# Selection Decisions Today for Tomorrows Dairy Industry

**Mike Coffey, Jennie Pryce and Geoff Simm**
SAC Animal Breeding and Genetics Department

There is no doubt that we are in a period of dramatic change within the dairy industry and that tomorrow's marketplace will be different from today's. However, as today's industry and marketplace is different to that of yesterday, so current dairy farmers have already demonstrated their ability to predict the future and react by breeding dairy cows that are right for the market environment. Widespread breed replacement of the Friesian by the Holstein was the right move given the circumstances of the time. In this article we look at breeding decisions that will result in success in tomorrow's dairy markets. Of course that requires an assessment of likely future markets, since today's breeding decisions result in a milking animal nearly 3 years from now and whose lifetime will be on average 3.5 lactations. Given the long time horizon of genetic improvement it is crucial to get it right now.

## Future Markets

In depth discussion of future markets is beyond the scope of this article, but for the purposes of discussion we assume that the future market place will be stable in terms of milk price but with increasing emphasis on quality assurance however that is defined. It is hard to imagine a future market dominated by high prices for raw milk and so it is fair to assume that there will still be market pressure on improving output per cow or per unit of land or both. The interesting point to consider is whether the future market segmentation will require different breeding goals or will demand different production systems that will require different breeding goals. Certainly the increasing popularity of milk produced in specialised ways such as organic systems has focussed attention on breeding strategies for different systems.

## Future Systems of Production

Again, there is considerable debate around the most likely effect that these changing markets will have on the way that milk is produced. There are those who consider that there will be a shift away from purchased feeds towards increasing reliance on home grown forage and grazing. These extended grazing type systems are widespread in New Zealand and are increasingly popular in Ireland and gaining interest in the UK.
There are others who believe the future is in large intensive dairy units run in a technically proficient manner and reliant on high throughputs per cow to reduce unit cost. Such farms could make good use of plant and food by products as a source of cheap energy and high quality forage such as maize silage as a major part of the cow's diet.
A small but significant number believe in a future that has specialised systems of production such as organic to enhance the range of products available to consumers. The rise in popularity in organic production systems has been relatively recent and has yet to prove robust to a large scale change in market requirements. However, It is likely to be a significant portion of the future dairy industry.
Whatever the future production system employed by any farmer the questions remain the same – what type of cow do I need for that system and how will I breed her? Should she be a Holstein, some other breed or a crossbreed? Furthermore, regardless of the breed, the right selection tools need to be available to ensure genetic progress in the chosen breeding goal traits. Selection indexes are the best way to combine information on a number of traits, weighting each by its appropriate economic value.

## Selection Indexes

UK dairy farmers already have a range of indexes available to bring about genetic change in their animals. There are production indexes for milk fat and protein, an index of survival called Lifespan, indexes for linear type traits such as Stature, Udder Support and Foot Angle, indexes for management traits such as Milking Speed and Locomotion and finally indexes that are combinations of other traits such as Type Merit, PIN and £PLI.

Most countries have methods for putting the wide range of available indexes together to make them easier to use for those farmers who want the convenience of using an overall index. In the Netherlands breeders use INET whilst in France they use INEL. Italy has ILQM and Denmark have a yield only index (Y index) and an overall index called the S index that includes yield, beef production, daughter fertility, calving index, mastitis resistance, body, feet and legs, mammary system, milking speed and temperament. All of these are examples of indexes that have been constructed after considerable research into the correct weighting of all the component parts. The weightings applied are usually a function of the relative economic value of each trait.

## Breeding for Many Traits Simultaneously

In order to breed for many traits (or at least more than 1) we need to weight the different traits in some way then rank bulls according to our new index. It is important to weight traits properly since the more traits that are selected for the less improvement is made in any one and we could reduce profitability by putting too much emphasis on something with relatively low value. Each trait must therefore contribute to the index preferably making a positive economic contribution. In the UK we have used economic weights to put Lifespan (constructed from actual daughter survival records where available and type information where survival is not available) and production together to produce £PLI. The economic values for production and lifespan are carefully calculated based on predictions of future prices for milk and replacement dairy heifers. Genetic improvement in the component traits (and other traits of interest) depends on the amount of genetic variation in these traits, genetic relationships with other traits that are being selected for and the economic weight of each component trait in the index.

That brings us on to an important part of the future market place for dairy products. It is easy to imagine that traits may have different values in different systems of production that are serving different markets. An easy and obvious example is Somatic Cell Score (SCC). This trait is fairly highly correlated to mastitis and therefore can be used as a proxy for resistance to mastitis. If two bulls are different to each other by say £10 PIN but the higher of the bulls has a SCC proof of +10%, which bull would you use? Since we know that the £10 is currently worth more than the +10% SCC, it could be more profitable to increase milk output by selecting the higher PIN bulls even though they might have a slightly increased SCC and therefore a slightly increased susceptibility to mastitis.

However, in a specialised system such as organic production, the routine use of antibiotics is limited (disposal of milk is for a longer period) and so the cost of mastitis is much higher. This then changes the relative economic value of SCC in these different systems of production. How can we accommodate such differences in national indexes that combine many traits?

## Customised Herd Indexes

By definition, a national index is considered to be suitable for most users. This has been the case up until now when a single index could be used to breed standard cattle to be farmed in fairly standard management systems to produce a fairly standard product. For the reasons mentioned above, a single national index may not be the best way to breed future generations of dairy cattle particularly if markets do begin to diverge more than they have before and management systems change as a result.

A method of overcoming such a problem is to enable breeders to construct their own indexes to suit their own circumstances. Of course that can happen already – farmers can decide on their own weights and select bulls accordingly. What they cannot do is calculate what the outcome will be or perhaps more importantly, calculate what the outcome of a different decision might be. What is required is a software package that would take all of the relevant farm data and then help the farmer to make good assessments of appropriate economic weights for a range of traits that fully accounts for expected future farm circumstances and markets. The program would calculate a new ranking for bulls based on the farmer's preferences and herd parameters. It would then forward calculate the impact of those decisions on future farm profitability.

This strategy of handling bull PTA's in a customised way may enable individual farmers to more precisely specify their breeding objectives but would have the added advantage of encouraging other farmers who may not use indexes to think more objectively about their own breeding strategy and encourage the appropriate use of indexes.

## Traits Not in Current Indexes

Whatever the farm circumstances or aspirations of the individual farmer, the objective of all is to maximise profits over a defined time horizon. The breeding goal is therefore profit and the index traits to be used are those known to impact upon profit. The problem for us in the UK is that we do not currently have indexes for all of the traits known to impact upon profitability. That is in contrast to many Scandinavian countries that have many different indexes for a wide range of health and fertility traits. However, things are changing as quality assurance and consumer awareness become higher profile issues.

## Mastitis

Previous research at SAC and University of Edinburgh has produced economic values for Somatic Cell Count indexes that could be used in overall indexes where SCC is used to predict mastitis. The addition of mastitis to £PLI would have a small but useful effect on some bulls position in the ranking lists. For many bulls it would be no more than a few pounds. This value reflects the direct cost of mastitis rather than its effect on banding payments for milk since the latter value is dependant on the herd mean SCC score. Reducing the bulk tank mean SCC when you are already in the top band has little value. In addition, the cost of culling for mastitis is already accounted for in Lifespan and we have to be careful to avoid double counting.

## Fertility

Research conducted by SAC and University of Edinburgh at Langhill Farm shows that selection for production has a negative effect on fertility. Research at Nottingham University using a wider range of farms and milk progesterone profiles has shown that fertility is declining at the national level over a 20 year period. Therefore a fertility index to enable breeders to counter that decline is a necessity. Research funded by MAFF and a consortium of Industry partners has recently begun with the objective of producing the UK's first fertility index utilising national data. The project will produce this index within 2 years and it will then be available to be incorporated into £PLI. With a lot of discussion on extended lactations currently, it is important to properly identify the true value of fertility for use in an index that will be using calving interval as a proxy for fertility. Of course research will be ongoing in order to enhance the selection tools with additional information such as milk progesterone tests and eventually genetic markers. SAC, University of Nottingham, University of Edinburgh and Roslin Institute are all academic partners in this major initiative. Additional information and improved accuracy is important for a fertility index because fertility has a low heritability. However, earlier work has demonstrated that there is sufficient genetic variation between bulls to make an index worthwhile.

## Lameness

This is a major cost to the UK dairy Industry. There are indexes that can be used to improve feet and legs in dairy cows but again, the heritability of these traits is often low (locomotion, feet and leg traits have heritabilities of around 15% compared to 35% for milk). In fact, the UK was the first country in the world to have a national locomotion index yet so far it has not been incorporated into an overall profit index. There is a lot of work required to work out the economic weights of the various indexes available and how they might be incorporated. Such work is likely to take on an increased urgency in future as consumers become increasingly interested in the methods of producing milk.

## What can the farmer do now?

Farmers cannot wait for a better measure of a particular trait to come along. There will always be more information available in the future but decisions have to be made now with the data available now. Given the long term nature of breeding and the expected time a cow will stay in the herd, it is important to get it right. Of course in the future that will be made easier with more information upon which to base the decision. But for now an idea of which market you want to sell into, an objective appraisal of all available information and

correct identification of the relative economic values of the traits involved in the selection decision are required. The first 2 are relatively straightforward but the third is very difficult and inappropriate weighting can lead to a loss in profitability by over emphasising uneconomic traits at the expense of economic traits. The important point is that there are almost as many opinions as there are dairy farmers and breeds!

## Summary

Selecting bulls and cows to breed replacement cows is becoming increasingly difficult in an environment where economic circumstances are rapidly changing. There is a greater amount of information being made available on the merits of bulls and relating those merits to individual farm circumstances is becoming increasingly difficult and time consuming. A customised herd index computer program is required to support farmers decision making process.
There will soon be an index of fertility in the UK. This index and SCC need to be incorporated into an overall profit index to rank bulls. This will help farmers make the best possible decision in the light of increasing amounts of information on which to make that decision. Getting it wrong based on supposition, opinion or lack of information will lead to a lowering of profits that ultimately will be unsustainable. Getting it right will maintain and even enhance the UK competitiveness in international markets that will have animal health and welfare as a higher priority in future