

Networked near infrared (NIR) analysis is enabling competitive production across borders and throughout the supply chain.

Proven: NIR analysis

does pay



A feed mill can save in the range of two to five EUR/ton of feed per year through NIR-based advantages such as reduced wet chemistry analysis and more accurate feed formulation. Plus, advances in network technology are allowing such advantages to be realized on a global scale with minimal costs.

Some might say that they have heard that sort of claim made about NIR analysis before, only to be disappointed in realizing a return on investment. But, while lack of knowledge and adherence to traditional methods may remain as barriers to adoption of NIR analysis, advantages are now being exploited by some larger feed producers with significant financial benefits.

One such company is Provimi, an international supplier of nutritional solutions and technology with a share of seven per cent of animal feed worldwide. Provimi has over 100 plants in some 30 countries and is a world leader in animal nutrition and related know-how. The company is the world's largest producer of premixes. Other products include complete feed, speciality feeds, pet food and aqua feed.

A pro-active approach

Paul Gerardy, General Manager of Provimi Research and Technology centre in Belgium explains that margins are decreasing at the beginning of the feed and food chain for the grain producer, the feed producer and the livestock producer.

“Costs and profit need to be monitored closely,” says Paul. “NIR gives you power and security.”

Paul says that, with wet chemistry analysis, a feed product can be eaten before the analysis results for raw materials arrive from the laboratory. “With NIR, suddenly you have a new dynamic,” he says. “You have proactive decision making instead of archiving data that arrive too late to correct your feed formula. You do not formulate looking into the mirror, but in front of you.”

Under Paul's guidance Provimi has taken advantage of advances in NIR analysis and complementary areas such as networking to set up a worldwide network of over ninety NIR instruments.

Of course, wet chemistry analysis is still the basis for the analysis operation. NIR calibrations are based on average results from eighteen validated laboratories. Typically, NIR is used to predict parameters such as: moisture, crude protein, crude fat and fibre, ash and starch. Provimi has 43 calibrations for raw materials, nine calibrations for complete feeds and two for silages.

For practical and economic purposes the network is managed from a central location. Calibration updates are sent from a central server to standardised instruments worldwide. Measurement results are then based on the same calibration, whether they come from India or Italy. Everyone can stay ahead. For instance, the calibration for the new soya harvest in Argentina is in the system before the ships reach port in Europe.

Soya 44 crude protein variation

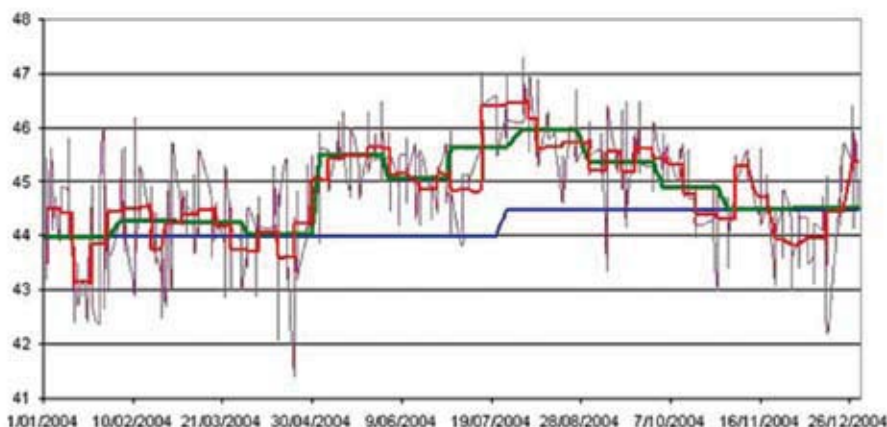


Fig. 1: NIR results for crude protein variation in soya samples. The blue line is the value used in feed formulation.

Every truck is tested

Just one example of the Provimi proactive approach in action is that all incoming raw materials are tested to ensure value for money and to stop anything outside the specifications. NIR analysis provides the right information in one to two minutes, that is, before the truck unloads the raw material. “If suppliers know we have NIR, we don’t have any problems,” says Paul.

The same can be applied to trucks leaving plants. None are allowed to leave without being tested. Out of specification feed will be retained in the plant.

There’s no need to be conservative

Paul explains that without NIR, the feed is produced before the raw materials have been analysed. Analysis is just for quality assurance purposes. But with regular NIR analysis, information is made real-time.

The decision process to update the feed matrix becomes easy and proactive. There is no need to be conservative, as illustrated by the graph of NIR results for crude protein variation in Soya samples, figure 1. In this example, each soya truck is analysed when entering the feed plant.

To those unfamiliar with NIR results, it may appear a little technical, but take a look at the blue line cutting through the middle of the other lines (figure 1). This is the value used in feed formulation. The monthly averages are indicated in green and the average per 300 tons in red (In this example, the feed plant uses two silos of 300 mtons to store soya).

Close monitoring of raw materials with NIR analysis ensures that the value used for the feed formulation is based on averages that are real and current. Feed formulation can therefore be more proactive without any in-built slack to allow for possible variations in protein content.

Fore instance, between 30 April and 10 October (dates on X axis), the feed producer could have formulated with protein values in the range of 45 to 46 % for soya instead of 44,0 and 44,5 % as indicated by the blue line in the graph.

The ability to produce feed with better monitoring of nutrient variation leads to significant savings.

To take an example, let’s assume a feed producer has two silos for storing soya, as shown in figure 2. and, as already mentioned, the raw material is checked at intake. One silo can be processed while the other one is being filled. The values used in the formulation system will then be the average values per 300 tons given by the NIR analysis of the incoming trucks, as indicated with the red line in figure 1.

Using the two silo example again, another approach could be to segregate the soya in the two silos: one for lower protein values and another one for higher protein values. The feed producer can then formulate more accurately to match expected content. And to keep everything on track he can monitor the feed formulation closely with NIR analysis.

From the experience at Provimi, conservative estimates indicate that savings of around two EUR per ton of soya can

be made by matching protein targets more closely.

Better animal performances

Working our way down the supply chain, the effect of closer standardisation has an impact on animal performance.

Just as in the feed formulation example, getting closer to target values saves money. For instance, if chicken feed contains soya with 45% protein one day and 46% the next, the ideal amino acid profile will not be respected and it will have an impact on the performance of the bird eating that feed. What is more, proteins above the ideal profile will be wasted. By optimising the protein levels, more chickens can be fed for the same cost of feed production.

From Paul’s estimates, the gains to be made through optimal animal performance can be considerable: in the region of twelve EUR per ton of soya.

Beyond the laboratory

NIR analysis has also helped Provimi to save on wet chemistry analysis. NIR technology eases the load by taking the bulk of analysis work, leaving the laboratory to focus more on other pressing issues such as food safety.

According to Paul’s estimates, more than 95 per cent of samples can be predicted by NIR. Under normal conditions, the savings thanks to NIR on wet chemistry are around 0,20 - 0,25 EUR per ton of feed per year.

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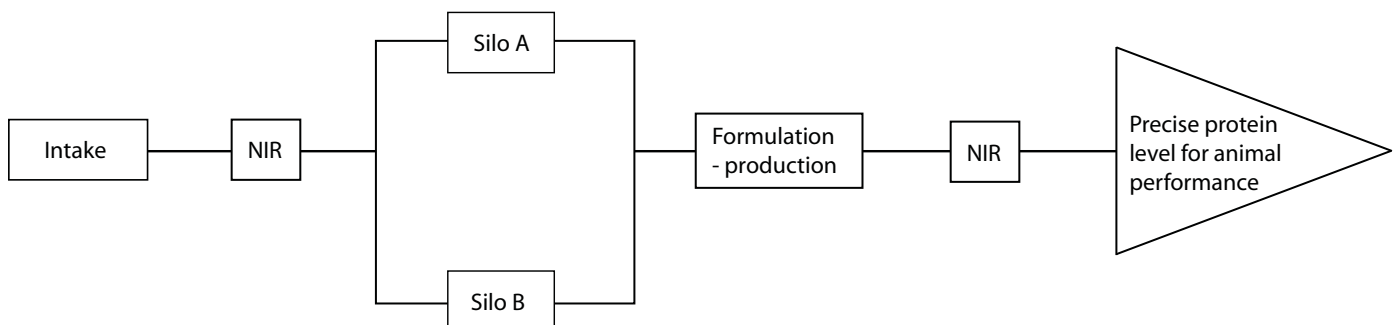


Fig. 2: Savings can be made at intake, in the flexible use of segregated material, in feed formulation and in optimizing animal performance.



How simple is it? With modern NIR technology, operators just need to load samples, either in ground or un-ground form and let the technology do the rest. Virtually instant results can be used for on-the-spot production control.

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However economy of scale is an important factor. “NIR in a feed mill is justified if the production is more than 50.000 mtons per year,” says Paul.

Making measurements is not an issue. Today, the simplicity of use provided by many NIR analysis instruments and associated software paves the way for analysis by non-laboratory staff. The latest NIR analysers allow samples to be measured in ground or unground form. Some analysers are also designed to be placed in the harsh production environment and require very little operator training to achieve valid measurements.

But is it reliable?

NIR analysis is based on reference analysis at accredited laboratories and NIR performance is regularly checked with wet chemistry. To date, the NIR analysis operation at Provimi is based on about 300.000 wet chemistry analyses on 69.000 samples of raw materials and complete feeds.

On the subject of NIR reliability, Paul is very clear. “NIR is just as accurate as wet chemistry, but more reliable because the human error is reduced to a minimum,” he says.

He is not so optimistic though about official approvals for NIR techniques, de-

scribing how, in Europe for example, each country has its own certification system.

The bottleneck is in the understanding

Effective NIR analysis requires good equipment, and reliable calibrations. The size of an operation is also important, for example, to realise savings against traditional wet chemistry.

And crucially, everyone in the organisation needs to understand what it is about if a NIR approach is to be accepted. With measurements taking less than a minute, NIR analysis generates a wealth of information. Everyone contributes and the information is used throughout the organisation. The Provimi approach shows that use of networking is important in this respect.

Using the network, experts based at a central location can organise information on the central server and manage the system remotely, for example, by making regular calibration updates. Staff at production sites need only think about making simple measurements as a straightforward part of their job while the information they receive provides a powerful tool for optimal feed formulation. Others such as business management can also use the

wealth of information to make strategic decisions based, for instance, on the performance of suppliers.

The Provimi example highlights the savings to be made with NIR analysis. The feed mill pays the right price for raw material, costs associated with wet chemistry are reduced, there is less wastage in feed formulation, better information leads to better decisions throughout the organization and optimal feed formulation leads to optimal animal performance per kilo of feed.

All in all, the savings for a feed mill can be in the range of 2-5 EUR per ton, per year.

In the future, a pro-active approach to control demonstrated by the Provimi model could benefit everyone throughout the supply chain. To an extent, this is already starting with many of Provimi’s customers coming online as part of the NIR network. Provimi started to develop its NIR network in 1998. To date, there are 92 installations, 31 at Provimi sites and 61 at customer sites. Two to three installations have been added to the network every month in the last three years.

by Richard Mills, FOSS