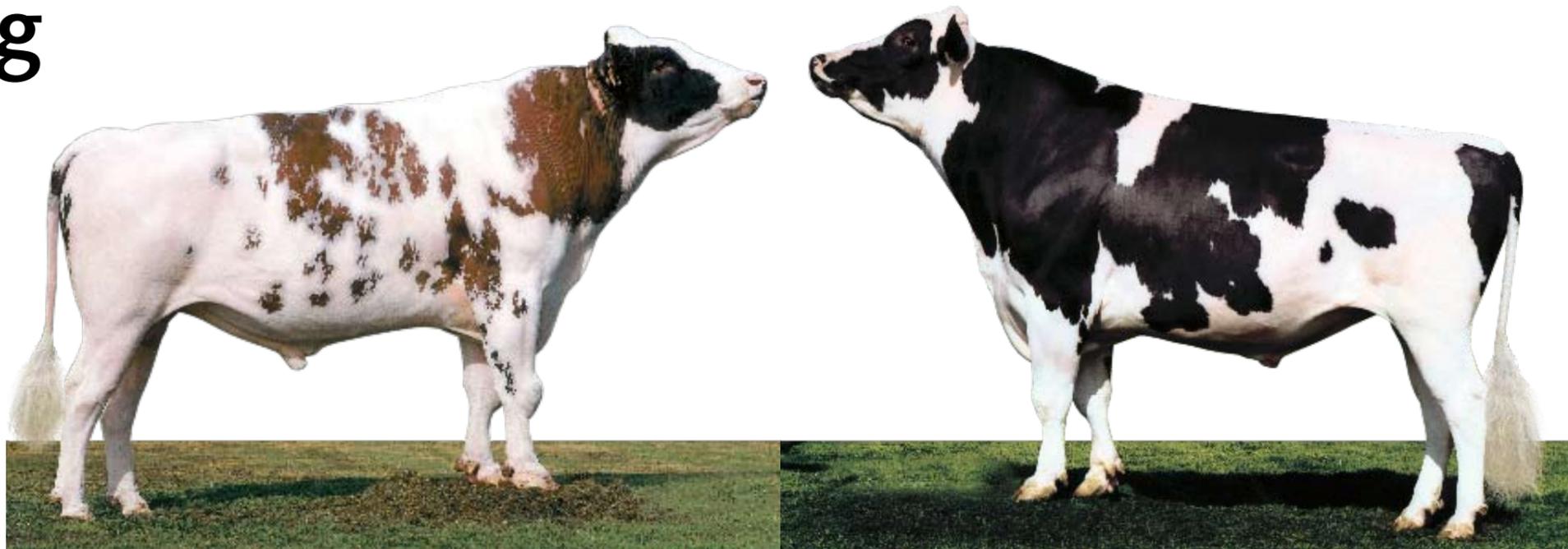


Producers can prevent close relationships by using a mating programme

No need to panic about inbreeding

Inbreeding is a hot discussion topic at the moment, now that a limited number of bulls and their sons are dominating the international indexes. But if breeding organisations keep a close eye on blood relationships then there is little cause for concern.

text Hans Siemes



Kian and his sons dominate the red-and-white indexes worldwide

Every AI stud is using O Man and his sons. This results in less diversity

In Holstein breeding OMan and his sons are now dominating the scene. Eleven sires in the top 20 of the Dutch-Flemish black-and-white sire index have OMan blood in their veins. Internationally, it is no different. The red-and-white index also teems with bulls that are related to Kian and Lightning. Inbreeding looms. Caution is required, but there is no reason to panic, according to Piter Bijma from the department of breeding and genetics at Wageningen University. "In breeding there is always a certain amount of inbreeding," he says. "That is normal and not bad in itself." The FAO, the World Food and Agriculture Organisation, maintains as normal that an average inbreeding increase of between 0.5 and 1% per generation is acceptable. Since breeding programmes in the dairy industry have a generational interval of about five years, this coincides with an increased inbreeding component of between 0.1% and 0.2% per year. If inbreeding increases more quickly, there may be problems. "We really need to watch out for mass use of OMan and his sons and grandsons, which could increase inbreeding levels by an additional 5%," says Dr Bijma.

"Then there would be a strong possibility that a genetic defect would crop up. But," he is keen to stress, "we are not there yet."

Past problems

It can go wrong. A well-known example is the bull Bell (Carlin-M Ivanhoe Bell, 1974) with descendants like BW Marshall and Durham. They were used very extensively, which resulted in a level of inbreeding with Bell that was too high. In the Netherlands it eventually resulted in a high number of bulls that were carriers of the genetic defects BLAD and CVM. CVM leads to deformed calves and BLAD causes incurable infections because the white blood cells do not function properly. Both disorders resulted in significant losses for both producers and breeding organisations. Some of the carriers were culled and others saw only limited use, but in the meantime costs were incurred in sampling these bulls as young sires. Other examples of genetic defects are smooth tongue and zinc deficiency. The possibility of a repeat 'blunder' like Bell is not that great, according to Dr Bijma. "Knowledge has improved and due to experience with, among

others, BLAD and CVM, the breeding organisations are more aware of inbreeding.

"Also, thanks to computer technology, it can be determined very quickly whether a blood relationship would become too close."

Producers can prevent this closeness by using a mating programme. Many breeding organisations offer such a program that automatically ensures that a cow is not bred to a too closely related bull.

If a programme is not available, then the producer will need to take care that they do not mate family members.

"If you go back three generations from the calf you want to breed, and you don't see any common ancestors on the paternal and the maternal side, then you are quite safe," is Dr Bijma's rule of thumb.

Limit risks

The most important parties to help limit the risks of inbreeding are the breeding organisations. Long term, the increase in inbreeding level is determined by the increased average kinship in a breed. This is largely determined by the selection of sires of sons and bull dams,

which selection is made by the breeding organisations. They are aware of the risks of relationships growing more and more close, according to Dr Bijma.

On the other hand, he sees that, driven by market demand, the breeding organisations all make use of the same group of bulls. "If everyone does this, it will lead to overuse," he says. A current example is OMan.

FAO guideline

Dr Bijma points to yet another phenomenon – the so-called effective population size of the international Holstein-Friesian breed is very small. Although world-wide there are millions of Holstein-Friesian cattle, the 'effective' number is not greater than 50 to 100 animals. This means that the inbreeding level in the Holstein-Friesian breed is equivalent to a population of 50 to 100 animals in which no selection occurs.

So in terms of an increase in inbreeding, the Holstein-Friesian is a small breed. The FAO has set the effective number of 50 as the absolute minimum for the long-term viability of a breed. The Holstein-Friesian breed just meets this FAO guideline.

In short, it is critical for breeding organisations to be mindful of too great an influence of certain bulls.

A tool to counter the negative effects of inbreeding is giving sufficient attention to functional traits like udder health, fertility, and longevity. Breeding for these traits pushes back the effects of inbreeding depression. "When breeding organisations limit kinship and use a balanced breeding goal, then the breed will not end up with problems," Dr Bijma says.

Eradicating defects

He mentions yet another aspect that will start playing a role in the future – the discovery of many more genetic defects. That coincides with the mapping of the DNA of animals, which is almost entirely known today. The characteristics of many genes can be traced.

Consequently more genetic defects will be identified, and this knowledge can be used effectively, for example, in mating programmes, to prevent carriers from being paired up.

"People think that there are only a few genetic defects, but that's not true," says Mr Bijma. "Expectations are that there are hundreds, and each animal probably

Diminished health

Inbreeding is the mating of close relatives – in other words animals that are related and have one or more ancestors in common.

Inbreeding has largely negative consequences for cattle. It leads to a loss of genetic variation, and contributes to diminished health, fertility and production, while more genetic defects will occur. The descendants are smaller and more susceptible to illnesses, and miscarriages occur more frequently. Milk production also suffers.

The inbreeding coefficient is an indication of the degree of inbreeding. For example, a calf sired by OMan and with OMan as the maternal grandsire has an inbreeding level of a quarter. This means that the calf has a 12.5% chance of a genetic defect if OMan is a carrier of that defect.

A calf with CVM



transmits one or more. Every animal has little 'mistakes' in the genome, which it receives from its parents and in turn transmits to its descendants. Through breeding, those little mistakes can be partially concealed.

"If we deal with this wisely, there is little cause for concern."

By wisely, he means that mating programs should prevent a bull with a particular defect from being mated with a cow with the same defect. The computer provides the solution here.

The expert from Wageningen indicates that the breeding industry needs to move away from the idea that there are bulls without genetic defects, and that you can eradicate genetic defects.

"The more we know and can research, the higher the number of defects that will be identified." |