Genetic identification of beef and dairy cattle breeds in five regions of Russia

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Introduction

The primary documentation in breeding farms is kept electronically in the form of Selex databases (Plinor Ltd). When filling out the database with primary cattle accounting data, errors inevitably occur, the magnitude of which is not always known. In order to identify these errors, the relationship between cattle is determined mainly using immunogenetic and DNA analysis (microsatellite loci). As part of the research process for determining the relationship is carried out by STR and SNP genotyping. The commercial assays of companies of the Institute L.K. Ernst (VIZ, Ministry of Education), Gordiz (Skolkovo), VNIIPLEM (Ministry of Agriculture), Termo Fisher were used for genotyping. There are a number of regional laboratories that use the methodology of Gordiz Ltd. and VNIIPLEM. Only the last three tests are designed according to ISAG rules. VIZ uses its own genetic testing algorithm. Therefore, the harmonization of the method of determining the relationship and bringing the methods of data acquisition, storage and processing, determining the relationship of animals are the main tasks before determining the breeding value (EBV) (from 2018).

Materials and methods

According to national rules for parentage testing, genetic identification is used to genotype 10% of the total breeding stock by analyzing of 11-15 microsatellite loci (BM1818, BM1824, BM2113, CSRM60, CSSM66, ETH10, ETH225, ETH3, ILSTS006, INRA023, SPS115, TGL0 , TGLA122, TGLA126, TGLA227) (ISAG). The genetic identification of cattle was carried out on a total of 8483 animals in the Moscow, Arkhangelsk (N = 150), Tyumen (N = 2091), Novosibirsk (N = 6179) and Yaroslavl (N = 63) regions. The Yaroslavl, Kholmogorsky, Holstein, Black and White, Salers, Aubrac, Aberdeen-Angus, Hereford breeds participated in the parentage testing. The panel of microsatellite loci was developed and jointly tested by Grodno state University and CMSCH, which was already certified according to the ISAG standard for cattle genotyping.

Results and discussions

The causes of errors in the primary registration of cattle are unintentional errors in the recording of the birth or purchase of an animal, and deliberate distortions. In the latter case, an error occurs when the data provided in the report is distorted. In this case, the breeding farm examines the livestock to determine kinship in a larger quantity of individuals (triples), and provides data that are correct in a predetermined amount. In this case, we cannot estimate the magnitude of the errors encountered, but we assume them based on our practice.

In breeding farms, the conditional range of errors of primary accounting of relationships is 5-30%, and in ordinary farms it can reach up to 45%. During genetic testing, in view of the intentional error described above, in the breeding farms revealed an overly low value error in determining the relationship from 0 (0-3) to 11% for the Holstein and up to 7% for the Black-and-White breeds. For other milk cattle breeds the error was 15-45%. When determining the relationship between meat cattle the error was 30-45% and higher.

The genotyping errors to ISAG values of Ngr, Ger, Aga, and Rga was 168-341, 0-172, 0.63-0.99, respectively. The high variance of the obtained error data is due to the application of tests from different manufacturers on the same breed at the same time.

Currently, only the commercial private company Gordiz Ltd has received the certificate of conformity ISAG and ISO in Russia. In Russia there are no laws requiring the conduct of quality control analyzes and cross-checks. The most accurate analysis is provided by laboratories that use @Gordiz, @VNIIplem and @Termo reagents.

The only thing that can be done to improve this situation is to create a network of independent and non-profit laboratories that are independent and loyal to the Ministry of Agriculture. These laboratories must adhere to ISAG / ICAR / ISO standards and pass international and national quality system audits.

Unfortunately, according to the law, immunogenetic parentage testing of livestock is still the predominant testing method. At this time, the genotyping databases for microsatellite loci and SNP chips are in the hands of commercial companies (Ministry of Education and Science and Skoltechh) and are a trade secret.

Conclusion

Currently in Russia in the field of animal genetic identification, ICAR / ISAG / ISO standards are being introduced. It is planned to implement these standards to breeding work with breeding cattle and when selling animals. Implementation of open databases on animal genotyping is needed.

During testing, an artificially low level of identification error was revealed. It is necessary to work on the elimination of errors with the use of international quality standards and regulations.

The National Research Center for Breeding (VNIIplem) receives and collects data on genotyping of livestock and organizes the receipt of these data in accordance with the part international standard ISAG / ICAR since 2018. The experts of VNIIPLEM starts to follow ICAR guidelines when developing methods for collecting productivity data and assessing breeding value.

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