

Does inbreeding present a risk to your herd?

Holstein Journal – October 2009

Inbreeding has been in the news in recent months – first when the RSPCA pointed the finger of blame for many dairy cow ills at high levels of inbreeding; and later when this summer's sire proofs became dominated by just one bull. Geneticist, Marco Winters, director of DairyCo **breeding+** has looked at the facts behind the concerns and suggests the action Holstein breeders should take.

There are a few incontrovertible facts in the inbreeding debate. And perhaps the most important is that a high level of inbreeding – or breeding between close relatives which leads to a narrowing of bloodlines – is not a good thing. It's well known that this can lead to a decline in the general 'fitness' of a population, otherwise known as 'inbreeding depression', and can also increase the occurrence of genetic defects.

But I already hear the breeders amongst you beginning to protest. After all, it's equally well-known that desirable traits can be 'fixed' by the very same process (often referred to as 'line breeding'), leading to true-breeding lines and the type of uniformity in a herd to which many breeders aspire.

So the question we must answer is where does the boundary lie? How much inbreeding is too much; is zero inbreeding either possible or desirable; how does the UK fare overall; and how do we avoid reaching the point at which we damage the national herd?

These questions have been much-debated in the farming press in recent months – first when raised by the RSPCA in connection with the health and fitness of the Holstein breed and more recently when one bull (O-Bee Manfred Justice) dominated the PLI (Profitable Lifetime Index) rankings. Here, he accounted for eight of the top 10 bulls, leading many journalists to ask whether bloodlines were becoming too narrow.

Our job at DairyCo **breeding+** is to keep a close eye on the situation and monitor inbreeding levels across the national herd - which we have been doing for many years - so that we can gauge whether the concerns have any foundation.

And our most recent evidence suggests they do not – at least, with some provisos. The most up-to-date ancestry records reveal that the youngest heifers milking in the national herd have an average inbreeding level of 3.5 percent. This is somewhat higher than the older cows (so the situation is getting worse) but considerably lower than the average Holstein in North America, where the level of inbreeding is now over five percent (see graph).

At this level, North American breeders should unquestionably be more concerned, as it is widely accepted that when inbreeding reaches high levels it will unacceptably compromise animal performance and fitness.

But precisely the point at which the compromises become unacceptable is difficult to quantify and open to debate. Established research has estimated that for every percentage increase in inbreeding, around 15kg milk will be lost per

lactation and 0.4 days will be added to calving interval. This has led to a (somewhat arbitrary) threshold of 6.25 percent inbreeding being regularly quoted as the point not to cross.

Here in the UK, our more favourable position stems in part from our base of British Friesian bloodlines (kept pure for many years when imports were restricted) and, perhaps paradoxically, the subsequent opening of our markets to a wide assortment of Holstein bloodlines from almost every country in the developed dairying world, from the late 1980s onwards.

Today, the UK's national black and white milking herd as a whole (all ages) stands close to three percent – a level which gives us little cause for concern. But there is categorically no room for complacency, as around this average there are many individual animals whose inbreeding levels are far too high; (most herds have at least one cow which exceeds the 6.25 percent threshold); and the trend as a whole is most definitely in an upward direction.

In fact, if current trends continue, the UK's average inbreeding level will increase by about one percent every six years, at which rate it will only be 16 years before we reach the threshold of 6.25 percent.

So what practical action can be taken to ensure we don't reach this position?

Perhaps most fundamental of all is to keep impeccable breeding records.

Members of Holstein UK have a head start in this respect as the very act of registering their herd ensures their bloodlines are recorded for posterity.

But then they need to go further. They not only need to trawl the sire proofs for those with the genetic qualities they desire (such as high Profitable Lifetime Index; high type; high production or good management and fitness qualities), but they must then study the pedigrees to ensure the bloodlines they choose won't unacceptably raise inbreeding in their herd.

This can be a fairly complicated process, so I would urge every breeder to consider the simple alternative to the time-consuming and manual approach. This involves using a computer mating program – such as that offered by Holstein UK or several of the AI companies - which specifies a level of inbreeding for every suggested mating. Avoid any which raise the level beyond 6.25 percent, and for cows which have already reached this point, choose an outcross bloodline which will bring this level back down.

For those who are keen to review their whole herd's position, there is also the availability of the DairyCo **breeding+** Herd Genetic Report. This is free to all milk recording producers and states the level of inbreeding for every animal as well as the level for the whole herd.

And for those who prefer to approach the issue without the use of computers, the table below may be of some help in determining the suitability of a proposed mating.

Inbreeding levels	
Mating	Inbreeding %
Sire/daughter	25
Full brother/full sister	25
Half brother/half sister	12.5
Grandsire/granddaughter	12.5
Grandson/grandam	12.5
Uncle/niece	6.25
Son/granddaughter	6.25
Daughter/grandson	6.25
Full cousins	6.25

Grandson/granddaughter	3.13
Half cousins	3.13

Clearly the table suggests that aspiring to zero inbreeding is unrealistic, and it's worth pointing out that it's probably also undesirable as it is widely felt that slight losses from low levels of inbreeding are more than offset by the genetic gain which can potentially be made by using good bloodlines.

This has been brought into sharp focus in recent months, since sons of O-Man – as well as the bull himself – have begun to feature so strongly amongst the top PLI sires. I've been asked on numerous occasions since the last proof run, whether the use of this bull and his sons will lead to unacceptable levels of inbreeding. And my answer remains that if the principles discussed in this article are adhered to, there is no reason why it should.

O-Man has reached the position he has through his tendency to transmit high volumes of milk, without compromising essential fitness traits - and it is precisely these qualities which the profit-driven milk producer needs. And since neither the bull himself, nor his sire (Manfred) nor maternal grandsire (Elton) were widely used in the UK, there remains plenty of scope for O-Man bloodlines to be used without inbreeding concerns. In fact, with almost every British AI company marketing an O-Man son - which descend from a wide variety of maternal lines - I'd argue that the UK's position to use these bloodlines should be grasped.

For those who have different breeding objectives, there remain many excellent bulls within the top 100 PLI list, which represent offspring of 50 different sires. So whatever your breeding priorities, there's really no need to concentrate on only a few related bloodlines, and if you can choose an outcross pedigree (and there will be plenty of these without resorting to crossbreeding), so much the better for your herd.

To register for a free Herd Genetic Report, please call DairyCo on 02476 692051 or visit www.dairyco.org.uk.

Graph title:

Inbreeding trends in the black and white dairy cattle population in the UK, Canada and the USA

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Source: DairyCo **breeding+**. UK data supplied by Holstein UK and milk records organisations, NMR, CIS, and UDF. Canadian data from Canadian Dairy Network (CDN) 2008 (<http://www.cdn.ca>); US data from Animal Improvement Programs Laboratory (AIPL USDA) 2009 (<http://www.aipl.arsusda.gov/>).