Reducing Inbreeding in Dairy Cattle by Selecting Less Related Parents of Potential AI Sires

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The use of artificial insemination (AI) and genetic selection has produced remarkable improvement in milk yield and type. However, the widespread use of bulls made possible by AI is causing the U.S. dairy cattle population to become more inbred. Because inbreeding lowers milk yield (75 to 100 pounds per lactation for every 1% increase in inbreeding), makes it difficult to get cows bred, and may increase susceptibility to disease, research is needed to find ways of reducing inbreeding. Therefore, a simulation study is being undertaken here at Iowa State University to evaluate one way of reducing the rate at which inbreeding increases.

Reducing inbreeding, as opposed to reducing the rate at which it increases, is not economically justifiable. It would require sacrificing too much genetic improvement in more economically important traits such as milk yield.

To reduce the rate at which inbreeding increases, bulls and cows that are relatively unrelated to the current AI sires can be selected to be parents of potential AI sires. Animals that are relatively unrelated to current AI sires may have lower predicted transmitting ability (PTA) for milk yield because selection for yield has increased the relatedness of AI sires. However, it may still be possible to mate these animals and produce outcross sires that have high enough PTA for yield (and other economically important traits) to make the active AI sire lineup. Although the selected parents may have low PTA for yield, the random way in which offspring inherit one-half of each parent's genes means that some could have high PTA for yield. Not all offspring will have high PTAs though. This phenomenon is known as Mendelian sampling.

The simulation study will estimate how many matings of animals with given PTAs and limited relationship to current AI sires are needed to produce bulls with PTAs that are high enough for use in AI. Results of this study will help bull studs determine how many matings are needed to produce a given number of useful outcross sires. Bull studs can then determine whether they can afford to make these matings. If outcross sires are produced by mating animals that are relatively unrelated to current AI sires, producers could slow the rate at which inbreeding increases by using these bulls in their herds.