

Future formulation with algae for improved digestibility

Sustainability most often refers to a process aimed at balancing economic, environmental and social interests for a given project or action. In the field of food and agriculture, the FAO has defined five principles of sustainability, the first being improving efficiency in the use of resources. In this respect, improving digestibility and feed efficiency of farm animals is of upmost importance.

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In monogastric animals, feed represents 55-75% of the environmental impacts associated with animal husbandry, thus any improvement made to minimise the environmental impact of animal feed will have significant consequences on global farming sustainability.

Multiple and non-exclusive fields are being explored to reduce the impact of livestock feeding on the environment. Since the impact of feed on the environment is mainly explained by the production and transportation of raw materials, initiatives are made to favour the use of local ingredients. This culture has a low impact on the environment (in terms of climate change, use of non-renewable resources, ecosystems eutrophication and acidification, land use, etc) and requires limited transportation to the feed mills.

Such an approach led to the development of the multiobjective feed formulation,

which combines the least-cost formulation technique and environmental impact considerations, in view of formulating more sustainable feeds with a minimum economic impact for the producers.

Tested in various French scenarios (considering raw material price variability and availability), the model systematically increased the use of by-products in the diet of fattening pigs and broilers, to the detriment of corn and soybean meal. The use of oleaginous seeds (pea, field bean) was also favoured.

In some scenarios, the multiobjective formulation could decrease the environmental impact of the feed by 9% to 23% (depending on the considered criteria), while limiting the formulation cost increase to 2% (<€7/T of feed), thus highlighting the interest of multiobjective feed formulation.

New initiatives

On the other hand, a lot of work is being done to minimise the environmental impact of the feed at animal level by reducing feed waste. Such initiatives include improving digestibility and feed efficiency of the animals, as well as developing precision nutrition, which consists of the development and implementation of feeding techniques that will provide the right amount of feed, of the right quality, to each animal, each day, depending on their own individual variability.

On the research side, precision feeding proves to be interesting, however its implementation in the field still requires the proper characterisation of the animal's



variability (breed, sex, feed intake, growth potential, efficiency for deposition, etc) to individualise the feeding strategy.

So far, the main application of precision feeding is to increase the number of feeding phases (multiphase feeding), to more accurately feed animals according to their growth rate.

On the side of feed efficiency, the objective is clear: limiting the amount of undigested feed to reduce wastage and ammonia emissions (resulting from poor protein digestibility), the first one being costly and the second one being responsible for eutrophication and soil acidification.

Growing and finishing stages (broilers >21 day-old) are the most important in terms of economic and environmental impact (>75% of the feed intake of broilers is made after 21 days), and thus are the focus periods for digestibility improvement. Feeding low protein diets, yet balanced in essential amino acids, has gained interest.

Several studies show promising results, though attention must be paid to the consequences that feeding low protein diets have on animal performance and carcass quality.

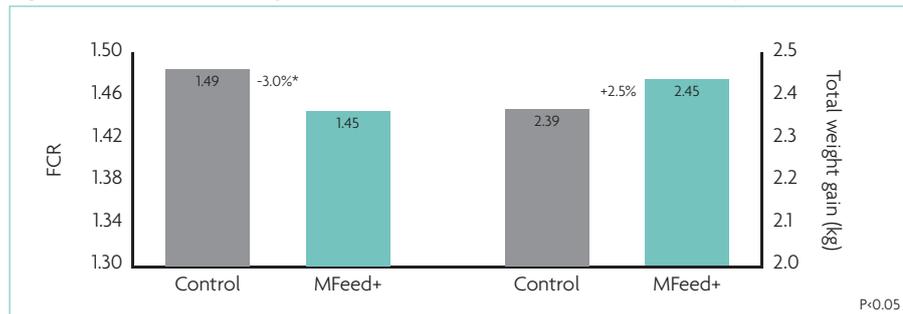
Another leverage to reduce undigested feed and ammonia emissions is to support digestibility. Several types of feed additives are available on the market. Among them, an innovative product combining clay and algae is very promising for its capacity to improve the efficiency of different types of diets, independently of the formulation.

The product relies on the natural capacity of clay (Montmorillonite) to improve feed digestibility, and enhances it thanks to a patented combination with seaweed extracts.

The technology increases the accessible

Continued on page 29

Fig. 1. Effect of MFeed+ on performance of broiler chickens fed a corn-soybean based diet.



Continued from page 27

surface of Montmorillonite to digestive enzymes and nutrients, thus favouring the contact between these two. Moreover, the presence of metallic ions on the clay surface and in the seaweed extracts further boost enzymatic activity, by acting as a cofactor for their activation.

The capacity of this algoclay product to improve feed efficiency of broilers was tested at the University of Viçosa (Minas Gerais, Brazil) by Pr H. R. Rostagno, Pr L. F. T. Albino and their team.

Cobb 500 one-day old male chicks were used in the study. Chickens were fed a starter feed from day 1 to day 21 and a grower feed from day 22 to day 35, both

corn-soybean based and formulated according to the recommendations of the Brazilian tables for poultry and swine.

Half of the chicks received the standard diet (control) and half received the same basal diet supplemented with 0.1% algoclay product (MFeed+) in replacement of washed sand. Results showed an increase in total weight gain for the chickens supplemented with MFeed+ compared to control (+60g at 35 days, $P=0.13$) and a significant improvement of feed efficiency: -3% on FCR ($P<0.05$) (Fig. 1). This was in line with the digestive enzyme activity measured by kinetic assay on duodenum samples (collected at 35 days, two hours after the last feeding, from 30 chickens/treatment).

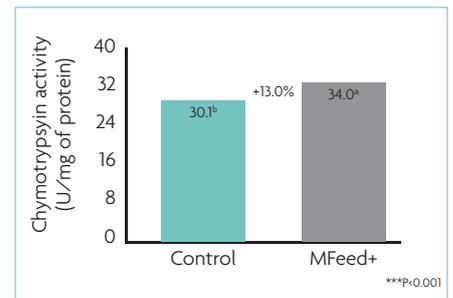


Fig. 2. Effect of MFeed+ on chymotrypsin activity in the duodenum.

The activity of chymotrypsin (a pancreatic protease) was increased by 13% ($P<0.001$, Fig. 2) in MFeed+ group compared to the control group, reflecting the capacity of the product to stimulate the activity of digestive enzymes. This improvement in digestion and growth performance led to a higher Production Efficiency Factor (PEF, +5%) and improved the benefit over feed cost by 4% for the chickens receiving the MFeed+ supplemented diet (net increase of €0.023/chicken).

Also tested together with the use of by-products, in France and the USA, MFeed+ proved to be a great tool to support the use of local by-products in the diet. Results showed either an improved efficiency of diets already using by-products, or the compensation of the loss in performance triggered by the use of by-products compared to a standard cereal-based diet.

MFeed+, based on natural resources (clay and algae), thus proves to fit perfectly in a sustainable farming approach, by improving feed efficiency, which contributes to optimise the use of raw materials and so their environmental impact, and by supporting the use of by-products in the diet, which have been shown to be a sustainable alternative to cereal-based diets.

Conclusion

Despite being 30 years old, sustainability is more than ever a hot topic in the industry. Improving sustainability of livestock requires strong coordination in the industry and efforts from all stakeholders.

A strong competition for low impact raw materials may emerge between different species and territories and acting on one segment of the industry should not narrow the possibilities of improvement for another.

Meanwhile, several tools are already available to improve sustainability in livestock farming, particularly at the nutrition level. Innovative formulation techniques and specific additives using natural ingredients and technologies can support the better use of raw materials and minimise their environmental impact. ■

References are available
from the author on request