

Why Crossbreeding?

Growing up in France, I witnessed successive waves of invading dairy genetics sweeping our countryside. First, the Dutch Friesian and later, the Holstein provided prime examples of how one breed replaced another, by crossing and then progressive absorption of the various local breeds. During those years there were plenty of first-generation cross cows to look at, and they were extraordinary specimens.

Crossbreeding makes sense to me. I continue to believe every commercial dairy, grazing or conventional, should crossbreed. You gain the potential benefits of hybrid vigor, or heterosis, and you introduce genetics that are likely to be more functional and, for graziers, better adapted to low-input systems.

Dairy's inbreeding problem

Heterosis is basically the health effect you can expect when breeding two genetically distinct individuals. The first big benefit of crossbreeding is that it eliminates the unhealthy effects of inbreeding.

Inbreeding is known first and foremost for depleting fertility and other functional traits. Haplotypes (groups of genes) discovered in Holstein, Jersey and Brown Swiss are believed to cause embryonic or fetal death when present in homozygous (identical for the same trait) form, resulting in a greater number of days open and lower conception rates.

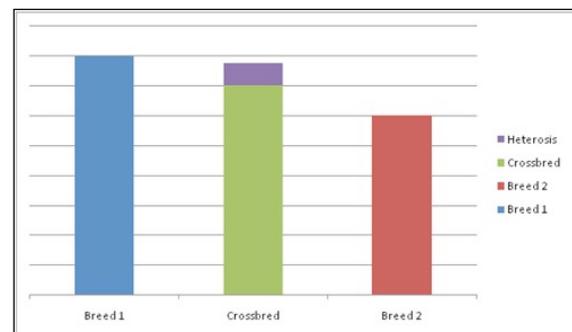
Studies have also shown that resistance to therapy is affected by inbreeding, resulting in greater susceptibility to diseases and diminished longevity. Finally, research indicates that production decreases with inbreeding to the point of erasing genetic progress from selection.

Dairy inbreeding as measured by the percentage of genes deriving from the same ancestor has increased dramatically in recent years. For the Holstein female population, the percentages have risen from 2.5% in 1990 to 6.1% in 2013, or an average of 0.1% per year over the past decade. This pace has doubled recently to 0.2%, apparently due to the advent of genomics. Geneticists consider 6.25% to be the threshold for health and fertility issues. The genetic relationship to the breed of some of the top bulls is mindboggling: Elevation and Blackstar are 14%, O-Man and Aerostar 16%, and Shottle 18.2%.

At 7.2% inbreeding, the Jersey situation is even worse, although the recent introductions of Danish bloodlines have slowed the pace of increase. But the Jersey is also seeing inbreeding pressure due to genomics, with the bull Duncan at 22% genetic relationship. And the Brown Swiss stands at 6.8%, with a faster acceleration than any other breed. Jetway is the predominant Brown Swiss bull, at 18.2%.

Heterosis provides an effect opposite that of inbreeding depression. With crossbreeding, at each location on the pairs of chromosomes the two genes are much less likely to be identical. Genetic recessives are thus not expressed. This fact alone makes a very good case for crossbreeding. But the benefits don't stop there.

Heterosis also delivers a definite performance increase. Whether this is due solely to the decrease in double recessives or a synergy created by a combination of different genes — or both — is not currently known. While this increase may not be easy to measure accurately, older studies say it should provide a boost of 5% for production and at least 10% for longevity, fertility, calf vitality and other health traits compared to what would be expected within the two parent breeds.



While theory would suggest relatively modest gains in the moderate to highly heritable traits such as production, actual crossbreeding experience suggests higher numbers. The latest studies out of California

and Minnesota indicate greater increases in milk than previously thought, with recent crossbreeds milking as much as pure Holsteins in conventional operations. If confirmed, these results suggest a shift in our crossbreeding approach for production. However, final numbers depend heavily on the type of crossbreeding.

The experience of commercial pig, beef and sheep producers is also often invoked as an example of the economic benefits of crossbreeding, as they have been using this technique for decades. Most of their crossbreeding schemes involve the existence of a terminal cross. That cross is usually done between purebred male with great finishing qualities and a hybrid female with great maternal qualities. This cross being final, there is no rotation unlike the dairy crossbreeding model. However, the female line used in the swine industry offers is the result of a cross, historically Yorkshire x Landrace. But lately, the trend has been an expansion of the gene pools used: European breeders have reached out to China for the high fertility genes of the Meishan breed and lean now towards a 4 way cross on the female side.

Three-way cross minimum

Maximizing this heterosis tool requires a diversity of gene sources over multiple generations, which is why you definitely need to continue crossbreeding beyond the second generation.

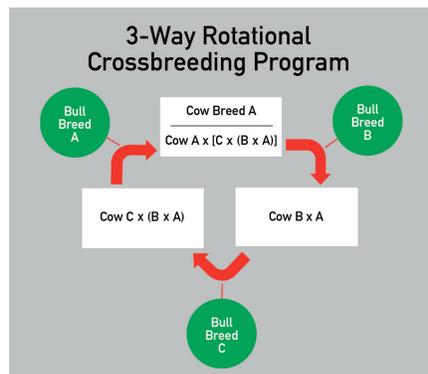
A first cross between two different breeds will always achieve 100% of the potential heterosis effect. Crossbreeding the resulting F1 a third breed will also result in 100% heterosis, and any subsequent breed will have the same effect as long as a new breed is used each time. However, as shown in the accompanying table, reintroducing the original breed will reduce the heterosis percentage.

To benefit continuously from crossbreeding, it is important to maintain at least 75% of full heterosis for each generation. Two-breed “crisscrossing” causes heterosis to dip as low as 50% in the second generation and surpass 69% only once throughout subsequent crosses. This probably explains the common perception that while the first cross is “good,” the second is “not good.” Conversely, going from two breeds to three dramatically increases the heterosis percentage for all generations. Going to four breeds brings another boost, although the gain is not as significant.

| Generation | 2 breeds | 3 breeds | 4 breeds |
|-----------------|----------|----------|----------|
| ----- (%) ----- | | | |
| 1 | 100 | 100 | 100 |
| 2 | 50 | 100 | 100 |
| 3 | 75 | 75 | 100 |
| 4 | 63 | 88 | 88 |
| 5 | 69 | 88 | 94 |
| 6 | 66 | 84 | 94 |
| 7 | 67 | 86 | 94 |
| 8 | 67 | 86 | 93 |
| 9 | 67 | 86 | 93 |

So if you decide to cross, the heterosis numbers are telling you to go at least three-way in order to reap the full benefits.

Be sure to keep your breeds as distinct as possible, too, either through genetic distance or by selecting complementary traits, as with combining “strength” breeds and more “dairy” breeds. In addition to boosting heterosis by being different from the more dairy breeds, strength breeds provide hardiness, fertility, and body condition to dairy genetics that have become too frail. Those who feed no grain may opt for a plurality of the strength breeds to ensure enough muscle to sustain the herd with low-energy inputs.



Rotational crossbreeding opens up many possibilities, allowing each dairy to structure a program to meet specific needs. For graziers seeking medium-size cows, it’s possible to establish a crossbreeding sequence in which bigger breeds follow smaller ones. Jersey can be included in the rotation for smaller size and components. Montbeliarde and Fleckvieh are the largest, Scandinavian Reds are more mid-size and the Normande is intermediate. Choosing low-stature bulls greatly helps to mitigate size and produce the medium-size cows that most graziers prefer.

So pick your breeds. Start your rotation. The slow nature of the cattle cycle gives you plenty of time to adjust and make changes, but it’s very important to start on this path with a sense of direction and

commitment to a rotation. Purebred breeding may still be the favored route for some, as there are always plenty of reasons for pursuing that approach. Benefiting from the added value and branding qualities could be some for the Normande, as well as becoming a seedstock producer.

Yet every commercial dairy farmer should seriously consider crossbreeding. As I tell people who stop by my booth at trade shows, please, do it for you, do it for your herd and do it for everyone's future. Even if you do not select the specific genetics I promote, for the good of all — your cows and you — please start crossbreeding.

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The case for using “strength breeds” in your crossbreeding program

Beef value is steadily rising in the United States, world-wide demand is not abating and grassfed is the hottest trend in beef. These indicators add up to a great opportunity for grazing dairy farmers, provided you have the right genetics.

No question, finishing cattle on grass in a short amount of time is not easy, especially if you aren't feeding any grain. Most cattle, including the so-called early maturing breeds, do not develop quality marbling and tenderness until two to four years of age, and slow growth is always preferable for taste.

In France, as in most European countries where all implants are banned, cull cows (both dairy and beef) constitute a huge share of the total beef consumed, including prime cuts. The United States has nearly four beef cows for every dairy cow. France, the United Kingdom and Ireland show a 1-to-1 ratio of beef cows to dairy cows, and most of the other European countries have no beef herds of any size.

While a number of males are finished in feedlots on corn silage (corn-only rations are rare in Europe), this type of production is considered lower quality, destined for low-end markets. Most prime beef in Europe comes from cull cows, and the majority are either beef or dual-purpose dairy cows. Holsteins are designated for lower-end markets.

In some cases, as with the Normande breed in France, a high-quality, breed-based label guarantees breeders a premium price provided they meet specific production criteria that include a minimum of six months of grazing per year, non-GMO feed, minimal grain finishing, cows harvested at less than eight years of age, and 14 days minimum dry aging. While the Normande is highly regarded for its marbling — possibly second only to the Angus — the Montbeliarde and the Fleckvieh also benefit from similar programs. Beef income for some of these dairies may reach 30% of total revenue.

Traditionally in the United States, even beef cull cows are not considered prime beef, and thus tend to be underestimated. Yet even here it's well known that good cull cows make good steaks.

Grassfed dairy's place

Given the rising demand for grassfed beef, with a large portion even being imported, it makes sense that U.S. producers are jumping on this opportunity. Organic Valley is developing a cull cow program, and there are many opportunities to market good quality cull cows for a premium.

For those not interested in direct marketing, it's only a question of time before some type of premium labels are set in place.

Adding “strength” to your breeding program has been shown to improve health traits and fertility due to better body condition. In the future, it is increasingly likely that adding muscling to your dairy herd will provide even more income through sales of bull calves and cull cows at no additional cost and with no extra work.