



How precision feeding influences milk production

Bethan Grylls interviews Dr Rita Fornaciari and Simone Blotta from Nutristar to find out why more dairy farmers should be focusing on their cows' nutrition.

THE WORLD OF dairy farming is rapidly evolving and the sector is in search of methods to support an efficient and high-quality production.

Numerous factors can influence the milk produced by dairy cows, among which nutrition plays a key role.

Without access to an adequate diet, animals can experience health and welfare problems, and milk quality and/or quantity can also be affected, with significant knock-on effects on farm profitability.

Italian company Nutristar develops feedstuffs and supplements for livestock with a particular focus on dairy cows, providing solutions for forage production on farm and animal nutrition for the European marketplace.

In particular, with systematic application

of various instruments, its experts carry out practical and dynamic tests both on farm and in the lab to formulate the best diet possible.

New Food spoke with Dr Rita Fornaciari, Nutristar's Laboratory Manager, and Simone Blotta, its Laboratory Technician, to find out more...

What is the ideal diet for a dairy cow and why does it matter?

Forage is the main bulk of a dairy cow's diet, but it needs to be optimised with non-forage feeds and supplements to ensure the animal has optimal intake of nutrients (energy, protein, minerals, etc).

A significant part of Nutristar's work is to analyse forages and feeds and interpret the results by applying the "rule of three diets"

(formulated, provided and ingested), which the company says should match each other as closely as possible.

"The samples we are sent include both raw materials and Total Mixed Rations (TMR) – essentially all the ingredients, from forage to feed, that the cow consumes. This enables us to spot any deficiencies in their diets and develop tailored solutions to resolve such issues and/or improve the farmers' end product," said Dr Fornaciari.

TMR is a mix of different forages and feeds that completely meets the cow's nutritional requirements. Since its inception in the 1950s, it is one of the most widely used methods for feeding high producing dairy cows.¹

This way of working helps farmers ensure that their cows are receiving a good

balance of proteins, fats, minerals, fibre and so on, which consequently reduces waste, enhances profitability and improves animal health and welfare.

“We tailor feed and supplements to cows’ needs, especially as they change through their lactation cycles,” explained Dr Fornaciari.

During each lactation, dairy cows go through three phases (early, mid and late lactation) and between each lactation, they undergo a dry period. According to Dr Fornaciari, it is imperative that the nutritional management of the transition cows (from three weeks before to three weeks after calving) is properly managed. In this critical phase, the analysis of forage and feed can reveal underlying issues – both in health and production – which can be addressed before they become a major problem. Ensuring that the lactation cycle begins on the right foot makes all the difference for the farmer and cow, Dr Fornaciari assured *New Food*.

In particular, the DCAD (the balance between anions and cations of the diet) is fundamental in close-up cow management. “We use an equation adapted from Goff’s,² which considers seven minerals (calcium, phosphorus, magnesium, sodium, potassium, chlorine, sulphur),” Dr Fornaciari said.

She continued: “We are also investigating the impact of diet on the minerals in milk, which are important for the cheese-making process.”

Moreover, through precision feeding, Nutristar can help farmers lower their



greenhouse gas emissions and reduce the use of drugs given to livestock, by balancing nutrients and applying nutraceutical principles. “Healthier cows need less vet intervention and this will help reduce antibiotic resistance and the high bills associated with

treatment. At the same time, they produce more and live longer.”

Analysis on the farm

At Nutristar the way towards an ideal diet begins on site (the farm); a member of its team ➤

EXPERT VIEW



Dr Adrian Fiege
Product Manager XRF,
Bruker



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Providing the optimal diet for your dairy cows at any time

Feed analysis expert at Bruker, Dr Adrian Fiege, explains the applications and benefits of X-ray fluorescence (XRF) spectrometry in the feed industry.

Establishing the optimal diet is of critical importance in the animal producing and feed industry, not only to generate high quantity and quality meat or milk, but also to ensure healthy and efficient growth. It can even help reduce greenhouse gas emissions.

The concentrations and ratios of macro and micro mineral nutrition in feed must be tuned to perfection and regular monitoring of the dairy cow’s urine and milk helps to ensure the best possible diet. Feed R&D, alongside diet monitoring and selection, require the right analytical tools, and a fast response is needed to drive meaningful actions at the farm, making speed and simplicity of analysis a must-have.

X-ray fluorescence (XRF) spectrometry is used to quantify, for example, macro and micro mineral nutrition in raw materials, pre-mixes, feed supplements, forages and urine, to name a few. It allows the determination of these concentrations from 100 percent down to parts per million (ppm) [$\mu\text{g/g}$] levels and covers most of the elements in the periodic table. Typical elements measured in various raw, intermediate mixes, final and supplement products include Na, Mg, P, S, Cl, K, Ca, Mn, Fe, Cu, Zn, Se and Mo, as well as toxic trace-level contaminants such as As, Cd and Pb.

Key advantages of XRF compared to traditional, wet-chemical

methods are the ease-of-use, simple sample preparation, short time-to-result, and the low cost of operation (no hazardous and/or expensive consumables; minimal user training required). As such, XRF is quite comparable to near-infrared (NIR) spectroscopy, which has become a well-established and extensively used analytical technique in the feed industry over the last few decades.

Notably, the same sample material which is analysed on an NIR spectrometer can be analysed on an XRF spectrometer without or with minimal additional sample preparation, providing elemental concentrations within minutes.



Simone Blotta in the lab at Nutristar using Bruker's XRF machine, the S6 JAGUAR

will carry out a physical evaluation of the TMR. The two key tools are the PARTICOMETRO, which evaluates the quality of mixing and the particle length, and the MATTOMETRO³ which quantifies the ruminative part of the diet.

The team members that work on farm are also trained to collect the representative samples of TMR, forages and feeds that need to be sent to the lab. Milk samples, both from bulk tank and individual cows, can also be collected and sent to the lab.

The role of the lab analysis

Nutristar receives around 150 samples every day. “We have several infrared instruments which we use to carry out the main bulk of our analyses,” said Dr Fornaciari. The team uses near-infrared (NIR) spectroscopy to establish the protein, fat, starch and fibre contents of the sample.

“We use an X-ray Fluorescence (XRF) spectrometer from Bruker on around 40 percent of these samples,” she added.

“The XRF is mostly used to analyse TMR, forages, milk and urine, and allows us to gather accurate information about the concentrations of the minerals measured by the instrument. This is a very useful insight as it means we can not only determine what the cow needs for her own health and wellbeing, but also what minerals she will need to produce better quality milk.” Certain minerals, for example, are key for cheese production (as mentioned above).

The XRF, Blotta explained, is a fairly automated process and even functions overnight when the lab is closed, enabling Nutristar to quickly turn around results. “This machine can carry up to 20 samples and takes approximately 10 minutes (per sample) to turn around solid sample results, and seven minutes for liquid samples. We achieve an excellent precision and accuracy with lower costs and in a shorter time than ICP. XRF is also a non-destructible type of analysis,” he noted.

The samples that arrive at the lab do need to be prepared manually, however. These are homogenised using a mill by the team as they arrive, leaving the technicians with a representative sample.

For accurate XRF analysis, forage samples are pressed into pellets. Liquid samples do not require preparation. Blotta also added that for milk – being an uncommon matrix to analyse – the laboratory established a unique protocol whereby homogenised samples are carefully measured into a ‘liquid cup.’ This precise and thin layer of milk prevents the fat in the milk pushing the minerals to top, which would provide an inaccurate representation of the milk the cow is producing.

The future

Although the work of Nutristar enables farmers’ dairy production processes to be more efficient and profitable, Dr Fornaciari said the company’s main ethos is animal wellbeing.

“Animal welfare is at the heart of what we do,” she said. “We base our formulations on what the dairy cow is lacking/requires. Through the analysis of forages and feeds and milk we can determine an awful lot about her health and welfare status, which obviously impacts rumen function and therefore dairy production.”

Commenting on the future of animal nutrition, Dr Fornaciari said that it’s about feeding cows “a diet that guarantees good quality milk and cheese, as well as animal welfare”, while also “reducing greenhouse gases emissions”.

As we concluded the interview, she highlighted the current focus of their R&D lab: “We have set up a ‘rumen microbiology area’ in our lab; here we are studying gas production from the diet. Thanks to our bioreactor, we have standard rumen fluid (cruelty free) available for *in vitro* fermentation experiments. The aim is to obtain feed that reduces gas emissions and preserve milks quality in terms of nutritional constituents.”



Dr Rita Fornaciari

Rita is Nutristar’s Laboratory Manager. She has a PhD in food and agricultural science, technology and biotechnology and she supervises the analytical activities and the studies of rumen fermentations *in vitro*.



Simone Blotta

Simone is Nutristar’s Laboratory Technician. He uses XRF and NIR spectrometers for feed analysis in any form: solid, liquid, powder and granulates. Recently, he started using the 9-MilCA method.⁴

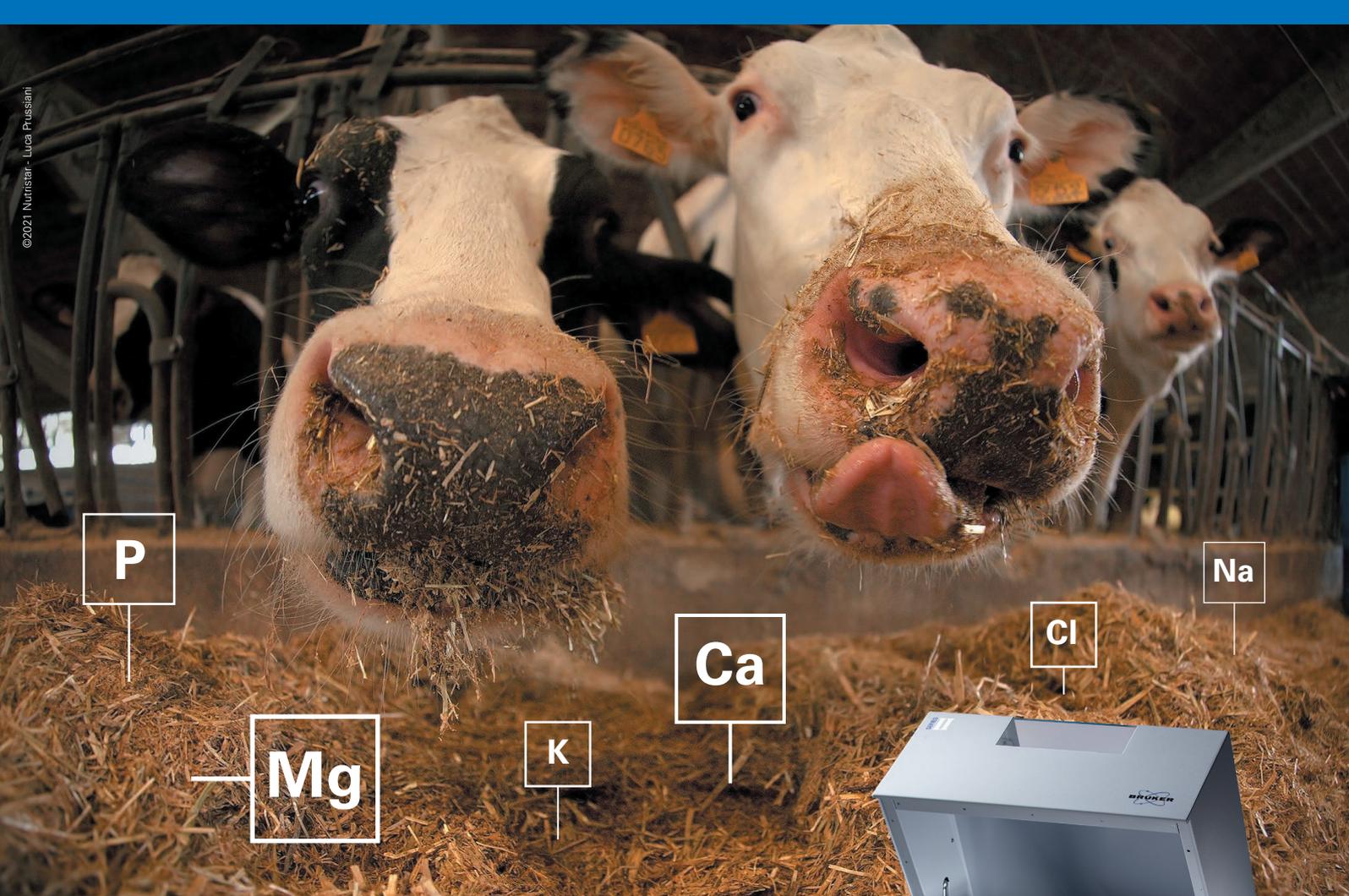
References

1. <https://extension.psu.edu/total-mixed-rations-for-dairy-cows>
2. Goff, et al. 1997, *J. Dairy Sci.* 80(Suppl. 1):169
3. <https://bit.ly/3jhMJ15>
4. Cipolat-Gotet, et al. *J Dairy Sci.* 2016, 99(2): 1065-1082



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