Cattle Health Status Criteria

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*Abstract***:** *Materials for studying disparate scientific data, performing studies and developing the criteria for evaluating the health status of cattle have been presented. The efficiency of the integrated approach to solving the problem has been shown. It has been found that metabolic diseases cause the most economic damage to livestock. Based on this fact, countries with developed cattle breeding pay increasing attention to the development and improvement of the methodological, organizational and methodical bases of metabolism monitoring, especially during the most hectic periods of the physiological cycle. In the Russian Federation, their methodological basis includes clinical examination, creating biologically full-fledged and high-quality forage base, bringing the animals keeping conditions closer to the natural ones, and laboratory study of the indicators of blood, urine, and milk as intermediate indicators of metabolism and of its conformity to the level and the nature of animal productivity. Among animal health criteria, one should consider the state of the immune system, which due to its sensitivity, may act as an indicator of the effect of various anthropogenic factors and ecological state on the organism.*

*Keywords***:** *cattle, health status, evaluation criteria, research, recommendations.*

I. INTRODUCTION

The system of animal populations' health diagnostics and correction in various geobiocoenoses includes assessment of the livestock populations. With that, the age, the sex, the ethological structure, the fertility, the mortality, and other indicators that show the reaction of this group to the effect of pathogenic geochemical factors [1] are determined.

It is known that in many regions of the country, the ecological situation is complicated and results in various pathologies and causes changes in the structure and functions of many organs and systems, and decreases the reproductive ability of cattle [2, 3].

The subclinical or preclinical stage is common for many diseases. With that, a significant role is played by the pathogenic factors that have a gradual long-lasting effect. Timely detection and removing of these factors and the disruptions caused by them mean restoring the health and preventing the reduction of animal productivity.

The biochemical status of the cattle, being the main variety of farm animals, has been studied by many Russian and foreign scientists. The main areas of this scientific activity are determining the normative values, the age, the breed, the physiological and sexual differences between the animals [4 – 8]. One of the most sensitive systems of an animal organism to the adverse environmental factors is the immune system, which, due to its sensitivity, may act as an indicator of the effect of various anthropogenic factors and environmental distress on the organism [9]. The above examples indicate both the broad spectrum of the research, and, unfortunately, the contradictory nature of the results obtained. This is due to using methods and tools of different precision and "routine" methods of chemical analysis of individual components of animal substrates. This research was aimed at studying the scientific data, performing research and determination of the criteria for assessing the health status of animals on the example of cattle.

II. OBJECTS AND PROPOSED METHODOLOGY

Reaching this aim was planned at base farms of the Novosibirsk region in three stages:

Stage 1 (January – May 2018). Creating the Assessment of Animals Health Status Laboratory. Generalization of the scientific data and development of the criteria for assessing cattle health status.

Stage 2 (June – November 2018). Assessing the effect of the biogeocoenosis state criteria, of the influence of feeding factors, keeping, and exploitation on cattle health. Studying the parameters of clinical and hematologic status.

Stage 3 (November 2018 – March 2019). Determination of the importance of criteria and development of recommendations for assessment of cattle health status.

Assessment of the biogeocoenosis status criteria, production indicators, keeping conditions and animal health was performed according to the scheme improved by the authors [10]. Biochemical and immunological (humoral) studies of blood and blood serum of cattle were performed using Infrapid-61 spectrum analyzer in accordance with the methodological recommendations [11]. All data were statistically processed.

III. RESULT ANALYSIS

Implementation of Stage 1. It has been found that the problem of animals "health" and "disease" have been of interest for the scientific community and practitioners for a long time. In studying the results of disparate research studies, it has been found that even small deviations in the state of animal health result in a significant shortage of products or reduction of its quality. Particularly large negative effects are caused by the unimportant at first glance non-contagious diseases rather than by threatening infectious diseases.

It has been calculated that the economic loss from the diseases caused by metabolic disorders is much higher than the loss caused by all infectious diseases together. Such animals remain ill for a long time, the disease manifests itself in non-specific symptoms, often remains overlooked, and sick animals meanwhile decrease their productivity and produce a low-quality product.

The animal health status is constantly changing under the influence of internal and external factors. Health is understood not as something fixed, but as the dynamic state of the animal, which is associated with development, performing certain functions, while maintaining the biological, chemical, physical processes in the organism within the norm limits and the maximum life duration.

Under the influence of any factor, the organism reacts as a single entity, speeding up or slowing down its functions, the speed of physicochemical processes, and metabolism. Such changes are quite natural, and the indicators of the overall state of the organism remain within certain limits, which are called the norm limits. They serve as the criteria for assessing the animal status; indicators in excess of the norm limit usually indicate a disease.

However, the onset of the disease does not always result in the excess of the indicators outside the norm. The body is able to self-regulate the internal processes, to engage additional mechanisms for equalizing the unbalance and bringing it back to the norm. By providing timely help to such an animal, the disturbed balance of internal processes may be restored.

Depending on the strength and the duration of the effect of the external factors, the organism engages and disengages various protection mechanisms. If the environmental factors are too strong or last for a long time, the defensive forces of the organism become depleted. It is therefore important to create the conditions that reduce the effect of negative and extreme factors of the environment.

Knowledge of the regularities of the physiological processes in the organism makes it possible, by changing the environment, to support the functions of an animal within the norm, to maintain its health, and to create healthy productive herds.

Implementation of Stage 2. It has been found that metabolic disruptions and diseases manifest themselves in various forms, with various characteristics. Some of them are easy to determine during a clinical study of the animals – by inspection, palpation, percussion, and auscultation. Other symptoms are difficult to identify this way. Diseases are often manifested in the subclinical, latent form. Their identification requires special methods of diagnosis, for example, biochemical and immunological methods.

Overall diagnosis of the metabolism is started with analyzing the structure of the fodder crop rotations and the fertility level, and the ratio of legumes and cereals to the root crops. Precise diagnosis requires knowing the quality of forage and its nutritional value by the following criteria: digestible protein per one fodder unit, digestible carbohydrates per one fodder unit, calcium, phosphorus and main elements, carotene, fiber and nitrogen-free extractive substances, the percentages ratio of lactic, acetic and butyric acids in the silage, mold fungi, etc. The overall state of a herd of dairy cows is studied most carefully, starting with the syndromatics and the physiological-clinical parameters.

Syndromatics of clinically healthy herds refers to the most important objective indicators that indicate metabolic disorders. These include:

– milk productivity for the herd over several months and years;

– weight gain by animals over months and years;

– body weight gain over weeks, months, during stud-bulls fattening;

– infertility in the herd, increasing the period from calving to fruitful insemination;

– calves body weight at birth (reduction by 10 – 12 kg is the indicator of metabolic disorders in mother cows);

– dyspepsia in calves during the first 1 – 3 days after birth (profound metabolic disorders in mother cows that have resulted in fetus intoxication);

– reduced amount of ejaculate, number of male germ cells, their motility, necrospermia;

– increased acidity of fresh milk and the appearance of ketone bodies in it;

– presence of mastitis, endometritis, and a tendency to their increasing; and

– increasing the self-cost of dairy products, high cost of fodder.

The clinical status of a herd is established monthly by the examination of all animals. With that, the following indicators are considered:

– fatness (average, when the last four ribs are visible on the left and on the right);

– the state of hair cover (dull and rumpled hair is typical for metabolism pathology);

– the state of coronet (dull glaze, hooves jam indicate disruption of vitamin metabolism); and

– getting up and walking (pain when standing up, joints cracking when walking, lordosis or scoliosis, bones weakness, reduction of the support area indicate pathology in the metabolism).

For the complete and deep study, reference (model) groups of 10 – 12 animals are formed: the first group includes cows in the first half of the lactation period, the second group includes cows in the second half of lactation, the third group includes non-milking cows, and the fourth group includes heifers.

Clinical experience and scientific studies show that irreversible structural changes do not develop immediately. They are preceded by a more or less prolonged period of the pre-disease status. This period is dominated by functional abnormalities that are barely noticeable during clinical observations and have the nature of quantitative shifts.

Protein metabolism disorders are accompanied by disruptions in the carbohydrate, lipid, vitamin, mineral metabolism, and in the defense mechanisms. Immunogenesis and natural resistance of animals are determined by the functions of proteins in specialized organs and tissues. Therefore, upon disruptions in the metabolism, the immune system is unable to efficiently protect the organism from potentially pathogenic agents.

For the integral assessment of cattle biochemical status, performing research using the methods that allow determining the largest number of components of the substrate is most interesting. An example of this method is comparative spectrometry.

The preferableness of using this method of studying the substrates of animals is associated with the possibility of simultaneous determination of the concentration of many components with the accuracy equal to that of standard methods, the absence of the necessity to use reactants and chemicals (the use of native samples of materials for analysis), non-adhesiveness of the method (material sample is not damaged), and, what is important, with the relative inexpensiveness of this method.

In this regard, the use of comparative spectrum analyzers, for example, Infrapid-61, for large-scale "screening" studies for assessing the biochemical status is promising and has practical and scientific importance.

Implementation of Stage 3. By the results of the work, the authors have developed and presented recommendations for assessing the health status of cattle.

The highlights of these recommendations are the following:

1. Metabolic diseases cause the most economic damage to livestock breeding. Countries with developed cattle breeding pay increasing attention to development and improvement of the methodological, organizational and methodical bases of monitoring the metabolism, especially during the most hectic periods of the physiological cycle.

2. In the Russian Federation, the methodological basis of preventive measures includes clinical examination, creating biologically full-fledged and high-quality forage base, bringing the animals keeping conditions closer to the natural ones, and laboratory study of the indicators of blood, urine, and milk as intermediate indicators of metabolism and of its conformity to the level and the nature of animal productivity.

3. To identify possible differences in the biochemical composition of the blood of healthy and ill animals, one should consider the informative value of these indicators, use more accurate measurement methods, and minimize their costs.

4. Among animal health criteria, one should consider the state of the immune system, which due to its sensitivity, may act as an indicator of the effect of various anthropogenic factors and ecological state on the organism.

IV. CONCLUSION

The veterinary-sanitary welfare of cattle-breeding complexes and farms largely depends on the system of breeding, growing and keeping technologies. With that, animals can fully implement their productive, reproductive, and adaptive abilities only when the following conditions are met:

– organization of animals breeding and keeping with regard to the main periods of forming the morphophysiological functions in the organism, correction of non-specific resistance of the organism during critical periods of growth and development;

– introduction of industrial technologies (technical, technological and organizational solutions) in growing, keeping and exploitation of the animals, aimed at promoting or maintaining the natural resistance of animal organisms at a sufficiently high physiological level, removing the factors that affect the physiological state, and ensuring manifestation of the phylogenetic capabilities of animal organisms;

– improving herds at breeding complexes and farms with the aim of improving the natural resistance of animals and the utmost satisfaction of the requirements of modern industrial technologies through livestock breeding and selection;

– optimization of the environmental and growing conditions, depending on the age and particularities of formation of functional systems in animal organisms;

– creating an adaptive system of animal feeding for stimulating in various growth and development stages of those functional systems that ensure the manifestation of natural resistance and the maximum productive ability of the organism; and

– organization of a controlled and tightly managed technology in compliance with the veterinary and sanitary rules and norms, and systematic objective monitoring of animal health.

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