# The Premium Milk Herd – Management Plan


## Summary

The feeding, breeding and management applied to the protein improver herd since it was established in 1996, indicates there is considerable potential to improve milk protein composition on farms throughout Northern Ireland. With the Protein Improver Herd at Greenmount, offering a high quality silage or grass sward combined with a starch concentrate improves milk protein composition. Grazing in late autumn and early spring for short periods, two-three hours per day, can enable substantial savings in silage requirements with increases in milk yield and composition.
The principal means the farmer can consider for altering milk composition are nutrition, breeding and management. Changes in composition from traditional breeding techniques are long term. In contrast, changes brought about by nutritional means generally occur rapidly, and nutrition may therefore be a more appropriate means of responding to today's rapidly changing market demands. The extent to which farmers exploit the full potential of feeding to manipulate milk composition will be determined in large measure by economic factors, particularly the rewards offered for producing milk with higher protein content.


## Introduction

Milk quotas combined with butterfat concentrations restrict the volume of milk produced. However, there are no quota restriction on milk protein production and current milk pricing systems in the UK provide a major incentive to increase milk protein. Provided the producer's milk protein concentration is above the protein base value (currently 3.18% for milk sold to United Dairy Farmers (UDF)), producers receive an additional 0.32 p/litre for every 0.01% increase in milk protein concentration. A similar pricing policy is implemented with regard to milk butterfat concentration, however the producer is only paid 0.18 p/litre per 0.01% increase in butterfat when their butterfat is above their reference figure. Failure to attain either the protein or butterfat base values incurs deductions in the milk price similar to that if the milk protein and fat concentrations are above the base values.

## Objectives

To improve dairy farm profitability there is considerable interest in developing strategies to increase milk protein concentration and maintain/decrease milk fat concentration whilst maintaining milk output. Consequently, the objective of this project is improve milk protein concentration (both on an individual cow basis and also on a herd basis) to a set target of 3.60% over a five-year period through the manipulation of feeding, breeding and management of the dairy cow. The management skills necessary to achieve high milk protein concentrations are demonstrated to students and farmers through open days, development groups, press articles and the internet www.

## Herd selection

50 autumn calving Holstein-Fresian cows were selected from the college herd in April, 1996 on the basis of having a lifetime milk protein content of at least 3.20%, with similar productions from the dam and/or grand dam. On allocation to the project, average 305 day lactation yields were 6151 litres/year, milk protein 3.26% and milk butterfat 3.86%.

## Feeding

Milk protein is closely associated with the level of energy intake. Increasing the energy intake of the dairy cow may be improved by producing high digestibility, high intake

grass silage, increased level of concentrate feeding, feeding concentrates containing a high starch content and including grazed grass in the diet. Furthermore, high energy intakes are not possible unless good husbandry is applied at all times, to ensure animals are offered high quality silage and grass ad libitum.

**Silage**

During the winter period, the forage component of the diet offered is grass silage, produced from a five to six week regrowth sward. The herbage is allowed to wilt for 24 hours (aiming for a grass dry matter of 25%) before being lifted with a precision chop forage harvester. Providing climatic conditions are favourable, wilting of grass before ensiling is a means of improving the fermentation quality of silage and reducing the production of effluent. Research has illustrated allowing the herbage to wilt for 24 hours increased the DM content of the silage and silage pH.
An inoculant is applied to the herbage at harvesting. Inoculant treatment of herbage at ensiling improves silage preservation, which should increase animal performance. Treating the herbage with an inoculant at ensiling improves silage preservation by decreasing pH and concentrations of ammonia N, lactic acid and acetate. Several studies at Agricultural Research Institute of Northern Ireland (ARINI)/Hillsborough have illustrated wilting of grass combined with treatment with an inoculant before ensiling increases silage dry matter intake, milk yield and composition. The results of the study are presented in Table (1).

**Table (1) The effect of untreated and inoculant treatment of grass at ensiling on animal performance**

| | Treatment | |
|---|---|---|
| | Untreated | Inoculant |
| Silage intake (kg DM/day) | 9.4 | 10.3 |
| Milk yield (litres/day) | 20.7 | 21.3 |
| Milk composition (%) | | |
| Butterfat | 3.74 | 3.92 |
| Protein | 2.76 | 2.85 |

**Straw inclusion in the diet**

Offering cows silage of high digestibility tends to reduce the fibre concentration of the diet, and the physical effectiveness of the fibre in terms of its ability to stimulate ruminal processes. Therefore, small quantities of straw (0.5 to 1.0 kg straw/head/day) are incorporated into the diet as a means of overcoming this problem and hence improving/maintaining animal performance.

**Housing facilities**

Cows and heifers in the Protein Improver Herd are housed in two separate groups in cubicle accommodation. This is to prevent social hierarchy being exhibited in the herd and heifers in particular being bullied, which may have an effect on their performance. Housing the heifers separately allows them the opportunity to achieve maximum silage intake, high milk yields, gain body condition and increased chance to first conception.

## Silage feeding

Access to the silage is by an easy feeding system, with fresh silage being offered twice daily in the form of silage blocks along the face of the barrier, in addition straw is added manually alongside the silage blocks. Allowing the animals ad libitum access to the silage via an easy feed system ensures they have a high silage intake. Silage feeding space available per cow is approximately 45 cm (18 inches).

## Silage intake

Each month, silage intake for both groups (first lactating heifers and cows) are measured as the difference between silage offered and silage refused. The cow's daily silage ME intake may then simply be calculated by multiplying the silage ME concentration by daily silage intake per cow. The cows energy requirement for maintenance (average 75 MJ/day/cow) is then subtracted from the cow's silage ME intake, to predict the amount of energy which would be available for milk production. Silage quality for both groups is assessed by near infrared spectroscopy (NIRS) several times over the winter feeding period. This year with the protein improver herd, cows and heifers may consume sufficient silage to meet maintenance requirements plus produce 12 and 9 litres of milk respectively.

## Concentrates Feeding

Milk composition and the yield of milk constituents can be manipulated by the type of concentrate and level of feeding.

## Concentrate composition

The ingredient composition of the concentrate, particularly starch content, can have a significant influence on milk composition. Studies undertaken at ARINI/Hillsborough have illustrated improved milk protein content and depressed milk fat content with animals being offered high starch rations both in indoor and outdoor feeding systems. This effect is particularly significant as the proportion of concentrate in the diet is increased. With low cereal prices, there is now a real opportunity to increase the milk protein concentration in the milk cost effectively. Cows in the Protein Improver Herd are offered a cereal-based concentrate containing 220 g crude protein (CP)/kg dry matter (DM) and 340 g starch/kg DM on a feed to milk yield basis. The main ingredient composition of the concentrate is barley, wheat, maize, maize gluten, rapeseed, Hipro-soya and protected soya. The starch content of the concentrate is 40% (on a % basis) and is mainly composed of barley, wheat and maize. Sources of protein in the concentrate are protected soya, hi pro soya and herring.

## Concentrate level

Animals are offered the concentrate on a feed to milk yield basis, with 0.40 kg of concentrate being offered per litre of additional milk produced, above the maintenance plus milk production potential of grass or silage. Irrespective of milk yield, animals are offered a minimum of 2 kg and a maximum of 8 and 10 kgs freshweight concentrates/day for heifers and cows respectively, through a combination of in parlour and out-of-parlour feeders.

## Out of parlour feeders

Prior to the out-of-parlour feeders being installed animals were offered a maximum of 5 kgs concentrate at each milking. Ingestion of large quantities of concentrate twice daily may have a detrimental effect on rumen conditions and pH. Dramatic changes in rumen pH can have a profound effect on intake. Research has indicated that extreme daily variation in ruminal pH can be more harmful to ruminal microbes than a constant low pH

because of continuous metabolic re-adjustments by ruminal microbes, which will inevitably affect fibre degradation and consequently rate of passage and intake. Increased frequency of concentrate feeding via out-of-parlours feeders can eliminate the extreme variation in rumen conditions, increase efficiency of rumen feed utilization, stimulate feed intake and lead to improved production, in terms of improved milk yield, increased concentration of milk solid components, or improved body condition. There is very little experimental evidence to support increased milk yield as a result of increased feeding frequency. In contrast to milk yields, increased feeding frequency is directly associated with milk composition – particularly fat. This is particularly evident when cows are offered a rapidly fermentable concentrate, such as the starch concentrate being offered to the Protein Improver Herd which can have a significant effect on the rumen volatile fatty acids and consequently milk composition. Offering cows a high starch supplement decreases the acetate and increases the propionate concentration in the rumen, which consequently depresses milk butterfat concentration. Detailed studies of increasing the number of daily meals of concentrate in the diet from two to six greatly reduced the milk fat depression caused by low roughage, high starch diets. Increased frequency of feeding can obliterate these dramatic fluctuations in the rumen, resulting in relatively constant rumen metabolite concentrations.
A research study was undertaken at the ARINI/Hillsborough which compared dairy cows being feed either by out of parlour or conventional parlour feeding systems (in parlour feeding). In this comparative study, both groups of dairy cows received the same total concentrate input, (1.33 tonne concentrates/cow year). One group was offered the concentrate on a flat rate basis through the parlour whilst the other was offered the concentrate on a fed to milk yield basis through out of parlour feeding. The results are presented in Table (2).

Table (2) Comparison of an in parlour flat rate feeding system with an out-of-parlour feed to yield feeding system.

| Concentrate System | Flat rate (in parlour) | Fed to yield (out-of-parlour) |
|---|---|---|
| Total concentrates fed (t/cow) | 1.33 | 1.33 |
| Lactation yield (litres/cow) | 5965 | 5903 |
| Milk quality | | |
| Butterfat (%) | 3.85 | 3.95 |
| Protein (%) | 3.20 | 3.30 |

Offering the dairy cows the concentrate through the out-of-parlour feeding system has very little on milk yield, however there were significant increases in milk protein and butterfat content. These improvements in milk composition reflect the benefits of offering concentrates to dairy cows ‘little and often’ rather than in two feeds per day.

**Feed level**

Several studies have reported increasing the level of concentrate feeding improves milk protein content and yield due to increased energy intake. This is clearly illustrated in a trial undertaken at ARINI/Hillsborough, in which autumn calved dairy cows were offered several levels of concentrate feeding over a 3 year period. The effect of level of concentrate feeding on milk yield and composition are presented in Table (3).

Table (3) Effect of concentrate feed level on milk production and composition

| | Feed level (kg concentrate/cow/day) | | | | |
|---|---|---|---|---|---|
| | 3.8 | 5.3 | 6.7 | 8.1 | 9.4 |
| Milk yield (litres/day) | 20.2 | 21.2 | 23.0 | 23.6 | 24.0 |
| Milk composition (%) | | | | | |
| Fat | 4.00 | 4.01 | 3.99 | 4.03 | 4.07 |
| Protein | 3.08 | 3.15 | 3.15 | 3.29 | 3.35 |

At low levels of concentrate feeding (less than 7 kg/day), additional concentrate feeding increased milk yield but had very little impact on milk protein content. However, at the higher levels of concentrate feeding, milk yield response to the additional concentrate is low however improvements in milk protein and butterfat content are observed. On average, for each kg of additional concentrate fed, milk protein composition was increased by 0.05%, from 3.08% milk protein at 3.8 kg concentrate/cow/day to 3.35 % milk protein at 9.4 kg concentrate/cow/day respectively.

**Animal performance**

Each month, average silage intake per cow is measured as the difference between silage offered and silage refused. Milk yields are recorded daily (using the Kingswood system). Milk composition is recorded twice a month. Body condition score is recorded monthly. Grass covers are measured weekly during the grazing season. All animal health (fertility and lameness) are monitored.

**Grazing management**

Spring Extended grazing – Cows are turned out to spring pasture as early as possible for a few hours each day (ideally from early March, weather and grass availability permitting) to reduce silage intake and improve animal performance. Research has shown that, turning cows out to pasture for a few hours each day (2 hours/day) increased milk yield by approximately 3.1 kg milk/day and reduced silage intake by 28% cow/day relative to that of animals retained indoors. Milk protein composition was also improved by approximately 6%, from 2.84 to 3.04% protein with animals housed indoors all times compared to cows allowed access to grass for a few hours each day. In financial terms, a gain of up to £1 has been obtained by turning animals out to pasture for a few hours each day in spring.
Grass cover is recorded weekly using a rising plate meter. Usually forty random readings are recorded in the sward by walking the sward area in a ‘W’ pattern. This ensures that a uniform distribution of the grass cover is obtained. The grass cover of the sward is calculated using an equation, which is as follows:

$$\frac{(\text{End reading} - \text{Open reading}) \times 316 + 330}{\text{No. of readings}}$$

**Extended Grazing**

Cows are turned out to graze immediately after the morning milking. Access to fresh silage is restricted prior to the morning milking to ensure the animals are turned out to the swards with an appetite. The objective is to have animals going into a fresh sward with a grass cover > 2,500 kg DM herbage/ha and grazing the sward to a residual grass cover of 1600 kg DM herbage/ha. Achieving the residual grass cover of 1600 kg DM herbage/ha is possible through manipulation of the area allocated to the cows (using a mobile electric fencer). If the residual grass cover deviates from target grass cover, the area allocated to the animals can be adjusted for the following grazing. The animals graze the paddocks from the back to the front, with individual forward and back fences

moved each day. The benefit of using a forward and back fence is to try and keep poaching of the sward to a minimum.

**Complete turnout to grass**

Spring/summer As spring progresses (March into April), cows are given access to the grazing paddocks for longer periods until full turnout to grass is achieved as early as possible (ideally mid April, depending on weather and ground conditions). Allowing the animals to gradually change from an indoor feeding system (silage and concentrates) to an outdoor feeding system (grazing and concentrates), enables the animals rumen to adapt to the change of diet and minimise any stress on the animal at this time.
Cows graze in a 1 day paddock system with a rotation length varying between 18 (spring grazing) and 28 (summer/autumn grazing) days, with a move to the new paddock after the morning milking. A flexible approach to grass allocation is adopted, with the aim of grazing swards with a grass cover of 3,500 kg DM/ha to a residual grass cover of 1600 kg DM/ha. The key objective to grazing is to be as flexible as possible to ensure the cows are offered a leafy, vegetative sward throughout the grazing season to ensure high levels of milk production and milk protein are achieved of grass.

**Maintaining grass quality**

Following grazing a follower group comprising of either dry cows or dry stock may be used to graze the sward down to the required residual sward cover. The objective of the leader/follower system is to maintain a high quality sward (leafy sward) throughout the grazing season. In addition the fields may be topped throughout the season to maintain grass quality. Grass quality during the grazing season is provided in the PIH management data section of the website – grass quality.

**Extending the grazing season in autumn**

The supply of grass from September onwards will depend on current grass growth rates, stocking rates, previous grazing management and nitrogen application. Rotation length is increased from late August onwards to allow an accumulation of herbage which may be used for grazing in October/November. Swards grazed first in the last rotation in late September to November will be allowed accumulate a grass wedge for early turnout the following year. Current grass covers are available in the PIH management data section of the website – grass covers.
Research has illustrated that extending the grazing season in late autumn improves milk yield, milk protein content and reduced silage intake compared to that of cows remaining indoors during the same time period.

**Calving period**

Calving commences in early September with first lactation heifers calving first. The target is to have most cows calved pre-Christmas. A teaser bull is introduced to the herd to help detect any cows in heat. Animals are artificially inseminated twice with selected Holstein Friesian semen from December onwards. Natural service is used for any cows repeating to the second insemination and at any subsequent repeats. Target breeding and fertility parameters are given in the Dairy herd fertility section of the internet website.