

CONDITIONS AND ANALYSIS OF METHODOLOGIES FOR TESTING TECHNOLOGICAL EQUIPMENT IN ANIMAL PRODUCTION

Summary

The research on the functionality of equipping in livestock housing are very important from a point of view of the science and the development of the comprehensive mechanization of technological processes. They have a close relationship with construction projects, improving and the standardization of solutions justified with welfare. The further technological progress is forcing to alterations of technical means including the development of zootechnics and technical studies. Reflecting of the effects of these works are research on the functionality. They are most often conducted in production buildings.

Key words: equipment for livestock, functionality, technological progress

UWARUNKOWANIA I ANALIZA METODYK BADANIA SPRZĘTU TECHNOLOGICZNEGO W PRODUKCJI ZWIERZĘCEJ

Streszczenie

Badania funkcjonalności wyposażenia w budynkach dla zwierząt gospodarskich są bardzo ważne z punktu widzenia nauki i rozwoju kompleksowej mechanizacji procesów technologicznych. Mają one ścisły związek z projektami konstrukcyjnymi, doskonaleniem oraz normalizacją rozwiązań uzasadnioną dobrostanem. Dalszy postęp techniczny zmusza do modyfikacji środków technicznych z uwzględnieniem rozwoju nauk zootechnicznych i technicznych. Odbicie efektów tych prac dają badania funkcjonalności, najczęściej przeprowadzane w budynkach produkcyjnych.

Słowa kluczowe: wyposażenie dla zwierząt inwentarskich, funkcjonalność, postęp techniczny

1. Introduction

The selection and purchase of livestock buildings equipment, regardless of their size are always associated with high investment costs. Undertaking such decisions is preceded by an analysis of costs and the selection of devices, most often based on materials provided by commercial suppliers which are not always objective. The second source of information about used equipment are current opinions provided by Producer Groups, Producers' Chambers, dairy plants and other often informal communities of farmers and breeders. Such messages contain serious errors resulting from incomplete information about eg construction of buildings, their foundation in the area, surrounding and vicinity of the facility, and links to the direct use of the building - farm, i.e. technological profile, type of feed, their supply, manure management, transport and receipt of products.

Design offices and factory laboratories operating in companies producing technical equipment for farms do not always have knowledge about technological and farm conditions which is necessary for the preparation of a reliable and professional opinion. Technological equipment used in animal production constitutes a specialized group of agricultural machinery which should be subjected to qualification tests (full or partial) the purpose of which is to determine the suitability of equipment for a given function. Full qualification tests should check and assess the quality features of the machine, specified in standards and regulations and other sets of requirements. Incomplete tests are performed more often which are designed to check some of the features or quality characteristics of the device, depending on the needs i.e. the development phase of the machine.

The following are considered as "machine development phases":

- model, "experimental prototype"
- industrial prototype
- machine from the trial (information) series
- modernized machine
- a serial production machine equipped with an electrical (electronic) installation.

As part of incomplete qualifying tests, all features determining the safety, ergonomics and functionality of the agricultural machine are checked and evaluated.

The framework program of full qualifying tests includes the following steps:

1. Preparation of tests:
 - a) acceptance of the machine,
 - b) completing the documentation,
 - c) preparation of measuring equipment,
 - d) performing the initial technical inspection.
2. Initial technical expertise, i.e. :
 - a) preparation of technical characteristics,
 - b) preparation of a description of construction and operation,
 - c) testing the simplicity of machine assembly,
 - d) testing compliance with the requirements / standards,
 - e) examination of compliance with road traffic regulations, technical supervision, sanitary regulations, etc.,
 - f) inspection of machine operation,
 - g) aggregation testing,
 - h) testing the machine performance quality,
 - i) testing the possibility of transporting the machine,
 - j) assessment of the instructions.
3. Testing the functionality of the machine, i.e. :
 - a) examining the quality of work,

- b) energy research.
- 4. Research on the safety and ergonomics of the machine.
- 5. Operational tests, i.e. :
 - a) timekeeping of the machine with simultaneous registration of the amount of work done by the machine and used consumables,
 - b) calculation of operating indices and operating costs.
- 6. Current and final technical expertise including:
 - a) measuring the wear of selected machine parts, especially quickly wearing working parts,
 - b) registration of damage and repairs (including the number of repaired parts),
 - c) assessment of the technical condition of the machine after testing.
- 7. The approval tests include the assessment of the machine's compliance with the technical conditions set out in the Minister's Regulation. These tests are subject to agricultural tractors, trailers and other machines designed for frequent traffic on public roads. The units authorized to carry out approval tests and confirming the fulfillment of technical conditions and requirements for the approval of a single vehicle for traffic are placed in the Official Journal of the Minister of Infrastructure and Construction, August 17, 2017 item. 57.

The test results are the basis for the manufacturer's approval certificate issued by the Director of Transport Technical Supervision (TDT) in the Ministry of Infrastructure and Construction in accordance with the provisions of the Act, November 8, 2013 on the amendment to the Road Traffic Law and the Law on technical supervision (Journal of Laws, item 1611).

Durability tests at test stands and test tracks include evaluation of durability of basic units or machine parts under conditions imitating loads (operational excitations). These tests are mainly covered by agricultural trailer assemblies.

Separate though related research are those that cover complex technological issues on various types of industrial farms. They have the task of performing tests which in a relatively short time will allow to assess the whole farm / facility, not going into the design details of individual machines and devices. These ratings are used to develop proposals and guidelines for new investors or producers interested in innovation.

Comprehensive research methodologies, however, do not cover many issues that in a relatively short period have become common solutions in the construction of devices, eg material diversity, automation, computerization, etc.

2. General characteristics of test methodologies

Methodology of device research as well as technological processes contain some general issues of the nature of research documentation (names, symbols, terms, documentation, etc.). Detailed research methodologies are different and depend on the nature of the tests - basic / laboratory or operation / production. They depend primarily on the place where they are made. It is much easier to develop methodologies for tests performed in the laboratory due to the permanent or reproducible conditions in which they take place.

The methodology prepared for exploitative research requires the identification for example, what species of animals, what type and form of fodder, technological system, and even the age of animals will be used for the tested device. For example, there must be different tests of rope-

roller conveyors for various livestock species, selection and composition of feeds, type and size of feeders, etc. In addition, equipment tests carried out under operating conditions, i.e. on the farm, must be preceded by an overall assessment of the correctness of the course of individual technological treatments as well as environmental / microclimatic conditions in which animals are kept.

A very important principle of conducting research is the collection of basic research documentation, which includes:

- study journal,
- sheets / measurement cards,
- records of measuring devices on measuring tapes and disks, cameras, electronic memory of research and computer equipment.

The retention period should not be less than one year. They can be used for scientific studies (without specifying the brand or producer), however, they can not be made available in a different form without the consent of the client.

3. Common parametric elements of technological devices research

The assessment of the quality and suitability of the tested devices or technologies of animal production will be of full value if the results obtained are referenced to existing standards or applicable norms.

Currently it is difficult, especially considering the lack of guidelines and recommendations that were once collected in the National Agricultural Machinery System, and they were jointly developed by groups of specialists Institute of Building Mechanization and Electrification of Agriculture, Industrial Institute of Agricultural Machinery and the Institute of Animal Production [4].

The Requisition Cards included in it were used not only to improve technological equipment for all species of farm animals in terms of construction and technology, but also took into account the behavioral needs of animals, serving the improvement of animal welfare and in a broad aspect of environmental protection.

Such a procedure of conduct in research works is desirable because it serves the development, especially in the currently used intensive methods of animal maintenance aimed at a rapid increase in economic effects.

Up to now and perhaps even more worth knowing, there are framework rules for conducting research on agricultural machinery developed by Pawlik [3] and Czczot [1] and large-scale livestock farms [5] developed by specialists, and revised at IBMER in 1973-1989 [2]. They included the assessment of devices for all animal species and types of production - meat, milk, eggs, including economic evaluation.

Generally, the methodologies for testing technological equipment intended for animal production should be tested in the following areas:

- compliance with technological requirements,
- quality of work and technical indicators,
- indicators of energy consumption, durability and reliability,
- evaluations in terms of health and safety.

As an example the factors characterizing the usefulness and correctness of functioning are given here, as well as the evaluation of the group of devices of the poultry feeding system maintained in the large-scale production (Table) [6].

Table. Technical indicators and quality of work [6]
 Tab. Wskaźniki techniczne i jakości pracy [6]

Technical indicators and quality of work	A. Silo	<ul style="list-style-type: none"> – easy assessment of the quality of feed in the silo, – formation of stagnant (vaults) in the hopper, – correctness of venting the silo (including the amount of fodder thrown away), – ease of cleaning, disinfection and disinsection the silo, 	
	B. Conveyor, silo-building	<ul style="list-style-type: none"> – low noise emission during work in loose and under load – correctness of operation of limit switches, – assessment of the degree of feed comminution by the conveyor, 	
	C. Line of conveyors and feeders	<ul style="list-style-type: none"> – uniformity of the distribution of the feed on the conveyor length, quiet running on the loose and under load ^{x)} – shaping of the conveyor channel protects against spreading of feed by birds ^{x)} – easy to adjust the level of the tray ^{x)} – assessment of the degree of feed disintegration by the device ^{x)} – assessment of the feed pollination level at the time of feeding ^{x)} – assessment of transport capacity of feed ϕ 2-5 mm by conveyor ^{xx)} – evaluation of the protection against throwing feed from the feeder, – assessment of protection against fodder clearing, – availability of feed for day-old chicks, ^{xxx)} – assessment of feed protection against feces contamination, – assessment of the protection of feeders against birding on them, – length of the edge of the feeder per bird in accordance with the applicable standards, (in operational tests) ^{xxxx)} 	<p>^{x)} applies to open conveyors</p> <p>^{xx)} applies to tubular conveyors</p> <p>^{xxx)} for feeders for chicks or universal ones</p> <p>^{xxxx)} dependence resulting from the possibility of installing feeders with a specific structure on the given surface</p>

4. Summary

The aim of this publication is to draw attention of a wide range of specialists to the fact important for science and its development, and thus for the recipients – farmers, of often uncritically introduced to livestock equipment, which is offered by sellers from all over the world. Many factories produce equipment based on cooperation with a number of subcontractors, do not have their own research laboratories – and often in the name of quick profit give false data characterizing a given product. The consequence is court trials which last for years and incalculable losses of Polish producers.

Therefore, it seems advisable to return to our own research and evaluation of the equipment offered on the market in the best interest of our domestic agriculture.

5. References

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