2001

Protein Plus : increasing summer milk protein levels

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Protein is the most important ingredient of raw milk, both nutritionally and economically. Protein provides most of the calcium in milk and gives dairy products much of their characteristic flavour. It sets yoghurt, gives texture to cheese and puts the froth on your cappuccino. However, Western Australian summer protein levels are the lowest in Australia. A project has commenced to find solutions. The Protein Plu$ team reports.

Seasonal changes in milk protein levels are common throughout the world, but Western Australia is unusual in both the size of seasonal differences and the low levels to which protein concentrations fall during summer.

In fact, Western Australian summer milk protein levels are the lowest in Australia and have declined during the 1990s (see Figure 1), causing problems for the State's dairy industry. Low protein milk is more expensive to process, while high milk protein levels mean higher prices and better returns for both farmers and processors.

The project

Protein Plu$ to date has involved a series of workshops in spring 2000 to help farmers recognise which characteristics of their production systems are contributing to low protein levels during summer, and to identify common factors across the Western Australian dairy industry. The workshops provided the first opportunity for many farmers to examine

Protein Plu$ has commenced as a collaboration between the Department of Agriculture and the CSIRO Division of Livestock Industries. The project is aimed at investigating the causes of Western Australia’s problems with low summer milk protein levels, and finding management solutions for farmers.
their milk protein profile in detail, to identify factors that contribute to seasonal changes in protein levels, and to compare their experiences with other producers.

There were very few farms on which a single factor or event was identified as the sole cause of low milk protein problems. This reflected the fact that milk protein is influenced by a combination of nutritional and genetic factors, as well as stage of lactation. The workshops also demonstrated that fluctuations in milk protein were not rapidly determined by the Western Australian environment, but largely influenced by management.

Common themes that emerged from the workshops were:

- Protein problems occur on both dryland and irrigated dairy farms throughout all dairy regions of Western Australia. Large differences exist between farms in the same regions, which tend to overshadow the smaller differences between regions (see Figures 2a and 2b).

- Low milk protein is rarely a problem in herds grazing green annual pastures. Protein levels tend to drop dramatically as pasture dries off, but some farmers are more successful than their neighbours in managing the extent of the drop. Protein levels are seen to increase rapidly once cows start to graze annual pastures in late autumn or early winter. Availability of irrigated pasture over summer means that the drop in protein levels is likely to be less severe, but does not guarantee high protein levels.

- Feeding supplements high in protein is unlikely to be a successful intervention strategy when milk protein levels are low. Increasing energy intake is more likely to be effective.

- Cows calving in summer suffer the combined effects of a diet where the forage is relatively low in energy, heat stress and the normal decline in protein levels up to 10 weeks after calving. Most summer calvers experience a large drop in milk protein levels after calving than winter calvers. Protein levels in summer calving herds often remain low until green feed becomes available in early winter.
Protein Plus is developing a number of management options, such as improving nutrition, to increase milk protein levels.

- Many farmers do not have good information on the energy and protein content of their silage and hay. This information is required to ensure that summer diets can meet the herds' nutritional requirements.

**Low protein factors**

Observations from the workshops were confirmed by an analysis of milk production data held by the Australian Dairy Herd Improvement Service (ADHIS). In particular, the analysis confirmed the widely held industry knowledge that different dairy breeds produce milk with varying levels of protein (see Figure 3).

The Holstein cattle that dominate the Western Australian industry have the highest total yield of protein per day, but also have the lowest milk protein concentration. Jerseys produce milk with higher protein concentration, but their lower milk yield means that total protein production per day is low. Breeds such as the Australian Red and the Holstein x Jersey produce less milk than the Holstein, but their higher protein concentration means that total protein production is similar to the Holstein.

Part of the explanation for this difference can be found in the calving patterns for the two States. A large proportion of Western Australian dairy cows calve during the dry summer and autumn months, while most South Australian herds avoid summer calving.

Cows in early lactation have a high energy requirement that is difficult to meet from the conserved fodder that makes up much of the summer diet in Western Australia. Cows calving on green feed will have fewer problems. Figure 4 shows that summer or autumn calving in a Mediterranean environment will almost always lead to problems with low milk protein. Figure 5 compares the calving distribution throughout the year in both Western Australia and South Australia.

**What next?**

The clear messages from the project to date have been that many dairy farmers have the opportunity to make low cost changes to nutritional and herd management that will help increase milk protein levels (see page 43 for details). Another important message is that dairy farmers don't have to have a 'protein problem' to benefit from such changes. Milk processors pay more for milk with a higher content of protein.
protein content, so more protein in the vat means more money in the bank!

The project will further increase the understanding of the factors driving milk protein levels through a program monitoring nutritional management on Western Australian dairy farms, which commenced in May 2000. Sixteen monitor farms (117 farms volunteered, showing the importance that industry attaches to the protein issue) provide a representative cross-section of the dairy regions in Western Australia, including both dryland and irrigation farms.

The project involves sampling and analysis of all feed stuffs given to lactating cows, and the recording of cow condition and weight. Detailed nutritional information from each monitor farm will be analysed using a computer model to determine whether there are clear nutritional reasons for any changes in milk protein levels. Early results from the monitoring program will be available to assist farmers with nutritional management in the summer of 2001/02. The results from this study will ultimately form the basis of a protein management decision support system.

Conclusions
The problem of low protein milk has arisen in Western Australia due to a combination of past pricing signals, genetic selection, the strongly seasonal environment, and sometimes inappropriate nutrition. There is no single solution that will suit all farms because of the differences between farms in environment and management. Rather, individual farmers must decide which combination of the various strategies is best suited to their farm management system.

Whatever strategy is chosen, all farmers should strive to improve the energy value of their conserved forage, adopt best practices for lead feeding, and choose semen or bulls with positive deviations in protein and fat concentration. Where possible, high starch grains in the concentrate ration should be used.

If grain feeding is already at a high level, then using an out-of-dairy feeding system to reduce the detrimental effects of slug feeding should be considered. For some farms, the introduction of new breeds to the herd or a change in calving pattern away from summer may be an option.

Figure 3. Protein concentration and daily average protein yield for eight Australian dairy breeds and the Holstein Jersey cross.

Figure 4. Effect of calving month and stage of lactation on milk protein concentration. Cows calving during summer in Western Australia are more likely to produce low protein milk than winter calvers.

Figure 5. Calving patterns for Western Australia and South Australia. Western Australian herds are much more likely to calve during the summer months.
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The research component of Protein Plus is partially funded by the Dairy Research and Development Corporation. The extension component has been supported by the former Dairy Industry Authority of Western Australia.

MANAGEMENT OPTIONS

Protein Plus has already developed a number of management options for farmers looking to increase their milk protein levels.

Long term

Genetics

- Select Holstein semen on the basis of high positive deviation for protein concentration. This can increase the herd average by approximately 0.1 per cent over 10 years.
- Crossbreed Holsteins with Jerseys. This can raise milk protein concentration by 0.2 per cent in the offspring, but will reduce total protein yield by about 20 grams per cow per day.
- Introduce and maintain a pure Jersey group within the herd.
- Consider introducing other breeds such as the Australian Red that will increase protein concentration without reducing protein yield.

Medium/long term

Calving pattern

- Shift peak calving away from summer to ensure a greater proportion of cows are in late lactation during summer. This can increase milk protein concentration during summer by up to 0.2 per cent. Decisions to adjust calving patterns should not be made without considering the implications of seasonal milk prices. It may be wise to wait until price patterns are established before making major changes.

Short term

Nutrition

Forage

- Aim to make conserved forage with the highest possible metabolisable energy (ME) value (greater than 10 Mega joules per kilogram). A 2 Mega joules per kilogram difference in ME of forage equates to 0.1 per cent difference in milk protein.
- If you cannot conserve high quality pasture forage, look at buying alternatives such as maize or cereal silage.
- Chopping silage to a 5 centimetre length will improve compaction and fermentation in the stack or pit. Feed intake is also improved by short chop lengths.
• Silage and hay with a high legume content will generally be of better quality than grass dominant forages and will promote higher intakes per cow.

• Increase the energy value of irrigated pastures by promoting perennial ryegrass and clover in the sward.

Balance your ration

• First ensure the ME needs of the cow are met – this is the driver of milk production.

• Focus on metabolisable protein (MP) rather than crude protein (CP). Crude protein is exactly that – a crude measurement of how much protein is present. MP gives you an indication of how much protein in the diet is actually available for use by the cow.

• Test your hay and silage so you know what you are feeding – bought in feeds can then be adjusted to optimise ME and MP in the ration. Results between labs can vary – try to maintain consistency by using the same lab each year.

• MP is not currently measurable in the lab but there are several computer programs available to estimate the MP levels in your ration. Match these with the MP requirements of your herd. For more information, talk to your nutritionist or contact the Department of Agriculture, Bunbury.

• Ensure the cow's mineral needs are met. In diets where essential minerals are limiting, the effect of improvements to general nutrition will be greatly reduced.

Concentrates

• Feed as much starch as is economically possible (up to 20 – 30 per cent of the total diet). Where the price is right, replace barley in the concentrate with higher starch grains such as triticale or wheat. Don't forget to take precautions to prevent acidosis.

• Many farmers are feeding too much poor quality degradable protein in the form of lupins. The value of lupins as a dairy feed is further reduced by the fact they contain no starch, even though they are a good source of energy. Discuss your ration with a nutritionist and where possible replace some of the lupins with higher quality proteins and starchy grains.

• Don't overfeed grain or pellets in the dairy. On many Western Australian farms, cows are expected to consume more than 50 per cent of their total daily feed in less than 15 minutes. Slug feeding at grain levels greater than 8 kilograms per cow per day may depress forage digestion, and reduce milk protein and fat. Consider the cost effectiveness of investing in a system for feeding concentrates between milkings.

Dry cow management

• Lead feed with an appropriate supplement for three weeks before calving. Select a supplement that is low in calcium and potassium and high in energy. The inclusion of anionic salts such as magnesium chloride may also reduce the incidence of milk fever in the herd.

• Take the time to condition score your cows. Ensure they are at the ideal condition score at calving, and monitor body condition throughout lactation so the ration can be adjusted to prevent over or under feeding. On a scale of 1 to 8, you should aim for a condition score of 4.5 at calving and drying off. Cows won't gain much condition in the last month of pregnancy, so adequate nutrition during late lactation is also important.

Minimise heat stress

• Make sure cows have access to shade and plenty of cool water in hot weather.

• Don't walk cows too far or fast in the heat of the day. Consider milking later.

• Sprinklers in holding yards can help keep cows cool while waiting to be milked.