Can alternative breeds and crossbreeding deliver robustness?

Robust cows which get in-calf easily at the time required, which produce milk efficiently within the production system in place, and which have few health problems and survive over multiple lactations, are key to profitable dairy farming. The previous article in this series highlighted how Profitable Lifetime Index (PLI) can be used to select sires which transmit both 'functional' and 'production' traits, and provided evidence that the increasing use of PLI has started to reverse some of the downward fertility trends previously observed within the Holstein breed. However, other breeds may offer opportunities to introduce 'robustness' traits into dairy herds, either through 'crossbreeding' or 'breed substitution'. These two approaches have recently been examined within DARD and AgriSearch co-funded research programmes which were led by scientists from AFBI Hillsborough. One of the greatest strengths of these research programmes is the fact that part of the research was undertaken on local dairy farms, while more detailed measurements were conducted at Hillsborough. Some of the key outcomes and practical conclusions from these studies are presented within this article which has been prepared by Conrad Ferris from AFBI Hillsborough.

Crossbreeding:

The AFBI crossbreeding research programme focused primarily on the role of Jersey sires within crossbreeding programmes, with the results of this research unequivocal. Within low to moderate concentrate input systems (up to 1.7 tonnes concentrate/cow/year), Jersey crossbred cows produced a lower volume of milk than Holstein cows (approximately 560 litres less across three studies), while producing milk with a higher fat and protein content (Table 1). As a result, the yield of milk solids and the value of milk produced was similar for both genotypes. In contrast, within higher concentrate input systems (over 2.5 tonnes/cow/year) the crossbred cows used part of the extra food nutrients offered for body tissue gain, and

as a result produced approximately 66 kg less milk solids/lactation than the Holstein cows. Thus in terms of their milk production response, Jersey crossbred cows do not appear to be suited to very high input systems.

However, in general crossbreeding with Jersey sires resulted in less mastitis (although not a lower somatic cell count), fewer hoof problems, improved fertility and improved longevity. For example, on average Holstein cows survived for 3.6 lactations, compared to 4.8 lactations for the Jersey crossbred cows. When the economics of the two breeds were examined, the crossbred cows had a net profit which was £39 per cow per year greater than for the Holstein cows. This value takes account of differences in cull cow value, bull calf value, milk composition, cow survival, health and fertility. The full results of this research programme will soon be published in a 'Farmers booklet' which will be available through AgriSearch.

Table 1 Performance and survival of Holstein-Friesian and Jersey crossbred cows within lower concentrate input systems

	Holstein-Friesian	**Jersey crossbred**
Lactation milk yield (litres/cow)*	6350	5790
Milk fat (%)*	4.25	4.71
Milk protein (%)*	3.35	3.62
Lactation fat + protein yield (kg/cow)*	490	490
Mean survival (lactations)	3.6	4.8
Net profit (£/cow/year)	373	412

* Mean of three experiments

Breed substution:

The Holstein breed is only one of many dairy breeds within Europe, and there is interest in the fact that some of these 'alternative' breeds appear to exhibit traits 'lacking' within the Holstein breed. For example, the Scandinavian countries have included functional traits such as fertility and health within their breeding

programmes for many decades, and cattle populations within these countries have superior health and fertility compared to those in many other countries. In view of the very different management practices which exist between Scandinavia and Northern Ireland, a research programme was established on 20 local farms to examine if the Norwegian Red breed could make a positive contribution to dairying within Northern Ireland.

Norwegian Red cows had a number of negative traits, including a poorer temperament than Holstein-Friesian cows, especially during their first lactation, and poorer 'type'. The latter was especially reflected in poor udder type, with 6.8% of Norwegian Red cows eventually culled due to 'poor udder conformation', compared to only 1% of Holstein cows. However, differences in production performance between the two breeds were relatively small (Table 2). The Holstein-Friesian cows had higher 305-day milk yields than Norwegian Red cows during lactations 1 – 3 (mean: 6476 vs 6219 litres), but not during lactations 4 and 5 (mean: 7206 vs 7178 litres). Nevertheless, there were very real differences in functional traits between the breeds, a reflection of the inclusion of functional traits within the sire selection programme within Norway over many years. For example, Norwegian Red cows had fewer calving difficulties than Holstein-Friesian cows when calving for the first and second time, while having a lower incidence of still births when calving for the first time. In addition, somatic cell counts were approximately 40% lower with the Norwegian Red cows, with this improved udder health reflected in the fact that 9.0% of Holstein cows, compared to 4.1% of Norwegian Red cows, were culled due to mastitis. Norwegian Red cows also had improved fertility, with 28.5% of Holstein-Friesian cows and 11.8% of Norwegian Red cows culled as infertile. Overall, Norwegian Red cows had improved longevity, with 27.2% of Norwegian Red cows and 16.3% of Holstein-Friesian cows surviving until the end of their fifth lactation. When extrapolated to give life-time survival, on average Holstein-Friesian cows completed 3.5 lactations while

Norwegian Red cows completed 4.2 lactations. An economic comparison of the two breeds indicated that net profit/year was £78/cow (22%) higher with the Norwegian Red cows compared to the Holstein-Friesian cows. The full results of this study have been summarised in a farmers booklet which is available from AgriSearch.

This study has clearly demonstrated that the use of selection indices which incorporate functional traits of economic importance (such as Total Merit Index (TMI) in Norway), have the ability to improve dairy cow robustness and economic performance. Thus irrespective of which breed you use on your farm (Holstein or an alternative breed), real economic progress will be made by selecting sires which are at the top of the list in terms of Profitable Lifetime Index (PLI).

Table 2 Performance and survival of Holstein-Friesian and Norwegian Red cows

	Holstein-Friesian	**Norwegian Red**
305 day milk yield (litres/cow)*	6768	6603
Milk fat (%)*	3.75	3.85
Milk protein (%)*	3.24	3.32
305 day fat + protein yield (kg/cow)*	471	472
Mean survival (lactations)	3.5	4.2
Net profit (£/cow/year)	361	439

* Mean of lactations 1 - 5

A number of practical conclusions from these research programmes are summarised below:

1) Neither crossbreeding nor the use of an alternative breed will solve problems associated with poor management or poor nutrition. Clearly identify why you are considering an alternative breed or crossbreeding (i.e. what is the problem that you are attempting to solve). Will alternative genetics provide part of the solution, or are management changes likely to be equally effective.
2) For many genetic ‘problems’, the solution may well be found within the Holstein breed. As already highlighted, selection indexes (eg PLI) which have a major emphasis on functional traits are now in place for the Holstein breed. Through

careful sire selection, bulls which can help to overcome existing herd weaknesses can be chosen, although on many herds it will take quite a few generations to reverse some longstanding problems.

3) Crossbreeding can introduce hybrid vigour which can be particularly beneficial for traits such as health and fertility, but relatively low for other traits such as milk yield (average of 4.7%). Adopting crossbreeding solely to gain the benefits of hybrid vigour is unlikely to be justified. It is critical to remember that hybrid vigour is not passed on to the next generation.
4) The use of alternative breeds or crossbreeding is a long term commitment. For cows that have been bred to a sire of a different breed this spring, it will be 2–3 years before the potential benefits of these animals becomes apparent within the herd, and at that stage these crossbred cows are unlikely to comprise more that 25% of the herd.
5) Alternative breeds and crossbreeding can complicate management issues, especially in relation to housing and milking facilities. Depending on the breeds used, offspring can be different sizes or a more diverse range of sizes. Smaller and mixed sized cows can result in problems in the milking parlour and in cubicle houses.
6) In general, Holstein cows have better quality udders compared to many other breeds. If considering the use of alternative breeds, it is important to choose sires which transmit good udder attachment traits.
7) The impact of crossbreeding and the use of alternative breeds on the value of cull cows, male calves and surplus breeding stock should be considered. The impact may vary depending on the breed chosen. In addition, the long term value of the herd needs to be considered.
8) Alternative breeds should be suitable for the milk production systems in which they will be managed (i.e. low vs high concentrate input). In most cases, a breed should be chosen to minimise any loss in milk production, while at the same time maximising the gain to be made in other traits.
9) Any alternative breed being considered should have an associated breed improvement progeny testing programme, with a significant focus on traits of greatest economic importance. When choosing a breed the first step is to identify the key goals of your new breeding programme, and to identify a breed which will allow these goals to be achieved.
10) The choice of sire within a breed can be even more critical than the choice of breed itself. Sires chosen from any alternative breed should be top sires for PLI from within the breed selected.