Factors Influencing Milk Butterfat Concentration

The average milk butterfat percentage recorded in United Kingdom dairy herds (UK Dairy Facts and Figures, 2001) has declined from 4.07% in 1997 to 3.99% in 2001 and there is a similar trend in Northern Ireland. Milk compositional quality payments represent a higher proportion of the total milk price at lower milk prices. Dairy farmers are therefore increasingly turning their attention towards achieving higher milk prices through improvements in milk quality. Improving milk butterfat represents an opportunity to increase milk price. For example, milk sold to United Dairy Farmers receives a bonus/penalty of 0.018 ppl for every 0.01% above / below 4.00% butterfat.

However, improving milk butterfat content also has milk quota implications. For example, if a milk producer supplying a 500,000 litre quota exceeds their butterfat base by 0.20%, then an extra 18,000 litres would have to be acquired in order to avoid superlevy payments. The financial value to the dairy farmer of higher butterfat milk at a range of milk quota leasing prices is indicated in Table 1. If milk quota leasing costs are less than 10.0ppl, increasing milk butterfat is worthwhile.

The breeding, feeding and management programme adopted on the farm will influence milk butterfat content. This technical note will highlight these factors.

### Stage of lactation

Butterfat percentage varies due to stage of lactation, with milk butterfat content lowest at peak production and highest towards the end of lactation. If butterfat levels remain low towards the end of lactation then factors such as breeding or feeding need to be examined.

### Breeding

The repeated use of sires for improved milk yield at the expense of milk components will result in the production of offspring with reduced potential for butterfat production. The full extent of the reduced potential for milk compositional quality may only become apparent in second and subsequent lactations as the animal’s milk yield increases towards full production potential. Farmers with access to a Herd Genetic Summary can estimate the impact their chosen breeding strategy will have on overall production. For example, the average Predicted Transmitting Ability (PTA) data for heifers entering the Greenmount Premium Milk Herd in autumn 2002 in terms of milk yield and butterfat production is given in Table 2.

### Table 1: Financial impact of increases in butterfat production (0.20% increase in butterfat with a 500,000 litre quota)

<table>
<thead>
<tr>
<th>Extra income (£)</th>
<th>Leasing price (ppl)</th>
<th>Leasing cost (£)</th>
<th>Net financial impact (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800</td>
<td>2</td>
<td>360</td>
<td>+1440</td>
</tr>
<tr>
<td>1800</td>
<td>5</td>
<td>900</td>
<td>+900</td>
</tr>
<tr>
<td>1800</td>
<td>10</td>
<td>1800</td>
<td>0</td>
</tr>
<tr>
<td>1800</td>
<td>12</td>
<td>2160</td>
<td>-360</td>
</tr>
</tbody>
</table>

The breeding, feeding and management programme adopted on the farm will influence milk butterfat content. This technical note will highlight these factors.
Table 2: Impact of breeding on milk production

<table>
<thead>
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<tbody>
<tr>
<td>Milk (kg)</td>
<td>290</td>
<td>780</td>
<td>1070</td>
<td>535</td>
</tr>
<tr>
<td>Butterfat (kg)</td>
<td>10</td>
<td>22</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td>Butterfat (%)</td>
<td>-0.03</td>
<td>-0.13</td>
<td>-0.16</td>
<td>-0.08</td>
</tr>
</tbody>
</table>

If these heifers were crossed with Bull A, which has a high PTA for milk and low PTA for butterfat concentration, the resulting progeny would have a breeding value for milk yield of 1070kg and a butterfat deviation of -0.16%. This is an estimate of how much more or less this individual heifer would expect to produce in her first lactation compared to the base year (2000) production for all heifers of the breed. For the Holstein/Friesian population the PTA 2000 base year heifer equivalent production for milk yield and butterfat percentage is 6279kg milk at 3.98% butterfat. In other words, the heifers produced from the proposed cross would be expected to produce 7349kg milk at 3.82% butterfat in their first lactation. Furthermore, these animals will transmit a butterfat deviation of -0.08% to the next generation, that is, 50% of the animal's butterfat deviation breeding value. In herds where milk is marketed for processing and payment is based on the milk compositional quality, farmers may need to consider a compromise between milk yield and compositional quality in their selection of sire for future years. Breeding decisions made now will take five years to have a major influence within the herd. Making the correct decisions now will pay dividends in future.

Feeding management

**Fibre** - Dairy cows require a minimum quantity and quality of fibre in order to stimulate chewing/cudding, maintain healthy rumen function and prevent butterfat depression. Cudding increases saliva production which helps buffer rumen pH. A low rumen pH will depress milk butterfat percentage. Diets containing very finely chopped forage may cause depressions in butterfat production. Farmers operating diet feeders with chopping mechanisms should avoid over-mixing of diets and ensure sufficient long fibre is available.

**Forage:Concentrate ratio** - Diets with a low forage:concentrate ratio will result in the production of milk with lower butterfat content. Sources of digestible fibre such as sugar beet pulp, citrus pulp and soya hulls may be added to concentrate supplements in an effort to improve butterfat concentration where high levels of concentrate feeding is required.

**Concentrate feeding frequency** - Frequent feeding of concentrates, particularly where large quantities are being fed may help to alleviate depressions in butterfat. This is an advantage of out-of-parlour feeding or Total Mixed Ration (TMR) systems.

**Starch levels** - Experimental results from the Agricultural Research Institute of Northern Ireland (ARINI), Hillsborough, have shown that cows fed concentrates containing large quantities of cereals (starch source) produce milk with a lower butterfat concentration. However, the financial benefits from increased milk protein may be offset by reduced butterfat during the grazing season.
Fat content of the ration - In general, feeding rumen-protected fat tends to improve butterfat content. However, feeding diets that contain large quantities of unprotected unsaturated fat (for example, full fat rapeseed) tends to decrease butterfat production. Diets are usually formulated to contain less than 6% oil in the dry matter to reduce the risk of depressions in butterfat. Where quota-leasing costs are above 10.0pp, feeding unprotected fat sources to reduce milk butterfat may be viable. Soya oils are suitable fat sources to reduce butterfat content.

Silage - The treatment of grass at ensiling can alter milk butterfat content. The results of 11 studies carried out at ARINI, Hillsborough, have shown that treatment with formic acid or a range of inoculants recorded an average improvement in milk fat percentage of 0.33% and 0.11% respectively over untreated grass. The silage technique may also influence milk compositional quality. Rapid wilt silage making systems improved butterfat percentage by 0.14%.

Buffer feeding grass silage - Buffer feeding can have an impact on milk yield and butterfat percentage when they are a large component of the diet. This is the case when access to grazed grass is restricted and conserved forage is offered overnight. Two studies carried out in the United Kingdom showed that buffer feeding grass silage, under restricted grazing conditions, resulted in an increase in milk yield of 0.4kg/day and butterfat by 0.12%. Responses to buffer feeding will vary according to silage quality and grass availability. In experimental situations where grass was readily available and poor quality silage (63 D-value) was buffer fed, milk yields were reduced by up to 4.0kg/day, while butterfat increased by up to 0.48%. Depressions in milk yield can be alleviated through increasing the energy and protein content of the buffer feed, by feeding additional concentrate or brewers grain. However, careful consideration should be given to the cost-effectiveness of this approach.

Buffer feeding straw - There has been some interest among dairy farmers, particularly when grazing spring grass, in buffer feeding straw to improve butterfat content. Experiments carried out in the United Kingdom have shown that offering straw, either as a straight buffer feed or in a straw/concentrate mix, has had relatively little impact on butterfat production.

Cow condition - Cows calving down in poor condition, that is, less than condition score 2.0, will produce milk with a lower butterfat content than cows calving down at condition score 2.5-3.0.

Other factors

• Cows should have ad-lib access to fresh feed at all times to minimise depressions in milk butterfat content.

• A high incidence of mastitis within a dairy herd may depress milk fat production.

• A high incidence of liver fluke infestation can reduce milk butterfat concentration.

• There can be considerable day-to-day variation in fat tests among individual cows and across herds. Monitoring milk butterfat content against previous years may indicate more meaningful trends.

Summary

Milk butterfat content is influenced by a number of factors including genetics and the quantity of fibre, starch and oil supplied within the diet. Dairy farmers interested in improving butterfat production should pay attention to both the breeding and feeding management programmes adopted within their herds.