

# The basis of feeding the modern dairy cow

## NutriOpt Dairy Rationing System



# Q. Would you like...

**Cows milking consistently well and as expected**

**Better butterfats and proteins to exploit your contract**

**More consistent milk ureas**

**Better rumen health with fewer signs of acidosis**

**Improved overall body condition and better fertility**

**More cost-effective production**



**A. Balancing the diet is the key to achieving these benefits.**

**NutriOpt Dairy is the radical new rationing system for you and your herd. It helps develop efficient diets to increase production, health and margins, whatever your feeding system.**





# A new rationing approach for today and tomorrow

Today's dairy cows are very different from those of even 20 years ago. Since 1995, yield per cow has risen by over 43% (see graph 1) and management approaches need to develop to exploit this potential.

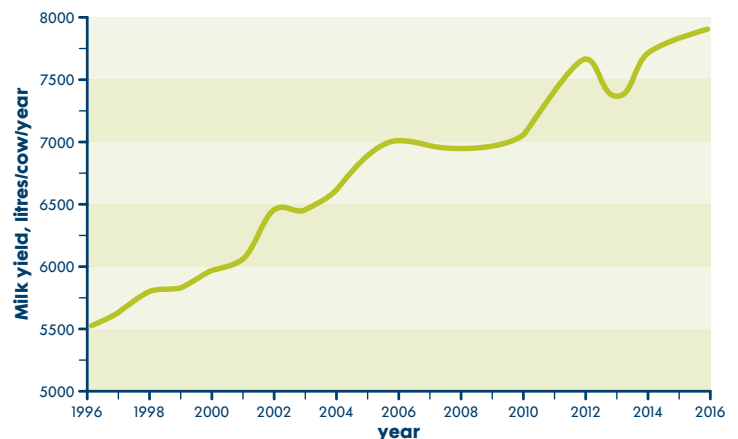
Two key areas have helped deliver this improvement:

## 1. Advances in genetics.

Better indices, more rigorous selection and the introduction of techniques such as semen sorting and genomics have helped farmers breed more productive cows. Genetic gain accounts for about half the increase in yield per cow seen over the same period. To exploit this genetic potential, we must feed cows better.

## 2. Development of more advanced dairy nutrition models.

We have progressed through hay and starch equivalents to the ME system which, although introduced in the 1970s, still underpins our current feeding approaches.



Graph 1. Showing the increase in milk yield per cow per year between 1996 and 2016. (Source: AHDB Dairy).

## From Feed into Milk...

The last major revision was the Feed into Milk system more than 15 years ago. Since then there have been no major advances in the systems used to formulate efficient and effective dairy cow diets... **until now!**

Building on many of the Feed into Milk principles, NutriOpt Dairy is an exciting new system, drawing together the latest research into a powerful new rationing system that will improve dairy cow rationing and help to ensure more cost effective production from healthier cows.



## ...to NutriOpt Dairy

NutriOpt Dairy is the first rationing system to consider energy and protein supply in a fully integrated approach. As digestion starts in the mouth and ends in the large intestine, NutriOpt Dairy takes account of all the processes taking place along the whole digestive tract of the cow. This makes it the most accurate system available to formulate dairy cow diets.

Based on extensive research into the rumen degradability of the principle individual nutrients in forages and feeds, we can now more reliably predict the true nutritional value of feed.

In addition, we can better understand all the components of digestion that provide the specific nutrients used by the cow for milk yield, milk fat and milk protein:

- Fermentation in the rumen
- Digestion in the small intestine
- Fermentation in the large intestine



# Why should I change to NutriOpt Dairy?



## NutriOpt Dairy will let you feed more efficient and cost-effective diets to your cows.

### Did you know?

- Cows do not produce milk from the feeds they eat; they produce milk from what those feeds become and how they are fermented in the rumen and absorbed in the digestive system.
- The rumen is king. Two thirds of the energy and protein used by the cow are the result of rumen fermentation:
  - » Different combinations of feeds are digested in different ways and at different rates and this affects how the diet performs.
  - » Every time you change the diet you affect rumen fermentation.
  - » What matters is how the feeds interact and are fermented by the rumen microbes.
- About 20% of the energy and protein used by the cow comes from digestion in the small intestine and 10-15% of the energy comes from fermentation in the large intestine.

### The research project behind NutriOpt Dairy means we know considerably more about:

- How best to analyse feeds to understand how they are used by the cow and the real amount of energy and protein they will provide.
- How quickly and thoroughly different feeds are fermented in the rumen.
- How diets can be balanced to ensure more efficient rumen fermentation to give better production.
- How cows use their diet.

### If we can describe feeds better and more accurately calculate how they will be used by the rumen microbes, we can produce diets that:

- Ensure better rumen health and high rumen efficiency
- More accurately supply the energy and protein the cow needs
- Deliver more efficient milk production
- Improve cow health
- Reduce costs of production

**Based on the latest science, NutriOpt Dairy is a significant step forward in dairy cow feeding. If you want the best for your cows, you need to change your ration programme to NutriOpt Dairy.**

**nutriopt**

# Five reasons why NutriOpt Dairy is better

## 1 NutriOpt Dairy describes what happens in the rumen more effectively.

**For the rumen to be effective, the diet has to supply the correct nutrients to the rumen microbes. The better we understand how feeds behave in the rumen, the more accurately we can feed the rumen microbes.**

The feed eaten by the cow enters the rumen where the carbohydrates and proteins are broken down at different rates. Some are quickly fermented in less than 2 hours after the food has been eaten, while others are fermented more slowly taking more than 2 hours. By better understanding this, NutriOpt Dairy can help ensure that all of the different rumen microbes have a continuous source of food and that microbial protein yield is optimised. If all of the rumen microbes are satisfied then the rumen works more efficiently and fibre digestion will be optimised. As a result this drives dry matter intake.

## 2 NutriOpt Dairy makes sure the rumen is balanced.

**For optimum digestive efficiency we need to ensure the rumen has the optimum population of different microbes.**

Balancing both rapidly fermentable carbohydrates and proteins, and slowly fermentable carbohydrates and proteins within the rumen is essential for rumen efficiency and optimal microbial protein yield. An imbalanced rumen will be inefficient.

If there is too much rumen fermentable protein and not enough rumen fermentable carbohydrate then diets may be oversupplying protein and therefore will not be cost effective.

If there is too much fermentable carbohydrate and not enough fermentable protein in the diet then potential microbial protein yield may not be achieved and therefore overall digestible intestinal protein supply may not be met.

Other rationing systems are not able to ensure the rumen is balanced for optimum efficiency.

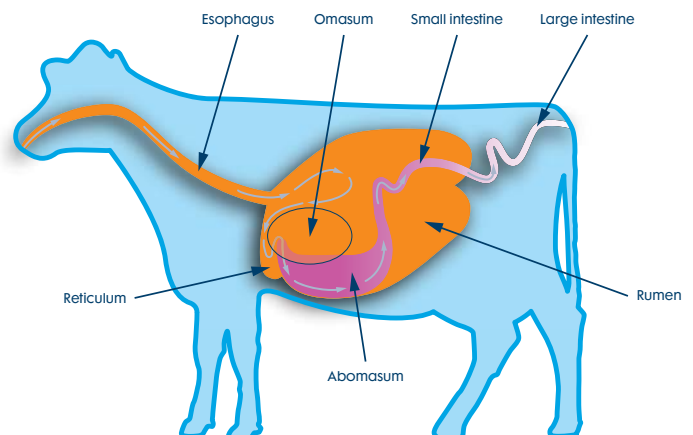
## 3 NutriOpt Dairy helps maintain good rumen health.

**Good rumen health means keeping a consistent rumen pH which allows microbes to perform at maximum efficiency.**

All fermented carbohydrates and proteins produce volatile fatty acids (VFAs) when they are broken down, causing a decrease in rumen pH.

Different feeds produce different amounts and proportions of VFAs at different rates. NutriOpt Dairy includes these proportions and rates to calculate the potential acid loading more accurately for individual feeds, and the risk of acidosis in the total diet. NutriOpt Dairy also calculates a fibre index for individual feeds which assesses the capacity of physically effective NDF for buffering the rumen.

Using the acid load and fibre index within NutriOpt Dairy means the risk of acidosis can be reduced.





# Five reasons why NutriOpt Dairy is better



## 4

### NutriOpt Dairy determines energy requirements and supply more accurately.

**The more accurately we can assess the energy value of feeds and how these meet the energy requirements of the cow, the more nutritionally accurate and cost-effective diets will be.**

The current ME system is an imprecise approach based on total digestibility and takes no account of how and where feeds are digested within the cow.

NutriOpt Dairy can accurately predict the products of digestion and how these are utilised within the cow, giving a more precise value for true energy available for milk production. Energy requirements and supply are calculated using a new and more accurate measure called Dynamic Energy (DyNE).

DyNE is the sum of all of the energy available from the end products of fermentation in the rumen, digestion in the small intestine and fermentation in the large intestine. This results in the most accurate prediction of overall energy supply that can then be more precisely matched with requirements.

Whereas Feed into Milk used ME, NutriOpt Dairy looks at DyNE; the table below demonstrates an example of how you can expect to see a different magnitude of results between the two systems.

Typical example	Feed into Milk	NutriOpt Dairy
	Metabolisable energy, MJ	Dynamic energy, MJ
Energy for maintenance (MJ/cow/day)	80.0	37.0
Energy per litre of milk (MJ/litre)	5.0	3.1

# 5

## NutriOpt Dairy determines protein requirements and supply more accurately.

NutriOpt Dairy can more accurately assess metabolisable protein requirements and supply, leading to more efficient diets.

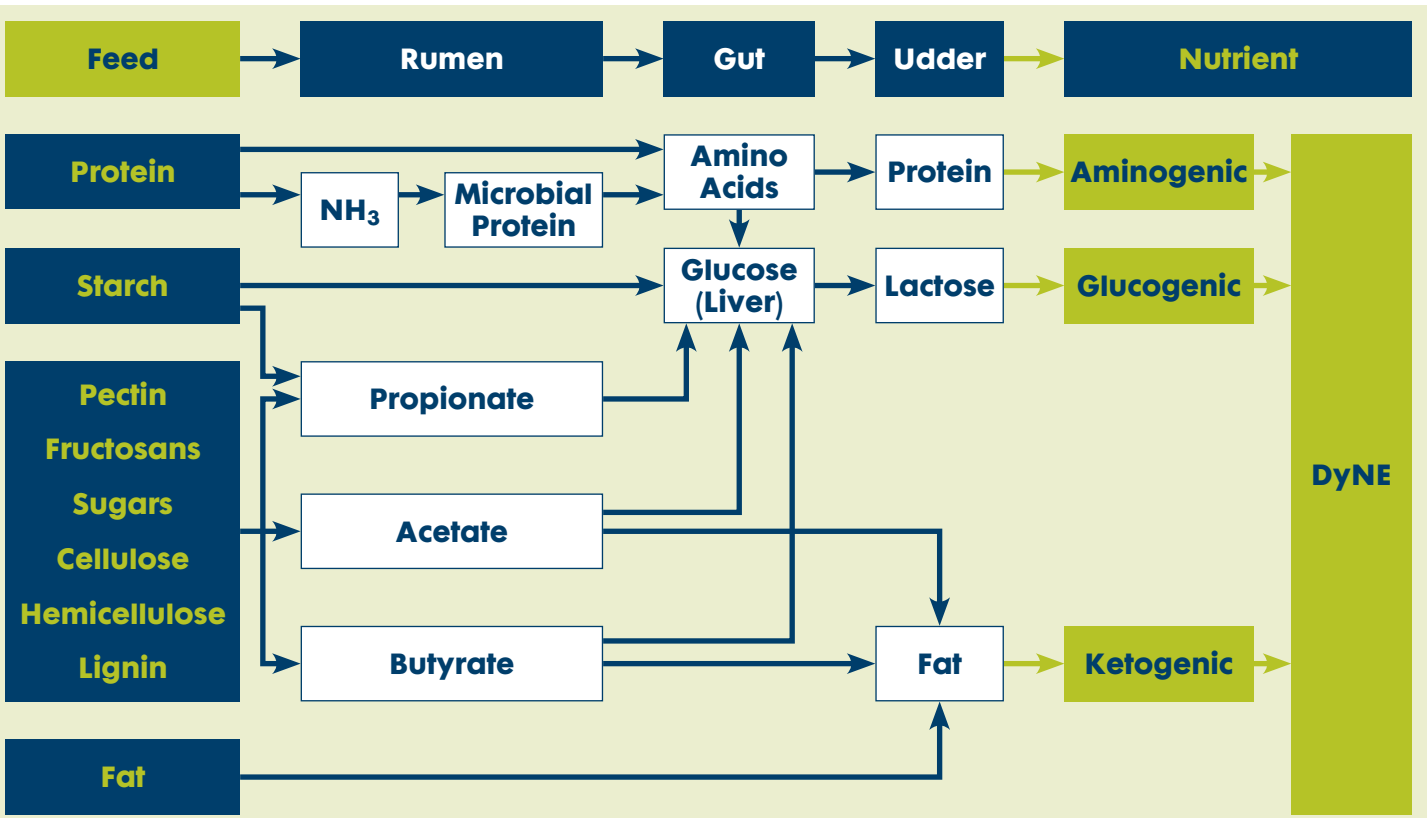
The total metabolisable protein supply for the cow is made up of microbial protein synthesised in the rumen and rumen bypass protein from the diet. In NutriOpt Dairy metabolisable protein requirements and supply are calculated in terms of NutriOpt Digestible Intestinal Protein (NDIP).

Microbial protein is the best protein source for cows to match their amino acid requirement so it needs to be maximised – this means making sure the rumen microbes can work efficiently.

Fermentable carbohydrates provide rumen energy, and fermentable proteins provide nitrogen for the rumen microbes – NutriOpt Dairy can balance the two to optimise microbial protein production.

## Summary

**NutriOpt Dairy means dairy cows can be fed with greater precision resulting in improved focus on rumen stability and general animal health.**



# Understanding forage analysis



**NutriOpt Dairy parameters are available on all our forage reports. Your feed advisor will be able to recommend a balanced ration specific to your forage analysis.**

## Forage Analysis Report



**Sundry Account**  
**Farm** A. FARMER  
 A. FARM  
**Reference** A SALES MANAGER  
**Material Type** FIRST CUT SILAGE  
**Variety**  
**Additive**  
**Date Received**  
**Lab Report No.** L771419

NutriOpt Values (Dry Matter)		Result	Low	High
Rapid Ferm. Carbs (RFC)	g/kg	182.1	<180	>220
Total Ferm. Carbs (TFC)	g/kg	450.7	<370	>480
Rapid Ferm. Protein (RFP)	g/kg	72.2	<70	>110
Total Ferm. Protein (TFP)	g/kg	95.1	<80	>110
Acid Load (AL)		44.0	<44	>52
Fibre Index (FI)		202.2	<170	>210
Glucogenic Energy	g/kg	119.7	<100	>120
RUFAL	g/kg	14.4	<10	>15
DyNE	MJ/kg	5.97	<5.5	>6
NDIP	g/kg	63.8	<50	>60
NDIP Lysine	g/kg	4.5	<3.8	>4.8
NDIP Methionine	g/kg	1.1	<1	>1.2
NFEPB	g/kg	-0.4	<0	>20

### Comments



Signed.....

Report Authorised By: Richard Tunnicliffe. Position: Analytical Services Manager.

All work is carried out subject to our standard Terms and Conditions, a copy of which is available from:  
 Trouw Nutrition GB Blenheim House Blenheim Road Ashbourne Derbyshire DE6 1HA





# Glossary of NutriOpt Dairy parameters

Nutrient	Description
<b>Energy</b>	
<b>Rapidly Fermentable Carbohydrates (RFC)</b>	Carbohydrates that are fermented in the rumen in less than two hours after feeding. Mainly starch and sugars.
<b>Slowly Fermentable Carbohydrates (SFC)</b>	Carbohydrates that are fermented in the rumen more than 2 hours after the feed is eaten. Mainly starch, NDF and pectin.
<b>Totally Fermentable Carbohydrates (TFC)</b>	TFC is the sum of RFC and SFC. It includes carbohydrates from all sources that are fermented in the rumen. TFC is used to optimise formation of microbial protein.
<b>Bypass Starch</b>	Starch escaping rumen fermentation and available for digestion in the small intestine or fermented in the large intestine.
<b>Glucogenic Energy</b>	Glucogenic energy is the total amount of glucose precursors available from fermentation acids and intestinal absorption available for milk production. Especially important in early lactation for fertility.
<b>Glucogenic Energy Ratio (GER)</b>	GER is a measure of the amount of glucose precursors in the total energy supply of the diet. Used in early lactation to ensure glucogenic energy is maximised relative to fat intake.
<b>Dynamic Energy (DyNE)</b>	DyNE is the measure of the total amount of energy available for milk production (it replaces ME). DyNE is the sum of the products of fermentation in the rumen, digestion in the small intestine and fermentation in the large intestine, which includes all VFAs, glucose, amino acids and fatty acids.
<b>Protein</b>	
<b>Rapidly Fermentable Protein (RFP)</b>	The amount of protein fermented in the rumen in less than two hours after feeding.
<b>Slowly Fermentable Protein (SFP)</b>	The amount of protein fermented in the rumen in more than 2 hours after feeding.
<b>Totally Fermentable Protein (TFP)</b>	TFP is the sum of RFP and SFP. TFP is important for supplying enough fermentable protein for microbial protein synthesis to occur efficiently.
<b>NutriOpt Digestible Intestinal Protein (NDIP)</b>	NDIP is the total supply of metabolisable protein available to the cow. It is the sum of microbial protein yield formed in the rumen and bypass protein that is digested in the small intestine. NDIP also calculates the supply of the essential amino acids – Lysine and Methionine.
<b>Rumen balance</b>	
<b>NutriOpt Fermentable Energy and Protein Balance (NFEPB)</b>	NFEPB is the balance of fermentable carbohydrates and proteins in the rumen. Understanding how and why the rumen is unbalanced means the diet can be modified effectively so that the rumen works more efficiently.
<b>Rumen health</b>	
<b>Acid Load (AL)</b>	AL is an index based on the total fermentation products from VFA production in the rumen, and intake of acids from silages or other feeds. Acid Load should be used together with Fibre Index to optimise rumen health.
<b>Fibre Index (FI)</b>	FI is a measure of how well fibre promotes rumination, and also takes into account the chop length of forages. A low FI may require additional structural fibre to balance the ration, whilst a high index may result in slow rumen function and reduced feed intake. Fibre Index should be used together with Acid Load to optimise rumen health.
<b>Rumen Unsaturated Fatty Acid Load (RUFAL)</b>	RUFAL is the sum of the three primary unsaturated fatty acids consumed by dairy cattle; oleic acid (C18:1), linoleic acid (C18:2) and linolenic acid (C18:3).

# How can NutriOpt Dairy help in practice?

The problem	What is the cause?	How can NutriOpt Dairy help?
<p><b>Failing to hit target milk yield</b></p> <p>How can I increase milk yield?</p>	<p>Performance can be affected by multiple factors:</p> <ul style="list-style-type: none"> <li>• Poor cow condition</li> <li>• Poor transition into lactation</li> <li>• Acidosis</li> <li>• Not meeting energy and protein requirements</li> <li>• Low dry matter intakes</li> <li>• Mineral deficiencies</li> </ul>	<p>Using NutriOpt Dairy allows us to define raw materials and forages more accurately in terms of their true energy and protein supply, and can balance diets more efficiently in terms of rumen balance by using NFEFB.</p> <p>Because we know the true availability of energy and protein by using DyNE and NDIP, NutriOpt Dairy ensures sufficient nutrients are available for maintenance and milk production.</p> <p>Using Acid Load and Fibre Index, NutriOpt Dairy also ensures a healthy, functioning rumen to allow cows to reach their potential milk yield.</p>
<p><b>High milk urea</b></p> <p>Am I producing milk efficiently?</p>	<p>Milk urea levels are a useful guide of how well the rumen is balanced in terms of energy and protein. High milk urea levels indicate an excess of rumen fermentable protein.</p> <p>In the liver excess protein, in the form of ammonia, must be converted to urea. This has an energetic cost and can also compromise fertility.</p>	<p>NutriOpt Dairy uses NFEFB to identify if the rumen is balanced for energy and protein on a total diet basis.</p> <p>If the rumen is not balanced, RFC, TFC, RFP and TFP will help identify whether the diet has excess rumen protein or is deficient in rumen energy.</p> <p>The NFEFB value of different feeds will indicate how best to supplement for optimal rumen efficiency.</p>
<p><b>Acidosis</b></p> <p>Cows have loose dung and don't appear to be ruminating.</p>	<p>Acidosis is often a hidden problem on farm, or is noticed too late after the diet has been fed.</p> <p>The wrong source of sugars and starch in the diet may be fermented too quickly, or too much total fermentable carbohydrate can rapidly reduce rumen pH.</p> <p>Acidosis can result from big changes in rumen pH and an unstable rumen environment. This causes changes in microbial population and suboptimal digestion of feeds and poor rumen health.</p>	<p>NutriOpt Dairy is unique in that it can determine if a diet has the potential to cause acidosis before it is fed.</p> <p>NutriOpt Dairy looks at all sources of carbohydrates and whether they are rapidly or slowly fermented in the rumen.</p> <p>To reduce the risk of acidosis use:</p> <ul style="list-style-type: none"> <li>• RFC and TFC to ensure the correct sources of carbohydrates are fed at the correct levels to maintain a healthy rumen, whilst ensuring all microbes are fed.</li> <li>• Acid Load to take into account all sources of fermentation acids, acids from silages and other feed products, which could affect rumen pH.</li> </ul>
<p><b>Fertility problems</b></p>	<p>Poor fertility is a complex multifactorial problem but there are some dietary solutions where NutriOpt Dairy can help to improve fertility.</p> <p>In early lactation the most important factor for a successful lactation is increasing DMI and encouraging a rapid return to positive energy balance.</p> <p>To do this cows require energy from glucose, not from fat, to gain body condition, begin their oestrous cycles and ovulate a good quality egg.</p>	<p>Using NutriOpt Dairy will ensure that overall energy requirements are met by using DyNE, whilst ensuring energy is coming from the correct source.</p> <p>Using glucogenic energy and GER can ensure that glucogenic nutrients are maximised in early lactation to meet DyNE requirement, without increasing the fat content of the diet which could actually decrease body condition and be detrimental to fertility.</p>
<p><b>Low butterfat</b></p> <p>How can I increase my butterfat levels?</p>	<p>Decreased butterfat is a seasonal problem but can be manipulated through the diet.</p> <p>If rumen conditions are unfavourable; high levels of rapidly fermentable carbohydrates, increased Acid Load and low fibre levels, butterfat levels may be low.</p> <p>The diet also needs to be sufficient in fibre to provide acetate which is the substrate for butterfat production.</p>	<p>Using NutriOpt Dairy can help determine if cows are at risk of decreased butterfat. Balancing the NutriOpt nutrients; RFC, TFC, Acid Load and Fibre Index allows the ration to be fine-tuned to maintain optimal rumen conditions.</p> <p>Fibre levels can also be maximised to provide buffering and the substrate acetate to increase butterfat levels.</p>

# Summary



## Strong scientific foundation for the system

NutriOpt Dairy was developed by Trouw Nutrition based on extensive research in order to consider energy and protein supply in a fully integrated approach.

## Maximise forage utilisation

Our research investigated the degradability of the principle individual nutrients in forages and feeds. As a result we can now more reliably predict the true nutritional value of feed.



## More efficient rationing

For the rumen to be effective, the diet has to supply the correct amounts of fermentable carbohydrate and protein to ensure all of the rumen microbes have a constant supply of nutrients. This will ensure the rumen functions efficiently; optimising microbial protein yield, fibre digestion and dry matter intake.

## Optimise rumen health

NutriOpt Dairy balances Acid Load and Fibre Index to reduce the risk of acidosis, and increase buffering capacity to ensure optimum rumen health.



## Manipulate milk yield and milk constituents

Digestion starts in the mouth and ends in the large intestine. NutriOpt Dairy takes account of all the processes along the whole digestive tract of the cow. Using the new and more accurate measures of DyNE and NDIP, it accurately predicts the true energy and metabolisable protein available for milk production.





For more information  
**[trouwnutrition.co.uk](http://trouwnutrition.co.uk)**

NutriOpt is a brand of Trouw Nutrition, a Nutreco company.

Trouw Nutrition is a global leader in innovative feed specialities, premixes and technical services for animal nutrition. Quality, innovation and sustainability are the guiding principles behind everything we do – from research and raw material procurement, to the delivery of cutting-edge products and services for agriculture.

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