

Feeding high yielding cows

*Adapted and extracted from **Feeding the Dairy Cow** by A T Chamberlain and J M Wilkinson*

*Published by Chalcombe Publications, Lincoln, UK
(241 pages, 87 figures, 126 tables)
ISBN: 0 948617 32 2*

It is not possible to use the normal approach of balancing nutrient requirements for a given yield, as often we do not want to specify or limit milk production. It is also difficult to predict how much milk a high-yielding dairy cow is likely to give. For example a recent world record holder for milk production gave 89 kg milk when given a diet that was only predicted to be adequate for 41 kg of milk. The efficiency of energy use had probably changed relatively little so this cow must have eaten 2.2 times more feed than was predicted initially. Furthermore, the lower milk quality of many high-yielding cows complicates the calculation of nutrient requirements as it will reduce the requirements for each litre of milk and considerably reduce the overall requirements.

Diet formulation for the high-yielding cow therefore revolves around two factors: achieving the correct nutrient density in the diet and maximising feed intake.

14.4.2 Maximising feed intake

The remarkable thing about high yielding cows are the reported intakes: for a 600 kg cow the intake is more than 4% of body weight. It is the relatively high intake, more than anything else, that allows the nutrient requirements for high yields to be met. If we assume the ME of good quality silage to be about 11.0 MJ/kg DM, that of concentrates to be 13.0 MJ/kg DM, and that a diet should contain no more than 50% concentrates, then a mixture of these two feeds can supply the energy requirements up to the first diagonal line. To the right of this the energy density required cannot be met by a 50:50 mix of forage and concentrates.

To increase the energy density of the diet further, we need to add an energy-dense feed. Fat, with about 35 MJ/kg, is the most energy-dense source available. If we limit the total content of fat in the diet to 10% of DM we can satisfy rations up to the next diagonal line in the table; any ration density to the right of this line is impossible.

The values in the table clearly demonstrate the importance of achieving high voluntary DM intakes in high-yielding dairy cows. The urge to eat large quantities of food is in fact likely to be there in the high-yielding cow but we must do our best not to foil her desires!

How some cows manage to eat 4 to 5% of their body weight a day whilst others only consume about 3% of body weight as dry matter is not well understood. American workers (Dado et al., 1993) studying high-yielding cows showed that milk production was correlated positively with intake of both DM and water. High-yielding cows ate the same number of meals and at the same rate as their low-yielding counterparts, but the

higher-yielding cows ate for a longer total amount of time per day and hence consumed bigger meals. However, the high-yielding cows spent less time ruminating and chewing per unit of dry matter ingested suggesting that they chewed more efficiently.

How to maximise feed intake. The most important aspect of maximising voluntary feed intake is to look after the rumen. Firstly, do not insult the rumen. Secondly, feed the rumen correctly. The major insults the rumen suffers are high intakes of starch and fat, large meals of these nutrients, and acid overload. Starch and fat must therefore be included in the diet with care, to ensure that they do not adversely affect the balance and growth of the rumen microbial population. The best way to do this is to ensure that starch and fat (i.e. the concentrated feed ingredients of the diet) are eaten in several small meals each day, or mixed together intimately with forage in a complete diet.

The rumen has to buffer both the acids in silage and the VFA produced by the microbes. Reducing the acid load in silage and feeding alkali feeds (e.g. soda grain) will help to maintain the pH of the rumen at approximately 6.5.

Whilst looking after the rumen is the most important consideration in achieving high feed intake, we must remember the cow herself. The diet should be presented in a way that will encourage the cow to eat as much as possible. The feeding area should be away from draughts and rain, and should preferably be sited adjacent to the living area such that the cows have maximal access to the feed trough throughout the day.

The diet should be offered *ad libitum*, which implies a certain amount of wastage. About 10% of the total amount of feed offered to high-yielding cows should be refused and removed from the feed trough frequently. This material need not be totally wasted as it can be "diluted" and offered to lower-yielding groups of cows where maximising voluntary intake is not so important.

If there is a stampede of cows when new feed is put in the trough the diet is not being offered *ad libitum*. No more than half the cows should show an interest in the feed as the feed trough is filled or refilled. Feed troughs should be cleaned out several times a week, but never by the cow. Trough space should be adequate, both in terms of the volume of feed it contains and the length of feed space allocated per cow.

Cows are gregarious animals and voluntary intake will be maximised if all the group can feed at once. Similarly, intake will be maximised if sufficient feed is within reach and the cow does not have to strain against awkward feed barriers. Feeding areas should be quiet and peaceful; the cow is most vulnerable to attack (from predators and other cows) when she is feeding and so a secure environment will ensure long uninterrupted feeding sessions.

Milk contains about 85% of its weight as water. Reduced water intake can quickly restrict milk production. Cows should have access to water immediately after milking, especially if they receive dry feeds in the parlour. The water trough and piped water supply should be

adequate to meet requirements, so that the tank is still full when the last cow to be milked arrives to take a drink. Voluntary intake is maximised if the water is clean and fresh. When troughs are first installed a large drainage bung should be fitted so that washing out is easy and can be performed regularly.

Water intake and outflow of digesta from the rumen were raised following the application of sodium fertiliser to the pasture. Herbage intake, degradability of dry matter and rumen pH were elevated, resulting in an increased fat content in milk.

14.4.3 Formulating diets

When formulating diets for high-yielding cows all the ingredients must "work" - there is no room for "rubbish" or fillers. All ingredients must be included for a specific purpose - if there is no nutritionally sound reason for including a feed in a particular diet it should be left out! Some producers go so far as to say that all feeds must be analysed before they are used to ensure that their quality is satisfactory. Certainly any feed that contributes more than 2 kg of the dry matter intake should be analysed for its primary nutrient. For example wheat should be analysed for starch, soya and rapeseed meal for protein content and straw for fibre (NDF) content. "Straights" - raw material feeds - are often used rather than compounds or blends to obtain better control of diet composition and quality. Some producers use very complex mixes with several sources of protein and several sources of energy in a bid to minimise the effects of variation between batches of raw materials. Maize silage is a common factor in many diets for high-yielding cows, but it should contain at least 30% starch in the total DM.

Table 14.3 shows a possible blueprint for the composition of diets for very high and high-yielding cows. Diets should be formulated to meet specific targets for the concentrations of essential nutrients, rather than to a specific content of energy alone.

Once formulated, the actual yield achieved by cows of high genetic merit depends entirely on how successful the diet and management are in stimulating a high level of intake.

Table 14.3 Blueprints for diets for very high and high-yielding cows

Nutrient	Very high yield > 10,000 litres/year	High yield 8,000 to 9,000 litres/year
Crude protein (g/kg DM)	175 to 190	170 to 185
Starch (g/kg DM)	250 to 300	200 to 250
Sugars (g/kg DM)	100	80
NDF (g/kg DM)	300 to 320	320 to 360
	(70% from forage)	
QDP	50% of ERDP	50% of ERDP
Fat (g/kg DM)	50 to 70	40 to 60
Energy (MJ ME/kg DM)	12.5	12.0

In most high-yielding herds, the aim is to breed cows of high genetic merit and to allow them to perform to the best of their abilities. The cows are given a very high quality diet and as long as they do not get fat they remain on the same diet for as long as possible. Cows that put on too much weight in mid-lactation are moved on to a lower plane of nutrition; either their genetic ability is limited or they are too late in their lactation to partition sufficient nutrients to milk production.