NUTRITION FOR OPTIMAL REPRODUCTIVE PERFORMANCE

The reproductive performance of a herd is reliant on a large number of factors, some nutritional but many management related. Optimising this performance is paramount to profitable dairying. The InCalf Project run in the 1990’s identified key areas of management on which producers should focus to maximise fertility.

Possibly the most valuable tool to come from the InCalf Project was the Fertility Focus Report. While their user-friendliness is arguable, the reports measure parameters which can identify where fertility problems lie on individual farms. If reproductive performance is a true concern on your farm, the first and most important step should be to identify where the problem lies – do the numbers before assuming there is a quick fix! InCalf information is available on line, or speak to your advisor or nutritionist for further information.

While nutrition is only part of the story, it is where we will focus with this paper. The primary nutritional factors that need to be considered are energy balance, dietary protein (both excess and deficit) and a variety of minerals and vitamins.

<table>
<thead>
<tr>
<th>Table 1: InCalf Fertility Management Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf and Heifer rearing</td>
</tr>
<tr>
<td>Body condition and nutrition</td>
</tr>
<tr>
<td>Heat Detection</td>
</tr>
<tr>
<td>AI technique and Sire selection</td>
</tr>
<tr>
<td>Bull Management</td>
</tr>
<tr>
<td>Cow Health</td>
</tr>
<tr>
<td>Calving pattern</td>
</tr>
</tbody>
</table>
ENERGY BALANCE

Energy Balance represents the difference between energy intake (Dry Matter Intake) and energy output (Milk Production). Because of low intakes and high demands in the early fresh period, cows are in negative energy balance (losing weight) for a number of weeks post calving. While cows are in negative energy balance, chance of conception is only 15 – 20%. This jumps dramatically as soon as cows start gaining weight (positive energy balance) with chance of conception 75% or greater.

The time taken for cows to return to positive energy balance is on average 8 weeks or 50 – 60 days, but is hugely variable. In healthy, well fed cows the first heat will occur at 10 – 12 days (often silent) and the third heat is the most fertile (often the second observed heat), occurring around 53 days. High production cows, heifers and animals that have suffered from any metabolic illness will return to positive energy balance more slowly than the average cow. To move cows from negative to positive energy balance, milk production must be reduced or intake must increase. Increasing grain and reducing body condition mobilisation must be considered.
PROTEIN

Milk protein % is determined by glucose metabolism, so is related to Energy Balance (not dietary protein). Protein test of bulk milk, as well as individual milk samples, can therefore be a great indicator of cow energy balance. Aim for > 3.15% protein for joining.

The first factor we must consider with regards to dietary protein is bypass protein, or rumen undegradable protein. UDP provides amino acids to the cow, which are utilised in the liver to generate glucose, a process called gluconeogenesis. This is an important and effective tool in promoting milk production in fresh cows. However prolonged use of this will delay the return of cows to positive energy balance.

Canola meal, cottonseed meal and soybean meal are all useful UDP sources, but their use must be limited at joining.

Rumen Degradable Protein is protein available for use in the rumen by the micro-organisms. It is essential that the rumen bugs are provided with protein in order to ferment feeds and provide the cow with sufficient VFAs for meeting energy requirements. If RDP levels are inadequate, energy utilisation drops and again, cows fail to reach positive energy balance.

The third part of the protein story involves urea levels in blood and milk. High levels of protein result in more ammonia and urea circulating in the blood and in the milk. These urea levels can be measured and are referred to as MUNs (Milk Urea Nitrogen) and BUNs (Blood Urea Nitrogen). As a consequence of high circulating ammonia, ammonia levels in the uterus are also higher. There is a theory that high MUNs and BUNs cause lower fertility, and high levels of ammonia in the uterus can reduce embryo survival. This theory is widely voiced but may actually be a convenient excuse for poor reproductive performance on pasture based systems.

Trials conducted with embryos at different levels of ammonia actually showed increased embryo survival as ammonia levels rose. Additionally trials conducted looking at MUNs and BUNs have proved that higher production herds have higher levels of circulating...
urea (through increase intake of protein and increased mobilisation of muscle protein). The associated drop in fertility is related to high production and negative energy balance NOT to the MUNs and BUNs. As US Nutritionist Dr Bob Patton so eloquently stated:

’a town with a higher population has more priests, it also has more hookers...the priests did not necessarily cause the hookers.’

MINERALS AND VITAMINS

All minerals and vitamins play roles in enzyme and hormone systems within the body, so NONE should be neglected. The following is a summary of the roles played in reproductive performance by some of the key minerals and vitamins required in dairy diets.

CALCIUM is essential for maintaining muscle function – including uterine involution and rumen contractions. Low Calcium reduces rumen fermentation, lowers Dry Matter Intake and increases Negative Energy Balance.

PHOSPHORUS also important due to its link with energy balance (adenosine tri-phosphate – or ATP – is the unit of energy within the body). PHOSPHORUS deficiencies have also been linked to ovary function – inhibition, depression and irregular oestrus.

A diet deficient in PHOSPHORUS or MAGNESIUM will decrease CALCIUM absorption and a less than ideal Ca:P ratio (3.5:1.5) may lead to ‘silent heats’.

One of the primary trace minerals involved in fertility is COPPER, due it being a precursor for LH (luteinising hormone essential for follicular development).

COBALT (Vitamin B12) is required for liver metabolism of glucose, thereby playing a role in Energy Balance. Additionally, deficiencies in COBALT are linked to irregular and silent heats and increased time for uterine involution after calving. Folate is also thought to play a role due its strong relationship with Vitamin B12.

SELENIUM and VITAMIN E are antioxidants. Deficiencies will weaken the immune system and lead to silent heats, poor fertilisation of ova, delayed conception, abortions and birth of premature, weak or dead calves.

Deficiency of BETA CAROTENE (precursor to Vitamin A) is shown to delay ovulation, increase incidence of ovarian cysts, decrease size of corpus luteum, decrease intensity of oestrus and lower conception rates.

ZINC important for immune system and particularly important for semen production in bulls.

PRACTICAL IMPLICATIONS

Lead feed springers to ensure mineral balance is on track from the start of lactation, as well as a rapid return to positive energy balance through higher dry matter intake post calving. A transition herd for the first couple of weeks of lactation is also particularly useful.

Energy Balance must be the key focus in balancing rations for joining. Higher levels of grain may be required, particularly for high production cows, or for late calvers who are likely to be still losing weight on Mating Start Date.

Bypass protein sources are useful for promoting milk production. Work with your nutritionist to determine the appropriate levels for joining. They can stay in the diet, but usually at reduced levels.
Adequate dietary protein is essential for fermentation and digestion of feed, so do not be scared by the MUNs and BUNs theory and supplement protein as required. In most dairying regions, feed quantity drops in autumn and feed quality drops in November (protein especially). These are popular times for mating.

Ensure all bases are covered with mineral supplements. Performance have a range of products packaging their Direct Fed Microbials with trace minerals and vitamins, as well as with macro minerals if desired. Ensure that no minerals or vitamins are overlooked.

Use milk protein test as a tool for determining whether cows are in positive energy balance. Over 3.15% is a good starting point, but it needs to be rising or higher than the same period last year.

Dairy Australia and InCalf have the resources (which you funded!) to measure reproductive performance. There are many factors other than nutrition that will affect fertility, and if it is a concern on your farm, find out the areas on which you can focus for greatest return.