Impact of multiple ovulation and embryo transfer on genetic gain and diversity in dairy cattle

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Anna-Charlotte Doublet[1,2]*, Gwendal Restoux[1], Sébastien Fritz[1,2], Alexis Michenet[1,2], Chris Hozé[1,2], Denis Laloë[1], Pascal Croiseau[1]

[1]GABI, INRA, AgroParisTech, Université Paris-Saclay, 78350 Jouy-en-Josas, France

[2]ALLICE, Paris, France

*corresponding author: anna-charlotte.doublet@inra.fr

With the beginning of genomic selection, annual genetic gain increased in major French dairy cattle breeds. In some breeds, it was linked with an increase of annual loss of genetic diversity. Yet, a loss of genetic diversity can have detrimental economic effects due to inbreeding depression and loss of adaptive potential.

The recent spread of new technologies such as multiple ovulation and embryo transfer might increase selection intensity on dams of bulls. Consequently, the use of these technologies presents a risk for genetic diversity and should be managed carefully to ensure the sustainability of breeding schemes in the future while maintaining acceptable levels of genetic gains.

The impact of the use of embryo transfer and multiple ovulation on genetic gain and genetic diversity was addressed by simulating different breeding schemes scenarios, based on different French dairy cattle breeds. We analyzed the impact of changes in i) the proportion of embryo-donating heifers relative to the total number of dams of bulls, ii) the number of flushes per donor heifer, iii) the proportion of pre-selected calves entering breeding station born from donor females compared to those born from dams of bulls under conventional insemination, and iv) the proportion of pre-selected calves becoming sires of bulls. We also analyzed the impact of maximum allowable thresholds of kinship within groups of donor or conventionally inseminated dams, as well as within groups of calves entering the breeding station.

The outcomes of these different scenarios in terms of genetic diversity were evaluated thanks to genomic measures of inbreeding, based on Runs of Homozygosity.

The results of these simulations will help to adapt the use of multiple ovulation and embryo transfer within selection schemes in order to make them more sustainable in terms of genetic diversity while maintaining genetic gain.