usually settle in the nasopharyngeal cavity, and with a diameter of 1.5 - 0.8 microns - mainly in the bronchioles and alveoli, less than 1 microns - completely settle in the lungs and can enter the blood. In addition, dust is a carrier of harmful microflora. Representatives of the microflora, which consist of bacteria of the E. coli group, staphylococci and streptococci, are most often found in poultry houses [20].

Thus, the basic principles of the formation of technological parameters of the microclimate in poultry farming are to maintain a stable temperature, which should be 16-18 ° C and relative humidity should reach 60-80%.

Conclusion. The paper examines the technological equipment available at the production facilities of the «PRIMA KUS» poultry complex, designed for optimal life support for the raised «Ross-308»

broiler chickens of different age groups, and the capabilities of this equipment to maintain the necessary microclimate conditions and meet the physiological needs of birds.

1. The optimal moisture level for growing broilers is 50-70%.

2. The use of an irrigation system guarantees humidity of 60-70% at the time of settlement of chickens, reduces stress, and allows them to quickly adapt to the conditions of the poultry house.

3. To maintain a constant humidity level in the room, moisture entering it daily must be completely removed during the operation of the ventilation system.

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ТҮЙІН

Ауылшаруашылығы құстарын ұстау жүйесі өнеркәсіптік құс шаруашылығы үшін құс өсіру көрсеткіштерін төмендететін және экономикалық шығындарды арттыратын маңызды мәселе болады және болып қала береді. Микроклиматты зерттеу келесі көрсеткіштер бойынша жүргізілді: құс-кешендерінде ауаның температурасы мен салыстырмалы ылғалдылығы тәуліктің әртүрлі уақытында (таңертең, түсте және кешке) тігінен 3 түрлі нүктеде (құстардың өсу деңгейінде 0,2 м), еден деңгейінен шамамен 1,5 м биіктікте және төбеден 0,6 м биіктікте анықталды. Бұл зерттеулер Ветеринариялық санитария кафедрасында, «ҚазҰАЗУ» ЖЕАҚ базасында жүзеге асырылды. Бройлер балапандарын өсіру бойынша эксперименттік зерттеулер «PRIMA KUS» ЖШС базасында жүргізілді. Зерттеу нысаны «Ross 308» кросс бройлер балапандары болды. Зерттеудің негізгі әдістері – салыстырмалы түрде жоғары және төмен температураның әр түрлі жастағы бройлер массасының орташа тәуліктік өсуіне әсері (тәулігіне /г). Зерттеудің міндеттері: Жоғары және төмен ауа температурасы зерттелген көрсеткішке, демек, табынның өнімділігіне теріс әсер ететін эксперимент жүргізу. «PRIMA KUS» - толық өндірістік циклмен айналысатын мамандандырылған құс шаруашылығы кәсіпорны: бройлер балапандарын өсіру, сою және өңдеу.

РЕЗЮМЕ

Система содержания сельскохозяйственной птицы был и остаётся серьёзной проблемой для промышленного птицеводства, снижающей показатели выращивания птицы и увеличивающей экономические затраты. Изучение микроклимата проводилось по следующим показателям: температуру и относительную влажность воздуха в помещениях определяли в разное время суток (утром, днем и вечером) в 3 разных точках по вертикали (на уровне роста птиц (0,2 м), высоте примерно 1,5 м от уровня пола и на высоте 0,6 м от потолка). Данные исследования были осуществлены на кафедре ветеринарной санитарии, на базе НАО «КазНАИУ». Экспериментальные исследования по выращиванию цыплят-бройлеров проводились на базе ТОО «PRIMA KUS». Объектом исследования были цыплята-бройлеры кросса «Ross 308». Основные методы исследования – влияние относительно высокой и низкой температуры на среднесуточный прирост массы бройлеров в разном возрасте (г/сутки). Задачи исследования: провести эксперимент, в котором высокие и низкие температуры воздуха отрицательно влияют на исследуемый показатель, а, следовательно, и на производительность стада. «PRIMA KUS» является специализированным птицеводческим предприятием, занимающимся полным циклом производства: выращиванием цыплят-бройлеров, убоем и переработкой.