



SPECIFIC
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AUTUMN 2022

IN THE

MIX

#57

It's all in the
detail at
Gunnee



DID YOU KNOW?

Could we soon grow yeast from trees?

In 2019, Lallemand joined the Food of Norway Consortium, aimed at investigating novel sustainable feed ingredients for livestock and aquaculture. Today, the group has reached an exciting milestone by literally producing yeast cells from wood as an alternative to molasses! The consortium achieved the successful industrial scale-up of 1,600 kg of yeast produced from sugars from Norwegian spruce trees. Production was a joint effort by our R&D team, Borregaard, and the Norwegian University of Life Sciences (NMBU).

Sugar from Norwegian spruce trees was produced by biorefinery company Borregaard, and this was used to grow the yeast at the Lallemand production site in Salutaguse, Estonia. The yeast will be used in large-scale feeding trials with pigs and Atlantic salmon, in collaboration with leading feed companies in the Foods of Norway.

"We are proud of this important milestone on our journey towards the development of alternative feed ingredients using local Norwegian resources. There is still a lot to be done before commercial development can be realized, but this achievement reinforces the technical feasibility of the concept developed through Foods of Norway towards a more sustainable feed production."

Mathieu Castex,
Director of Research and Development.



Hydrolysed yeast product

3 questions to Vassilia Theodorou, about the brain-gut axis



^ Vassilia THEODOROU, Director of Research, Neuro-Gastroenterology and Nutrition Unit, INRAe Toxalim, France

The brain-gut axis is quite a new concept that we are starting to get familiar with in human medicine. Could you please briefly introduce the concept?

I agree with you that we are speaking a lot recently about the brain-gut axis, but the concept is not so recent. The brain-gut axis is an integrated bidirectional communication between the gut and the brain through the connection of the enteric nervous system located in the gut wall, and the autonomous nervous system. In this way, messages are conveyed from the gut to the brain and back to the gut. What is more recent in this bidirectional communication is the involvement of gut microbiota as a new player in this dialogue, modulating signals in the intestinal barrier received by the enteric nervous system.

What is the role of the intestinal microbiota on the occurrence of human diseases? Do you think we can find similarities in production animals?

The symbiotic relationship between the gut microbiota and the host is present not only in humans but also in production animals. This symbiotic relationship can be disturbed, leading to what we used to call dysbiosis.¹ Dysbiosis is linked to pathogenicity. For instance, infection by pathogens or intestinal inflammation leads to dysbiosis and disease. However, even if dysbiosis is closely linked to disease in several human pathologies, we do not know yet what comes first, the egg or the hen.

How does stress influence the physiology of the gut?

There is a large body of literature underlying the effects of stress on gut functions. For instance, it is well known that stress accelerates the intestinal transit, modifying the intestinal motility. It is also well known that stress disrupts the integrity of the intestinal barrier function resulting in increased gut permeability, alterations of mucus secretion and modifications of the microbiota profile.

Can probiotics help modulate barrier function and prevent intestinal dysbiosis?

Absolutely! Probiotics have been shown to be able to reduce gut hyperpermeability that is induced by stress or inflammation. This reinforcement of gut barrier results in less upload of luminal agents, less mucosal immune activation and, consequently, less nerve activation.

¹ Dysbiosis is defined as an "imbalance" in the gut microbial community that is associated with disease. This imbalance could be due to the gain or loss of community members or changes in relative abundance of microbes. (from Messer et al., Physiology of the Gastrointestinal Tract (Sixth Edition), 2018)

Probiotics have been shown to be able to reduce gut hyperpermeability that is induced by stress or inflammation.

Welcome

Welcome to another packed edition of *In the Mix*. How time fly's! COVID seems to be settling down and a sense of normal is descending down on us, but is it really? The chaos of supply chains, raw material pricing and availability continue to cause concern with no light at the end of the tunnel. Throw in the recent drenching of rain? The devastation from Gympie to Tweed, to Lismore and beyond? Our thoughts must reside with those that lost so much. The conflict in Ukraine is unsettling an already unsettled world and the markets are becoming more uncertain and ever changing. Rest assured that we are doing everything we can to ensure effective supply of products to the farm. As we look ahead its very clear that effective forage planning with Silage at the centre is the key to FUTURE PROOF YOUR BUSINESS.

Alex Turney - Country Manager



Lallemand Animal Nutrition is excited to welcome Ali Tucker to the team. Based in the Maroochydore office as the customer service officer, Ali will be a friendly voice on the on the other end of the telephone.

She has a background in customer service, being the first point of contact for customers, warehouse management, orders administration and CRM packages.

The Lallemand team welcomes Ali and looks forward to the insights and energy she brings to the team

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Attention to detail pays at Gunnee

Attention to detail across every aspect of silage production and utilisation is paying big dividends at Gunnee feedlot in northern NSW. Located outside Delungra, about 35 km west of Inverell, the property hosts a (well maintained) 10,000 head feedlot as well as 1600 ha of country used for cropping, forage production and backgrounding.

Feedlot Manager, Mark Byrne, has worked closely with Lallemand Animal Nutrition staff over the past two decades, including Ken Rich (decd), Trevor Schoorl (decd) and current Technical Services Managers, Jordan Minniecon and Nathan Lister.

"Trevor was absolutely pivotal in setting up our current silage program," Mark says. His expertise, enthusiasm, and commitment to producing quality silage was second-to-none. Lallemand has proven time and time again it has the expertise and products to help us to get the very best outcome from our silage."

"Silage is a big part of the feeding program, forming about 8–10% of our rations for short-fed cattle and about 10–15% in our Wagyu program, so we want to reduce shrinkage as much as possible. The goal is to make sure that whatever we put into the stack can be taken out in 12–24 months' time as quality hygienic forage and put into a ration."

"Silage gives us a source of digestible fibre. It has consistent quality and the right particle size ranging from – 12–20 mm – depending on plant dry matter at harvest. We also like the fact that silage is pre-processed, which saves us time during feeding out."

Gunnee aims to have sufficient silage to meet its requirements for at least two years. "Our capacity is 12,000 to 15,000 tonnes and we always aim to have at least 8,000 tonnes available at any one time," Mark says.

"Silage gives you the comfort of knowing that we can carry on through challenging times. It also gives us flexibility in the formulation, particularly during dry periods when it can be hard to find roughage, or if you can, it is expensive to freight."

Gunnee utilises the full range of Lallemand silage technology, including Silostop oxygen barrier film, SilageKeeper UV covers and MAGNIVA Platinum.

Silostop limits the growth of spoilage-causing yeasts and moulds. Independent testing has confirmed these multi-layer polyethylene films are up to 100 times more effective than conventional polyethylene film in preventing the entry of oxygen into silage. Silostop is available in a range of thicknesses to suit different storage conditions and duration.

SilageKeeper UV covers protect silage against the impact of sunlight and damage caused by animals and environment. These woven covers are ideal for covering Silostop oxygen barrier or conventional PE films. With proper care, these reusable woven UV covers will last for a minimum of three years.

MAGNIVA Platinum is a new-generation inoculant that combines a patented bacterium strain, *Lactobacillus hilgardii* CNCM I-4785, with the industry standard, *Lactobacillus buchneri* NCIMB 40788. This unique combination provides fast-acting 'front end' fermentation with proven 'back end' aerobic stability, allowing silage to be opened earlier and last longer after opening.



"You can focus on all the important things, like crop maturity, yield and chop length, to optimise quality but without an effective inoculant and sealing system, you won't have anything to feed out," Mark says.

Gunnee's silage is produced on-farm from a range of irrigated and dryland crops, including corn and barley. Crops are harvested by Wayne Galley Silage Contracting, a family-owned business with nearly 30 years' experience in making quality silage.

The Processed crop is stored in three stacks on laser-levelled and compacted pads. Each pad has a slope to the front and sides, and a spoon drain in between pads to ensure adequate drainage. "We put in the pads about 15 years ago and are very happy as they have improved our quality and reduce spoilage at feed-out," Mark says.

"It is important to point out that while growing a good crop and managing the covering and sealing is very important, it is absolutely critical to manage the silage once opened. To this end, our milling and feeding team, led by Noel and Nick, have absolute

buy-in to managing the face of the stack to ensure we minimise losses and maximise value to the ration."

Lallemand Animal Nutrition Technical Services Manager, Nathan Lister, says Gunnee's standard of management is exceptional.

"Their discipline towards executing every step of silage production is first class," he says.

"Everything they do is driven by the desire to optimise the quality of the silage they produce, and just as importantly, the quality of the silage they feed out. Losses due to spoilage can be typically in the order of 10 to 15%. Gunnee aim for 5% or less."

"Gunnee was an early adopter of Silostop film, SilageKeeper UV covers, and MAGNIVA Platinum forage inoculant. This inoculant suits Gunnee's silage program perfectly because their management program means they can take full advantage of that extra stability during feed out."

**Want to take
control of your
silage quality?**

www.QUALITYSILAGE.com



Flood recovery

The extreme wet weather in Queensland and New South Wales has proved challenging for silage making as wet ground conditions, flooded crops, high moisture and high temperature environments, mature crops, low moisture and high dry matter, all takes its toll.

While the worst of it may have passed for the moment, weather forecasters are predicting more wet weather to come.

This information aims to arm you with knowledge and options for a proactive response in the event of another serious deluge.

MAGNIVA Platinum forage inoculant will help manage yeast and mould growth which decreases forage quality. This leads to aerobic deterioration, heating and production of mycotoxins. MAGNIVA Platinum will also decrease pH very quickly controlling some of the undesirable bacilli bugs and maximise the use of the available sugars. Special enzymes for breaking down fibre bundles will help improve digestibility in mature crops.

The following information and options may also help you to make the most of difficult situations:

1. Wet Ground Transport

Engage with you contractor and see what they have in the way of buggies, trailers and other transport to enable access into wet ground when trucks are not viable.

2. Contaminated Material

Crops that have been flooded will have been exposed to silt which carries soil microbes. These microbes have a negative effect on silage fermentation, quality, stability and ultimately animal health. In these extreme situations our recommendation is to

inoculate the crop with 1.5 times the normal application rate of MAGNIVA Platinum. MAGNIVA Platinum will initiate a very strong and fast initial fermentation dominating and dropping the pH extremely quickly. This will help limit the effect from these undesirable soil microbes.

3. Aerobic Deterioration

High humidity and high temperature environments lead to a perfect situation in which yeast and moulds thrive. Yeasts and moulds decrease the quality of the silage, lead to aerobic deterioration (heating) and produce mycotoxins which have a detrimental effect on animal health. Once again treating these forages with MAGNIVA Platinum at 1.5 times the rate will help to manage these situations and detrimental microbes.

4. Low moisture and high dry matter mature crops

As the crops have remained in the field longer, conditions are ideal for yeast and mould proliferation. Low moisture and high dry matter crops are lower in sugars and this makes them more difficult to compact and this in turn challenges fermentation. Mature crops have more indigestible fibre portions, which can lead to less nutrients being available to the animal.

5. Chop Length

Shortening your chop length on the forage harvester and processing the grain well will help increase compaction (density) which helps dramatically with fermentation while processing will help digestibility of starch portions in the grains.

6. Testing

We also recommend analysing the material going into the pit as this will provide a starting point for the quality of the crop

being ensiled. Further, we recommend that the silage is regularly tested at feedout. Rations may then be balanced around what is being fed, not what could be assumed as being fed.

It is important to recognise that these conditions are extreme and challenging. Try not to be disillusioned by reduced end product quality on this occasion. Farms should consider these factors to maximise potential silage quality and seek advice from specialists and consider using quality-enhancing products.

Flooded silage stacks

With the latest series of rain events, many farms in various parts of the country have seen flooding and have had their fodder reserves inundated with rain and floods

When finished silage is flooded, the acids that preserve the silage can leach out and the VFAs are washed away along with soluble nutrients. What's left behind is usually of low nutritional value and is most likely to spoil.

Bulk silage pits and buns suffer from infiltration of contaminants from the flood water as well as the wash-out effect.

While, each individual situation would need to be assessed and managed accordingly, careful feeding and separation of the unaffected silage at the top of the spoiled feed will be needed.

Analysis of the stack would be a valuable tool as some of the silages made last spring are showing lower quality than expected and higher levels of yeast and moulds.



Get fresh cows back on their feet



YMCP is a probiotic and mineral booster that helps to create a stable rumen environment and stimulate rumen function in fresh cows at a time when their appetite is naturally suppressed. Offered to cows immediately after calving, it helps to reduce the amount of time that fresh cows are energy-deficient and gets them back on feed and on their way towards peak production.

YMCP contains *Saccharomyces cerevisiae* CNCM I-1077, a natural, strain-specific live yeast that has a documented mode of action upon rumen function, rumen pH and fibre digestion. The beneficial effects of *S. cerevisiae* CNCM I-1077 upon the health and performance of dairy and beef cattle have been described in more than 60 scientific papers published throughout the world. YMCP also contains a rich source of magnesium, calcium, potassium, betaine (glycine), niacin (Vitamin B3) and electrolytes to help the cow recover from calving.

Fourth-generation dairy farmers, Chris and Katrina Heathwood, milk 370 Holstein cows under an all year round-calving pattern at Goomeri, 75 km west of Gympie, in Queensland. The Heathwoods began using YMCP about a year ago.

"Our nutritionist and vet suggested that we consider using a fresh cow product," Chris says. "We'd been using LEVUCCELL SC in our milking and transition rations for several years, so we were more than happy to try another product from Lallemand Animal Nutrition."

"We use YMCP as a preventative maintenance measure in all of our fresh cows and heifers. It helps to clean them up, rehydrate them and get them back onto feed quicker."

"It's a good investment. The small cost of YMCP is easily paid for by having our cows restored to full health quicker. YMCP has been a great pick-up for us and we are very happy with it."

The Heathwoods also utilise Lallemand Animal Nutrition's expertise in their silage program. Sorghum silage, which accounts for almost half of the ration, is treated with MAGNIVA Platinum forage inoculant and covered with Silostop Max oxygen barrier film. "MAGNIVA Platinum gives us the aerobic stability that we need," Chris says.

Technical Services Team



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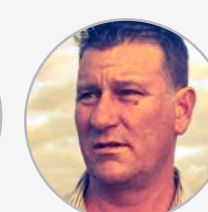
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Optimising digestive function for better udder health

Over the last decade, tremendous research has been devoted to gut microbiome understanding in humans and animals. We have learned gastrointestinal microbiota plays a key role in digestive function, and also for other functions, including immunity, metabolism, and behaviour.

More and more, it is understood what happens in the rumen can cascade into gastrointestinal function, metabolic status, liver function, immune response, and the mammary gland. This progression is illustrated by disruptions that may start in the rumen and which will have measurable consequences on milk production for example. Sub-acute ruminal acidosis (SARA) and its consequences are a good example.

Diets rich in readily fermentable starch, or sugars, are known to alter the composition and diversity of rumen microbial communities and their functions. In turn, this alteration leads to fermentation profile changes and a decrease in rumen pH, which characterises SARA. Low rumen pH for a prolonged period can negatively affect feed intake, microbial metabolism, and feed efficiency as it inhibits fibre-degrading communities (Villot et al., 2018).

The role of bacteria

It is well-established SARA induces the release of large amounts of cell-free lipopolysaccharide (LPS) in the bloodstream (Plaizier et al., 2012). LPS is a component of bacterial structures that is mainly released when bacteria die. This component has been shown to trigger inflammation patterns at the rumen-wall level. Diets associated with ruminal acidosis may induce bacterial death and also increase the turnover rate of bacteria, leading to a strong LPS increase in the rumen. In addition

to LPS, other inflammatory compounds such as histamine may be released in the rumen during SARA. Histamine is produced by low-pH tolerant bacteria (Garner et al., 2002) and can accumulate in case of acute acidosis (Golder et al., 2013, 2014; Silberberg et al., 2013).

Rapidly fermentable dietary carbohydrates

A high level of rapidly fermentable dietary carbohydrates (as with high concentrate or grain-based diets) promotes the production of volatile fatty acids (VFAs) that are an important source of energy for the animal. However, rapidly fermentable dietary carbohydrates will also increase harmful lactic acid production which may accumulate in the rumen. These high acid concentrations have damaging effects on the rumen wall, leading to papillae erosion, rumen wall destruction, and to overall increased permeability.

Inflammation

Because of this rumen wall permeability, inflammatory molecules such as LPS and histamine may pass easily from the rumen to the bloodstream, triggering systemic inflammation that involves a greater glucose requirement (Kent-Dennis and Penner, 2021) and increased energy demand. Inflammatory response elicited by the animal diverts nutrients that are essential for milk components synthesis (Dong et al., 2011). Histamine may also induce inflammation at the hoof level, causing laminitis (Garner et al., 2002).

In summary, SARA conditions can lead to the generation of multiple toxic compounds in the rumen. The detrimental effects of this SARA are observed beyond the rumen.

What is the impact on health and milk?

In addition to the reduction of energy available for body maintenance and milk component synthesis, the presence of toxic compounds in the bloodstream has an impact on immune response and inflammation in the udder.

LPS can be transported through the bloodstream to the mammary gland (Dong et al., 2011, Zhang et al. 2016) and invades the mammary gland, generating a local immune response (Aditya et al., 2020). This immune response might impair the immune defense of the teat and even destroy its barrier function (Dong et al. 2011), which increases the animal's exposure to bacteria invasion and increase the risk of mastitis.

An inflammatory response in the udder has been found to be associated with a reduction of milk protein content (Zhang et al., 2016). Similar observations have been made with histamine (Chang et al., 2018). Moreover, in addition to affecting rumen and lower gut microbiota, SARA has been suggested to alter the microbiota of the milk (Zhang et al. 2015).

As a result, SARA can impair body condition maintenance and milk production through disturbances in the rumen. This is due to an alteration of microbial fermentation and also because of SARA effects on inflammation and immune response which can be observed beyond the rumen.

In a nutshell:

1. Conditions in the rumen can influence functions outside the digestive system.
2. Sub-acute ruminal acidosis (SARA) is linked to shifts in microbial populations and fermentation.
3. These microbial population shifts may be responsible for the release of toxic compounds such as LPS or histamine, as well as overproduction of organic acids which may be aggressive towards the rumen wall.
4. The toxic compounds will activate inflammatory and immune responses at the rumen epithelium level but also affect the entire animal because of the transfer of these molecules to the animal's blood circulation.
5. LPS molecules from digestive origins have also been found in the mammary gland and activate immune and inflammatory responses.
6. At the udder, these responses may impair the immune defense of the teat and may reduce milk protein production.
7. Inflammatory and immune responses consume energy that will not be used for important physiological needs such as body maintenance or milk production.
8. Prevention of SARA by supporting optimised rumen microbiota balance and function helps alleviate these detrimental effects.



Microbiota modulation for better feed utilisation in gestating sows

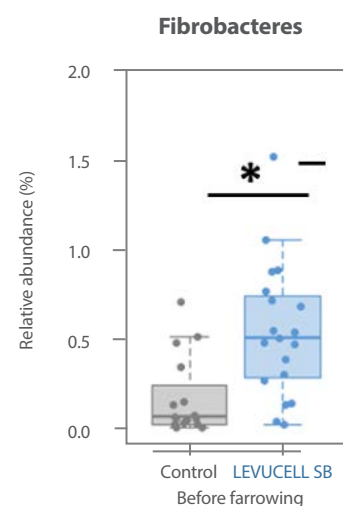


Figure 1

Fibrobacteres relative abundance in gestating sows fed with or without LEVUCCELL SB (Achard et al., 2019)

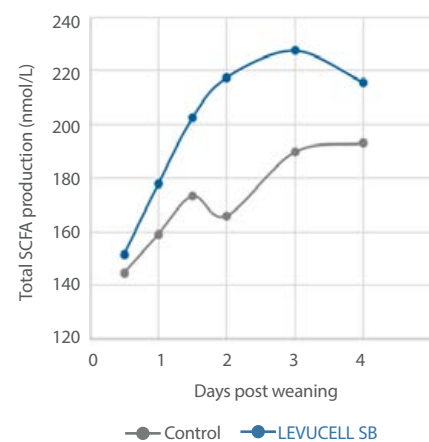


Figure 2

Kinetic of SCFA release in vitro with and without live yeast LEVUCCELL SB, using an in vitro pig gut model and simulation (from Gresse et al., 2021).

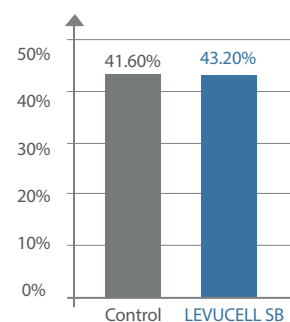


Figure 3

Effect of the live yeast *Saccharomyces cerevisiae* boulardii CNCM 1079 on the ratio between retained energy and metabolizable energy (Labussière et al., 2022).



The fibre effect: How to improve income-over-feed costs in dairy herds

Milk energy is coming mainly from fibre degradation

Ruminants have the unique ability to degrade and ferment fibre through microbial activity. Forage is a major fibre source and can be either grown on farm or available locally at a more competitive price than concentrates. Optimising the ration to maximise fibre digestibility helps cattle extract more energy from forage and improves feed efficiency, income-over-feed costs and, finally, farm profitability. A better understanding of how fibre is degraded in the rumen helps identify the changes that can help reach this goal and make sure fibre is no longer an untapped energy source.

Ruminant nutrition ration formulation is a compromise between raw materials, forage prices and nutrient availability of each of the feed components.

As energy is coming mainly from fibre degradation, one of the solutions is to optimise the rumen function, which leads to optimal digestion of fibre from all types of ruminant diets. This can be supported by the use of scientifically documented rumen modifiers such as the specific live yeast *Saccharomyces cerevisiae* CNCM I-1077 (LEVUCCELL SC).

The specific live yeast helps boost the efficiency at which feed is transformed into energy, principally through improved degradation of fibrous material. This specific live yeast has a beneficial effect on microbial

fibre degradation by stimulating the growth and fibrolytic activity of fibre-degrading bacteria and fungi populations. Moreover, the live yeast promotes an optimal rumen environment, with a beneficial action on rumen pH.

As a result, LEVUCCELL SC is able to improve feed efficiency by 3-7% under standard or stressful production conditions (Figure 1). This represents a valuable tool that allows for the forage portion of the diet to be maximised and gives producers and nutritionists the possibility to increase milk or meat revenue per kilogram of feed — or allows them to optimise feed costs while maintaining similar revenue.

It gives producers and nutritionists the opportunity to switch from one ration to another depending on their specific situation — without compromising on feed efficiency, which supports greater flexibility and resilience.

Improving feed efficiency while safeguarding animal welfare has always been an important objective for nutritionists. In the current context of raw material pricing, this goal continues to be a major priority. Improving fibre degradation is one of the keys. Getting every last nutrient out of the ration helps protect the narrow margins of farm managers.

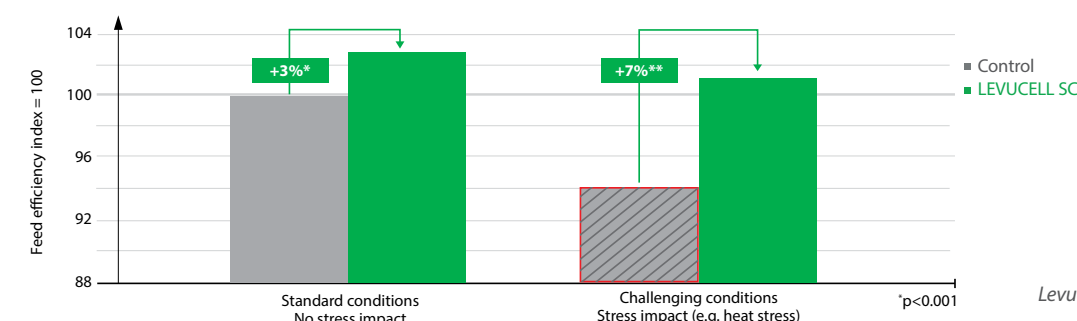


Figure 1

Levucell SC effects on dairy cow feed efficiency (average of several trials).

LALLEMAND TAKES PART IN SCALE, THE WORLD'S LARGEST MICROALGAE BIOREFINERY PROJECT



We are very pleased to partner in the SCALE project. The SCALE project strives to build and operate a first-of-its-kind flagship plant to valorize on an industrial scale natural active ingredients derived from microalgae for various high-valuated end-use sectors. It is led by Microphyt, a leading company in the production and marketing of microalgae-based bioactive ingredients based in France.

As part of the industrial consortium, the role of Lallemand Animal Nutrition is to evaluate the benefits and applications of microalgae ingredients in synergy with our own microbial-based solutions for animal nutrition and well-being. Our primary areas of investigation will be aquafeed applications to contribute to improved aquaculture production, as well as swine feed and pet food applications.

Why microalgae?

In the face of several global challenges, such as feeding a growing population, increasing pressure on natural resources, growing competition for land use, and other crucial problems such as obesity and malnutrition, it is considered essential to harness the untapped potential of the oceans as part of the solution to these challenges.

In this sense, microalgae are a highly promising source of aquatic biomass that could be applied to a wide range of end uses, due to their advantages of containing a high number of bioactive compounds due to their great diversity, CO₂ absorption capacity, and unlimited source of innovation for many sectors.

The SCALE project provides a unique technology to unlock the microalgal diversity in order to produce and extract bioactive compounds from microalgae for food, food supplements, feed, and cosmetics sectors, through economically sound and environmentally friendly processes.

About SCALE

The project will scale up the microalgae production process from demonstration scale to Flagship industrial scale with an annual production target of 24 tons of dry microalgae biomass and 105 tons of high-value ingredients and will be located in Baillargues near Montpellier (southern France).

SCALE brings together 11 renowned partners from 4 European countries at different stages of the value chain. The project will be carried out over 48 months, from June 2021 to May 2025, with an overall budget of € 24.5M including € 14.3M funding from the European Union's Horizon 2020 research and innovation program and the Bio-Based Industries Consortium.

For more information about SCALE visit: www.scaleproject.eu

IN THE MIX

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