Crossbreeding

Holsteins have been bred to produce a pure bred, which has a high productivity level. However overtime genetic selection for fewer sires has reduced the gene pool and lead to inbreeding, reducing the cows overall productivity. Crossbreeding offers an alternative solution for those wishing to use a number of breeds to increase genetic variation and obtain benefits of hybrid vigour.

Hybrid Vigour

Hybrid vigour is a genetic gain that comes from crossbreeding. Crossbreeding results in the combination of genes from different breeds, the genes from one breed enable the expression of beneficial genes from another breed. Crossbreeding is really the opposite of inbreeding depression and is associated with an improvement in milk production, fertility, productive life and calf survival.

Hybrid vigour is measured as the difference of the crossbred from the average of the parent breeds, and is expressed as a percentage.

e.g.

Holstein = 720kg fat per lactation
Jersey = 600kg fat per lactation
Holstein x Jersey = 693kg fat per lactation

= 5% hybrid vigour (33kg advantage over parent, average of 660kg)

Estimates vary but in general we expect 5-7% hybrid vigour for milk production traits and 8-10% for health and fertility traits.

Advantages

- Fertility can be improved by 10% from crossbreeding. Inbreeding increases the chances of non-viable embryos being formed.
- The quality of milk produced consists of more solids than a pure bred, which is being demanded for by dairies.
- The health of the cow generally improves, making the cow more resistant to diseases such as mastitis as the complement of genes provides more resistance.
- The increased resistance makes crossbred cows more appealing to organic farmers as the regulations become more stringent on the treatments they can use.
- There is a vast selection of breeds, which enables farmers to pick which ones would be best suited to the conditions and the desired characteristics.

Disadvantages

- The value of stock instantly falls with crossbreeding, as they are no longer purebred.
- The best number of breeds to cross is three. If two breeds are used the long-term impacts of hybrid vigour will be limited as the gene pool is not widened much further. If four breeds are used it may reduce the amount of impact one breed can have on the daughters and makes the breeding system very complex.
- For the hybrid vigour to improve the sire used must have an excellent progeny for the production to improve, otherwise the effects are likely to be minimal.

What Breed?

The majority of farmers choose to crossbreed using Holsteins as a base and crossing with a breed depending on the desired characteristics. Many breeds should be considered to crossbreed as they all have alternative beneficial traits. The breeds used should be chosen to suit the individual farm environments and needs.

The main breeds used to crossbreed include Jerseys, Montbeliardes, British Friesian and Swedish Reds. **Jerseys** offer a medium sized daughter with good components and are excellent for a crossbreeding programme. **Montbeliardes** are selected for their milk and protein production, with very good beef production. **British Friesians** are used to moderate dairy form with good fertility, high components, longevity and good beef production. **Swedish Reds** are excellent for a breeding programme with high fertility, good calving ease and health traits, including good mastitis resistance.

Although crossbreeding is used to increase hybrid vigour it is important to choose the best sires of the breed to enhance the genetic pool. If a sire is selected with a poor genetic merit there would be little or no impact on the hybrid vigour of the daughter, therefore not improving overall profitability.

What about the next Generation?

Crossbreeding will increase hybrid vigour by 5% or more, but the lasting impact will depend on the number of breeds being used. For example, using just two breeds will dilute the amount of beneficial genes available after the second cross, therefore reducing the amount of hybrid vigour. By crossing three or four breeds the amount of hybrid vigour lost whilst crossing will decrease as there are more genes available.

Hybrid vigour retained by crossing:

- 67% retained by two breeds alternating
- 86% retained by three breeds alternating
- 94% retained by four breeds alternating

However by using more breeds the breeding pattern becomes more complex, therefore management becomes increasingly more difficult.

Crossbreeding usually combines three different breeds to achieve the best results. The affects of the first cross can be seen instantly in the daughter (F1 generation), showing high fertility and good health. The F1 generation is then crossed with a third breed to produce a further daughter, which has the beneficial characteristics of three breeds. The crossbreeding pattern needs to be managed to ensure performance, depending on the management style and the desired characteristic wanting to improve.

Cross Breeding Research

Below are the results of a number of Cross Breeding Trials, which highlights the likely impact.

Trait	Holstein	Normande x Holstein	Montebeliarde x Holstein	Scandinavian x Holstein
Cows	294	171	194	120
Milk (kg)	31,8	28,6	31,0	33,3
Fat (kg)	1,10	1,01	1,10	1,17
Protein (kg)	0,94	0,89	0,95	1,01
SCS (SCC)	2,13 (55 000)	2,40 (66 000)	2,33 (63 000)	1,88 (46 200)
Fat+protein	2,03	1,90	2,05	2,18
% of Holstein		-6%	+1%	+7%

Source: B.J. Heins*, L.B. Hansen, and A.J. Seykora, University of Minnesota, St. Paul

Breed	**Milk kg**	**%Fat**	**%Prot**	**SCC**	**No.**	
S.Red x Holstein		24.2	4.49	3.5	100	35
NZ Friesian x Holstein	22.8	4.44	3.5	174	26	
Holstein		25.3	4.15	3.39	150	70

Source: Gavin Fowler, North Devon