тарельчатого дозатора, а также важные для формирования плотности распределения семян на грунте параметры положения тарельчатого дозатора: $H_д$ – высота размещения дозатора над грунтом и β – угол наклона пластинки рассеивания. Оптимизируемые параметры характеризируют функционирование системы, определяющие динамику процесса, непосредственно осуществляющего рассеивание семян по поверхности грунта.

Ключевые слова: ***равномерное распределение, тарелчастый рассеиватель, мелкосеменные культуры, полоса рассеивания***

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METHODOLOGICAL REQUIREMENTS TO TEST SET OF MACHINES FOR POULTRY

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Abstract. *The article summarizes the existing domestic, European and North American methodological requirements to test a set of machines for poultry. Characterized that the method of comparing the values of indicators in the subject of complex regulatory requirements and with relevant indicators for complex analog.*

It is also established that the results of mathematical processing of measurement data used for comparison with the required values of technical specifications with the state acceptance tests (technical terms, if state periodic testing) for a decision on the conformity of the test complex technical requirements to technical specifications). There are two possible cases. Also, for comparison of parameters obtained in the prototype testing of complex equipment and complex analog calculate the significance of differences in means.

Recommendations from the results of testing complex take on the basis of results of comparison of values of indicators of the test of complex equipment technical requirements for supply, zootechnical requirements and values for complex analog.

Key words: ***methodology, requirement, test, complex, machine for poultry***

Introduction. Poultry – efficient agribusiness. For every 10 years egg production is growing by 30-44%, and poultry meat doubles every 20 years [1].

Formulation of problem. The main reasons for this growth is the increase in population on the planet and the composition and properties of poultry products that contain the most complete proteins and besides, is the least costly in comparison with products from other livestock industries [2]. The number of birds, on January 1, 2017, mln – 201,7. The share of poultry in agricultural enterprises – 57%, in the private sector – 43% [3]. Production of poultry meat, thousand tons – 1165 (26 kg/year*person). The production of eggs from poultry, mln – 15100,4 (332 PCs/m*person). Profitability of egg production and 50±5%, meat without processing – -9±1%, with prom. processing – 15±3% [4]. However, the scientific community on mechanization provnice not formulated methodological requirements to test a set of machines for poultry [5].

Analysis of recent research results. These requirements apply to systems machines and equipment for outdoor and cage birds. Requirements set the typical program and methods of definition of indicators of quality assessment at state acceptance the state of periodic and preliminary tests of machines and equipment for outdoor and cage birds (further – facilities), which include the following technological lines [6-10]:

- feeding,
- watering,
- removal of litter,
- the collection of eggs
- creation of a microclimate,
- loading and unloading poultry.

In trials of specific complexes on the basis of this standard mashinobudivel organizations are working programs and methods, which after certification says the head of the test organization. All work on preparation and testing of the complex is carried out according to work programmes which should be specified the objectives, conditions and modes of testing, the range of defined targets and the methods of their determination. In the program of state acceptance tests should include examination of technical documentation according to the requirements of state and industry standards, and other regulatory-technical documentation. Tests carried out under conditions established by normative-technical documentation for this type of complexes.

State acceptance tests of the samples subjected to newly developed complexes, which may consist of [11]:

- test machines and equipment,

• prototypes and production machines and equipment,

• production vehicles and equipment, compiled in the experimental complexes.

State acceptance tests of the experimental complexes was performed to determine compliance with technical requirements, standard technical documentation and determine the possibility of production of complex on production [12]. State acceptance testing should include the determination of indicators, specified in the technical assignment for the development of the complex. Recommendations on the feasibility of production of experimental complexes take based on the results of comparative research complexes with the regulations stipulated in the technical specifications [13].

The state is subjected to periodic tests of serial samples of the complexes. State periodic tests are conducted to assess compliance with complex standards and specifications. Recommendations on expediency of the further production (delivery) production complex take on the basis of the results of the comparison of its performance with the specifications and requirements of existing standards and the results of previous tests.

Previous test subjects of experimental and prototypes of systems. Preliminary tests of the experimental complexes was performed to determine compliance with the requirements of technical specifications, standards and technical documentation and the decision of a question on possibility of representation of a complex state acceptance tests. With a set that are received on preliminary tests, must be submitted to the technical documentation in accordance with the requirements for prototypes. Recommendations on the appropriateness of a research facility on state acceptance tests take on the basis of comparison of its quality indicators with the indicators stipulated in technical specifications.

Comparative test subjected to experimental complexes which do not have technical specifications for the development, and also a few imported samples of complexes. These tests are carried out in comparison with the complex-counterpart. As a counterpart for comparison, take the best, as a rule, the production patterns, and in certain cases prototypes [14].

Purpose of research is methodological requirements to test a set of machines for poultry.

The results of the research. In a comparative test conditions should be comparable for the test compound and the complex-equivalent. To clarify the comparability of compared indicators of conditions on the subject is complex and a complex analogue. With this aim in terms of the environment, have a quantitative description count absolute difference (Q_1) and the percentage difference (α):

$$Q_1 = q_1 - q_2, \quad (1)$$

where q_1 and q_2 – the value of the index on the subject and porwnywanie complexes, respectively.

$$\alpha \frac{Q_1}{q_2} \cdot 100\%. \quad (2)$$

The test conditions considered comparable if the values of the main indicators differ from each other by not more than 15 %.

Import complexes are experiencing the program of the state periodic testing to determine their conformity with the technical documentation specified in the terms of delivery.

For the evaluation of complexes is carried out the following tests:

• functional to evaluate the zootechnical, energy, and economic performance,

• safety tests for the assessment of ergonomic performance and security

• reliability testing for reliability assessment,

• indicators specifications for evaluation are not required to undertake the functional tests is determined by technical expertise.

Indicators organize controlled operational tests. If such tests have not achieved the prescribed period required time conducted bench, field or field tests. Testing facilities should be subject to the requirements of industry standards for typical technological processes in the poultry industry.

According to test results of a Protocol in the form set out in the industry. Protocol agreed with representatives of the developer (manufacturer), as well as a representative of the poultry enterprise (farms), where testing of the property.

Technical feature should be made based on the organization submitting the car for test, and the results of the examination of the structure. When conducting technical examination of the complex determine the parameters of the specifications shown in the technical reference for the development of the property, or in the technical specifications for the manufacture, performance and transportability (weight, overall dimensions in transport position).

The technological parameters (with the exception of the complexity of Assembly, installation and adjustment operations during installation of the complex on the site of application), indicators of standardization and unification, as well as aesthetic and patent law used to evaluate the quality level of the complexes, determined by the organization-developer, the submitting machine to the test. The indicators characterizing the composition and maintenance of the complex, having digital expression (type, brand, number of machinery and equipment included in the complex, the number of staff, management style), determined by visual assessment. Indicators technical specifications determined by technical

expertise. Indicators overall, the geometrical parameters of the complex as a whole and its component parts, is determined according to 26025. Measurements are performed by measuring means selected taking into account the manufacturing tolerances for the nominal values of the measured parameters.

The mass of the complex as a whole, the machinery, equipment and Assembly units is determined on the weight equipment.

The ground supplied to the test unassembled in the package, allowed to determine by calculation – by subtracting from the total mass of the complex with vehicles and packing weight of vehicles and packaging. The results of the observation process to determine measurement error, including methodological and instrumental.

For the preparation of the technical specifications use the information obtained during the technical expertise, as well as zootechnical, energy, operational-production performance and reliability.

In the examination of operational documents define its compliance with requirements for completeness, completeness to quality of performance. To assess the manufacturing quality of the tested sample it is checked for compliance with specifications and drawings.

Indicators of technical level of the complexes is determined by the results of the tests. The level of mechanization and automation is determined by the formula:

$$K_M = \frac{M_0}{M_0 + M_H} \cdot 100; \quad (2)$$

$$K_A = \frac{M_A}{M_A + M_{HA}} \cdot 100; \quad (3)$$

where K_M – the level of mechanization, %,

M_O – the amount of work performed by machines and units developments,

M_H – work scope semejante way in terms of achievements,

K_A – automation level, %,

M_A – the number of process operations subject to automation,

M_{HA} – the number of process operations are not exposed to automation.

Characterization of the complex as a whole take according economic accounting. The room of a typical project take on project-estimate documentation. The material of construction of the room is determined visually. Internal room dimensions measured by tape measure. Total area, area occupied by birds; the area of technological equipment, is determined by calculation by conventional methods.

Characteristic birds are taken from data of the economic and zootechnical accounting. The ratio of components in the feed take on the documents of the feed mill. The temperature of the water is determined by 70.31.1-84. Water hardness is determined according to 4151-72. The

iron content in the water is determined according to 4011-72. The chloride content in the water is determined according to 4245-72. Coli-index, coli-titer, the number of bacteria in the water is determined according to 18963-73. The characteristics of the litter is determined according to the 70.20.3 OST-83. Indoor climate is determined by 70.31.2-84. Parameters of the climatic conditions during the testing period prescribed for the nearest weather station.

Methods of definition of indicators of quality of performance of technological process. Indicators: egg production (cyclicity, uniformity and intensity of oviposition), the distribution of eggs by category average daily gain in live weight, total live weight gain, livestock safety, exit business melodiki, feed cost per hundredweight of live weight gain, feed cost per 1000 eggs, conformation defects, the nature of oviposition in the nest or outside the nest. and take according to economic accounting.

The stocking density of birds is determined by the ratio of the total poultry population to the square of the house occupied by birds (including aisles). The utilization of floor space is a fraction of the distribution area occupied by birds on the common area of the house.

The number of birds that were injured during the period of the tests determines viprobuval organization. Indicators of the quality of the process through the feed distributing (performance, loss of food distribution, loss of forage at boot, uniform feeding, uniform feeding, given the food consumption by birds in the process of distribution, separation of the feed, the deviation from the norm feeding on 1 m. (RM.) along the length of the feed line). The deviation from the issue and the uniformity of feeding, taking into account its consumption in the process of distributing determined without birds. The results of measurements made according to forms.

Loss (spillage) of feed when feeding a single young in each age period: 10, 20, 30 and 60 days, the hens two or three times during the test period. To capture the scattering of feed by the feeding pallets are used, the design of which corresponds to a design of the tested feeders. Used pallets must not change terms of reach, bird feed and to provide 100 % capture of feed losses.

The day of the determination of the loss of the feed tray installed in any of three convenient locations for work. Determine the mass of feed and poured into pre-cleaned feeders to the depth recommended in the passport and the user manual for the feeder (armorsmithing). After eating at least 80% of the specified feed determine the mass of residual feed in the feeders. Pallets are removed and choose all the particles of food that got him. Assembled pallets of food weighing. Feed waste when feeding is defined as the ratio of the weight of the feed scattered eating around the feeder, to the specified feed.

In addition to these losses, are the losses from feed eaten:

$$\text{РК}_\text{С} = \frac{Q_{K1}}{Q_{K2} - Q_{K3}} \cdot 100; \quad (4)$$

where PK_c is the loss of feed from feed eaten corporatation, %, Q_{K1}, Q_{K2}, Q_{K3} is the mass of the feed, actually lost, given, and remained in the trough.

The results of the analysis conclude that selective slavianie feed in the process of corporization. Contamination of feed with manure (litter) is determined by analysis of samples (minimum 1 kg) of feed taken from five different sections of feed line. Contamination of feed is determined by the formula:

$$P \frac{m_p}{m_\text{к}} \cdot 100; \quad (5)$$

where P – the contamination of feed, %, m_p – the mass of litter (litter) in NASc, g, m_k – the weight of the portion of the feed.

The level of filling of the feed troughs is determined after feeding before slavianie his birds at the beginning, middle and end of the segment. To exclude the possibility of Sliyanie feed in the process of distribution it is necessary to stop the birds access to the feed lines in the ground determining the level of the feed. The feed level (the height of the layer of food from bottom of trough) is determined with a ruler. Allowed determination of the level of filling feed troughs and the uniformity of distribution of food to pick up or drop off birds. The measurements were carried out in triplicates.

Useful capacity of the hopper determine after the termination of the receipt of the feed in the hopper. Loaded food is weighed. Calculate the useful capacity of the container by the formula:

$$V \frac{\sum_{i=1}^{i=n'} Q_i}{n' \cdot j} \cdot 100, \quad (6)$$

where *V* – useful hopper capacity, m^3, *Qi* – the mass of feed loaded in the hopper for one the experience, kg, *n′* – the number of experiments, j – loaded feed density, kg/m^3.

The convenience of access to poultry feed to visually determine and record whether, uncomfortable. Indicators of quality of performance of technological process of watering systems are easy to access birds to the drinkers, dripping water in drinking bowls, water pollution, the capacity of the valve mechanism. The mounting height of drinking bowls for panino grate or floor measure every 10 m of length of a drinker or in areas of least water in the drinking bowl, or every 10 mkrescue or npelra drinkers. Height measure with a ruler. The measurements were carried out in triplicates. The water level in a flowing non-automatic drinking bowls is determined at the beginning, middle and end of the line, and scrotally drinkers – every 10 drinkers. Measurements are performed with a ruler, in triplicates.

To determine the working volume of the trough filled with water at 20-30 mm below the level of its edges. The water is then decanted and, using a graduated cylinder, set its volume. The measurements were carried out in triplicates. The cost of water in water troughs is determined using a flowmeter. Indicators of quality of performance of technological process in equipment for removal of litter is determined by the efficiency and quality of removal of the litter. The thickness of litter layers on the surface of the collection determined using a caliper. The measurements are carried out not less than 10 points of the deck before soaking in the change of party birds or at the end of the test. The speed of movement of the working body posile mechanism is determined by the formula:

$$v = \frac{S}{t}, \quad (7)$$

where v – speed of movement of the working body posile mechanism, m/s, S – marked portion (at least 10-15 m), m, t – time of passage of the marked area, S.

The definition of performance equipment for the collection of eggs is carried out in the period of maximum egg production of hens and poultry stock is not less than 95 % of the number of seats.

Performance aizenberga conveyor is determined by the formula

$$RP=(g\cdot 3600)/t, \quad (8)$$

where RP – the performance aizenberga conveyor, PCs/h, g – the number of eggs collected by conveyor units, t – time aizenberga conveyor, sec.

While working aizenberga transporter will determine cronometragem by using the stopwatch. The speed aizenberga conveyor is determined similar to the method of determining the speed of the working body posile mechanism. The capacity of the storage table is determined by counting the number of eggs responding to the surface of the table. The experiments to determine the combat (damage) equipment of the eggs was carried out for 3 consecutive days three times during the test. Ovasapyan the subject of eggs at least 3 times a day (morning, afternoon and evening meetings). In each sample should be at least 400 eggs.

During the control of egg collection are selected by candling the eggs with the wet and dry fight. Establish the nature of the battle, leakage from the sharp end, in the middle, with a blunt end.

The venue of the eggs set on the basis of the nature of the battle of balls: in masonry is broken sharp or blunt end, while rolling or assembly – middle of the eggs.

Micrometer (0-25 mm) measure the thickness of the shell damaged eggs, which break off a piece of the shell, and remove shell pdxonline, using compression gives the shell a flat shape. The overall combat of the eggs in % is determined by the formula:

$$P_p = \frac{g \cdot 3600}{t}, \quad (8)$$

where P_p – the performance aizenberga conveyor, PCs/h, g – the number of eggs collected by conveyor units, t – time aizenberga conveyor, sec.

While working aizenberga Transporter will determine cronometragem by using the stopwatch.

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During the control of egg collection are selected by candling the eggs with the wet and dry fight. Establish the nature of the battle, leakage from the sharp end, in the middle, with a blunt end.

The venue of the eggs set on the basis of the nature of the battle of balls: in masonry is broken sharp or blunt end, while rolling or Assembly – middle of the eggs.

Micrometer (0-25 mm) measure the thickness of the shell damaged eggs, which break off a piece of the shell, and remove shell pdxonline, using compression gives the shell a flat shape.

The overall combat of the eggs in % is determined by the formula:

$$B_{\text{о}} = \frac{w_b}{w} \cdot 100, \quad (9)$$

where B_0 – the overall combat eggs, %, w_b – number of broken eggs, pieces, w – the number of eggs viewed on the ovoscope.

The percentage of damaged eggs with normal shells (the thickness of the shell is more than 0.30 mm) is determined by the formula:

$$B_{\text{н}} = \frac{w_{\text{н}}}{w} \cdot 100, \quad (10)$$

where $B_{\text{н}}$ – the percentage of damaged eggs with normal shells, %, $w_{\text{н}}$ – the number of damaged eggs with normal shells, pieces, w – the number of eggs viewed on the ovoscope.

Of the total number of damaged eggs secrete a battle of eggs on the receiving device (elevator), ailesbury transporters in the cells by passing through areas that are checked, the equipment of the party with not less than 720 eggs, pre-checked for the ovoscope for damage, ensuring the normal density and structure of host eggs on the working bodies. The experiment is conducted three times during the test period, including the beginning and end of the test. Contamination of eggs determine when morning, afternoon and evening meeting. All

contaminated eggs are sorted according to the degree of contamination (weak, strong).

The number of eggs laid outside the nest when naplno the content of the bird, characterized by the ratio of the number of eggs laid outside the nests to the total number of eggs collected in the house during the day (expressed in percent). Experiments are performed for 3 days at maximum and average Eizenstat for the test period. The fullness of the rolling of eggs on the conveyor ailesbury defined as the ratio of the number of eggs that have sunk to jayasri Transporter to the total number of eggs collected, expressed as a percentage. Control and measurements of the egg that has not rolled, carried out visually at least 4 times during the day, providing a peaceful behavior of birds.

The lighting in the house is measured with a light meter. The measurements were carried out at the point of determining the temperature-humidity parameters of the room air. When determining indicators of quality of performance of technological process of installation to maintain the specified illumination mode and local (local) heating bird installed capacity of lighting lamps account for counting their number and total capacity. The type of light sources is determined visually by the number determined by direct counting. A heater for a given mode is determined by the time interval between the heater elements on and off. The uniformity of heating of air and the temperature deviation from the target is determined by measuring temperatures at 10 points on the diagonal at the level of the birds (approximately 5 cm). Measurements were carried out after 30 min for 3 h using a device of TET-2. The data obtained are subjected to mathematical processing. The uniformity of heating of air is characterized by coefficient of variation.

The performance of the equipment for loading and unloading live poultry is determined by taking into account the loaded and unloaded birds per unit time. The safety of livestock take according economic accounting. The method of comparing the values of indicators in the subject of complex regulatory requirements and with relevant indicators for complex analog. The results of mathematical processing of measurement data used for comparison with the required values of technical specifications with the state acceptance tests (technical terms, if state periodic testing) for a decision on the conformity of the test complex technical requirements to technical specifications). Thus, the following cases:

- known nominal value ($A_н$) of the parameter that is checked and tolerance (Δн) for this parameter: the complex meets the requirements of the normative documentation on this option if:

$$\widetilde{A} + \Delta \leq A_н + \frac{\Delta_н}{2}, \qquad (11)$$

$$\widetilde{A} - \Delta \geq A_н - \frac{\Delta_н}{2}, \quad (12)$$

- we know the value of ($A_н$) option, which is checked and no tolerance (Δн) for this parameter: the complex meets the regulatory requirements, if

$$\left|A_н - \widetilde{A}\right| \leq \Delta . \quad (13)$$

For comparison of parameters obtained in the prototype testing of complex equipment and complex analog calculate the significance of difference in means:

$$t\frac{|\bar{X}_1 - \bar{X}_2|}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} > t_{005,\nu}, \quad (14)$$

with the number of degrees of freedom

$$\nu \frac{(\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2})^2}{\frac{(\frac{\sigma_1^2}{n_1})^2}{n_1+1} + \frac{(\frac{\sigma_2^2}{n_2})^2}{n_2+1}} - 2, \quad (15)$$

where $\bar{X}_1$ – the average value for the subject complex;

$\bar{X}_2$ – the average value of the indicator from the complex-counterpart;

σ_1^2 – dispersion of indicator in the subject is complex;

σ_2^2 – the variance of the indicator from the complex-counterpart;

n_1 – the number of measurements the subject is complex;

n_2 – the number of dimensions in complex-counterpart ($n_2 \cong n_1$);

n – critical value student's t test with a significance level 0,05 and v degrees of freedom.

The difference between the average values is significant, if the index t is greater than the value $t_{005,\nu}$.

Conclusions. If the value of the index t less than a value of $t_{005,\nu}$ and the difference between the means is insignificant, and the value of the index on the subject of the complex is taken to equal the corresponding indicator for the complex analog. According to test results, a summary table of the indicators stipulated in the technical specifications for the development of complex, technical terms are complex and carried out their analysis by comparing with standard or base values.

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МЕТОДИЧНІ ВИМОГИ ДО ВИПРОБУВАННЯ КОМПЛЕКСУ МАШИН ДЛЯ УТРИМАННЯ ПТИЦІ

В. І. Ребенко, І. Л. Роговський

Анотація. *В статті узагальнено існуючі вітчизняні, європейські і північноамериканські методичні вимоги до випробування комплексу машин для утримання птиці. Охарактеризовано, що методика порівняння значень показників по випробовуваному комплексу з вимогами нормативної документації й з відповідними показниками по комплексу-аналогові.*

Також встановлено, що результати математичної обробки даних вимірювань використовують при порівнянні їх з необхідними величинами технічного завдання при державних приймальних

випробуваннях (технічних умов при державних періодичних випробуваннях) для ухвалення рішення про відповідність випробовуваного комплексу вимогам (технічного завдання технічних умов). При цьому можливі два випадки. Також для порівняння показників, отриманих при випробуваннях дослідного зразка комплексу обладнання й комплексу-аналога підраховують значимість різниці середніх значень показник.

Рекомендацію з результатів випробувань комплексу приймають на підставі результатів порівняння значень показників випробовуваного комплексу обладнання з вимогами технічних умов на поставку, зоотехнічних вимог і значеннями показників по комплексу-аналогові.

Ключові слова: ***методика, вимога, випробування, комплекс, машина для утримання птиці***

МЕТОДИЧЕСКИЕ ТРЕБОВАНИЯ К ИСПЫТАНИЯМ КОМПЛЕКСА МАШИН ДЛЯ СОДЕРЖАНИЯ ПТИЦЫ

В. И. Ребенко, И. Л. Роговский

Аннотация. *В статье обобщены существующие отечественные, европейские и североамериканские методические требования к испытаниям комплекса машин для содержания птицы. Охарактеризовано, что методика сравнения значений показателей по испытуемому комплексу с требованиями нормативной документации и с соответствующими показателями по комплексу-аналогу.*

Также установлено, что результаты математической обработки данных измерений используют при сравнении их с требуемыми величинами технического задания при государственных приемочных испытаниях (технических условий при государственных периодических испытаниях) для принятия решения о соответствии испытываемого комплекса требованиям технического задания технических условий). При этом возможны два случая. Также для сравнения показателей, полученных при испытаниях опытного образца комплекса оборудования и комплекса-аналога подсчитывают значимость разницы средних показателей.

Рекомендации из результатов испытаний комплекса принимают на основании результатов сравнения значений показателей испытуемого комплекса оборудования требованиям технических условий на поставку, зоотехническим требованиям и значениями показателей по комплексу-аналога.

Ключевые слова: ***методика, требование, испытание, комплекс, машина для содержания птицы***