research

Monitoring genetics to improve production and fertility in dairy cows

Targeted genetic selection could help to reduce the negative effects of inbreeding

By Dianne Priamo and Vanessa Virgo

Ontario dairy farmers commonly select animals with desired traits for breeding, but U of G researchers found that reducing a herd's genetic diversity could hamper milk production and fertility in dairy cattle.

These negative effects are known as inbreeding depression—lowered health and survival of offspring resulting from closely related parents—and were the focus of a research project by professor Christine Baes, Department of Animal Biosciences, and former PhD student Dr. Bayode Makanjuola.

"We wanted to understand the pattern of genetic diversity loss to determine whether measures should be implemented to improve animal health and efficiency," says Makanjuola.

The researchers estimated the effective population size of the current Holstein and Jersey populations to assess genetic diversity loss in Canadian dairy cattle. Their results suggested increasing rates of inbreeding, with more recent inbreeding having detrimental effects on production and fertility traits. Despite these findings, the economic gain achieved through selection still outweighed the negative effects of inbreeding.

The researchers then analyzed regions of the cow genome that indicate the level of genetic relatedness between individuals, known as runs of homozygosity (ROH), to investigate their effects on production and fertility traits in dairy cattle.

Preventing the negative effects of inbreeding depression

Researchers identified runs of homozygousity on the cow genome that were associated with negative effects on production and fertility.

By taking measures to prevent the mating of cattle with these unfavourable gene regions, farmers can reduce further adverse effects of inbreeding depression.

They were able to identify unique ROH regions with negative impacts on both production and fertility traits on nearly all 30 chromosomes (DNA structures containing the genetic material of the animal).

"Our results suggest the need to implement measures to control the rate of inbreeding, which will help to maintain genetic diversity," says Makanjuola.

The researchers believe that identifying animals possessing these unfavourable gene regions and minimizing their mating will reduce the frequency of these ROH regions in future generations. More research is needed to validate and zero in on these regions.

"By refining these identified ROH regions, selection programs could be implemented that would prevent further adverse effects of inbreeding depression," says Makanjuola.

This research was funded by the DairyGen Council of Lactanet and the Natural Sciences and Engineering Research Council of Canada.

Further information on the study can be accessed in the journal Genetics Selection Evolution. For more information, contact Dr. Christine Baes, Department of Animal Biosciences, at cbaes@uoguelph.ca.

Published by Dairy at Guelph
University of Guelph
ON N1G 2W1
dairyatguelph.ca

Written and produced by
Students Promoting Awareness of Research Knowledge (SPARK)
uoguelph.ca/research/spark

UNIVERSITY of GUELPH
IMPROVE LIFE.

DAIRY at GUELPH
CANADA'S DAIRY UNIVERSITY