Food Valley Update

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Green proteins

The Protein Cluster

Beyond meat replacement

Ripe for investment
The Protein Cluster
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“The market is ready for innovation and creativity”
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Discover and share Green Protein Innovations
Worldwide, businesses are continually developing novel solutions. Worldfoodinnovations.com features them. In this edition we share a few impressive green protein innovations.

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The Protein Cluster, an East-Netherlands collaboration
Sustainable (international) research, development and marketing of ‘green’ proteins is the raison d’être for The Protein Cluster, a collaboration between entrepreneurs in the vegetable-protein chain. The initiative was launched on 11 October, to a national and international audience.

The Eastern Netherlands boasts more than sixty companies, research institutions and ancillary organizations working at the forefront of protein-transition technologies. This is a globally-necessary transition from diets requiring high volumes of animal protein to diets based much more on vegetable protein. This significant concentration of knowledge and experience forms a solid platform for expanding the export of products, concepts and technologies developed in the Netherlands, in the area of green proteins, according to the partners who make up the The Protein Cluster. The initiative also underlines the importance of (locally-produced) vegetable proteins.

Hester Maij, Representative Nature, Food and Culture for the Dutch Province of Overijssel: “Consumers are demanding healthy and sustainably-produced foods, and vegetable proteins are playing an increasingly important role in meeting this need. Working together with The Protein Cluster, the Province of Overijssel – within our own Agro & Food program – is also promoting the production, processing and use of vegetable proteins.”

In addition, the provinces of Overijssel and Gelderland are working to develop a healthy local vegetable-protein ethos. Chain-wide support is central here, from stimulating the cultivation of vegetable-protein crops such as soy and fava beans, to the production of vegetable-based consumables. Representative Michiel Scheffer of the Province of Gelderland: “Vegetable proteins are the food of the future. I am convinced that, in ten years time, the world will be eating more vegetable than animal protein, benefitting both the environment and the economy. The Protein Cluster is giving this initiative the traction it needs during these early stages.”

The Protein Cluster is a collaboration between the provinces of Gelderland and Overijssel, Food Valley NL and Oost NL. Food Valley NL is the coordinator. www.proteincluster.nl
Food designer Katja Gruijters: “The market is ready for innovation and creativity”

Products made using green proteins have an increasing presence in stores, but often look suspiciously like meat. The food industry is missing opportunities, says food designer Katja Gruijters: “Vegetable proteins have so much more to offer.”

“New products often come onto the market in the form of a successful existing product,” says the food designer. The iconic hamburger was the model for the first meat substitute, roughly twenty years ago. Later came spreads, meatballs and other products, all inspired by meat. “Maybe a smart move commercially, but not very creative,” says Gruijters.

Copy
This tactic also leads many consumers to regard products with vegetable proteins as good or, perhaps, not-so-good copies of meat. Many of these products are also found at the meat counter – right beside chicken thighs, tartar and salami. “This sells green proteins short, because there is so much more you can do with them.”
It could be different, according to the food designer. “Falafel – which began life as a meat substitute during times of fasting, has developed a strong identity in the Middle East; consumers can buy it at many different places – including the supermarket – together with pita and fresh vegetables”, she says. “The same goes for paneer in India, and tofu in countries such as Thailand, Indonesia and Japan.”

In the Far East, for example, many variations of tofu are available for different dishes. “Firm tofu for Gadu Gadu, regular tofu for soups, and soft silken tofu for salads and desserts”, illustrates the food designer. “In most Dutch supermarkets only firm tofu is available, and consumers often do not know how to prepare it correctly.”

**Personal identity**

Green proteins can also develop their own identity, but this needs a real change of direction. “It is time manufacturers and retailers gave more space to innovation and creativity,” emphasizes Gruijters. “This is a joint challenge; one where they can take their inspiration from other cultures and from the sources of their raw materials.” At the moment, according to the food designer, consumers are uncertain from what, exactly, these meat replacers are made.

There are countless ingredients that, in processed or unprocessed form, can serve as vegetable protein. “But it still has limited availability in the store, or consumers do not know what to do with it,” says Gruijters. “Think, for example, of fresh seaweed, beans – that far too often are eaten with meat – mushrooms, and water lentils.” Apart from different ingredients, there is great variation in color, shape and meal times. “Soup or salad with green proteins? Why not?” Gruijters is convinced that green proteins can grow into an iconic product, with their own instore display.

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**About Food Designer Katja Gruijters**

Katja Gruijters is first and foremost a food designer. Already, while studying at the Design Academy, food was her way of communicating visually. In 1998 she graduated with a fictitious line of “Meat-replacing products that do not resemble meat”. Gruijters now creates and develops original food concepts for companies in the food industry, retail and food service. Last year, her book, Food Design: exploring the future of food, was published, with a chapter about proteins.
Discover and share Green Protein Innovations
1. Fresh, tasty and healthy Chlorella

To use microalgae as green protein source and to profit from their healthy nutritional aspects, it is necessary to apply them in great amounts. Duplaco made this possible, producing a mild, tasty ‘Chlorella’, which does not have the typical predominant algae taste, but still contains all health promoting properties.

**Heterotrophic cultivation**

Duplaco developed an innovative fermentation process, called ‘heterotrophic’ cultivation, to produce these food and feed grade (micro)algae. Using this sustainable, fully controlled and sterile cultivation process, they are able to produce fresh, liquid Chlorella; 365 days per year.

**Duplaco’s Chlorella**

Duplaco’s Chlorella has a high protein content (Per 100 gram: >45%) and contains all essential amino acids. Furthermore they contain healthy dietary fibres, many vitamins and minerals (e.g. rich in vitamin D and Iron), and they are extremely rich in antioxidants.

Duplaco provides their tasty Chlorella in the following forms:
- Supplements
- Powder
- Fresh (liquid)

**Microalgae**

Duplaco produces and delivers the pure microalgae; it is up to their customers to explore the endless possibilities.

2. Taste-enhancing proteins from onion residue streams

The industrial processing of onions for retail and restaurants results in large amounts of onion peel residues that have to be disposed of and have therefore a negative value.

**Onion processing**

Together with the onion processing company Mol Onion Ingredients (MOI), Biorefinery Solutions (BRS) has developed a unique biorefining technology that can isolate food grade proteins from such onion residues. These protein concentrates have very strong umami taste enhancing properties. Moreover, when extracted from red onion peels, the protein concentrate also has a heat stable carmine red color.

**Onion proteins and fibers**

This is the first time that value-added food ingredients have been isolated from onion residues. The biorefining technology developed by BRS and the resulting products are currently being patented.

The resulting onion fiber fraction has strong water binding characteristics and is useful as a gluten free dietary fiber additive in, e.g., bread products.

These products allow food companies to reduce salt in their product formulations and replace E-number ingredients, such as E621 (MSG) and E120 (Cochineal) with a natural alternative. This contributes to a much desired “clean-label” policy.

Applications are in consumer products, such as meat replacers, soups and sauces, snacks and bakery products.
3. Unique test facility: The Green Protein Accelerator

The Green Protein Accelerator is a unique food grade production line, available for start-ups, suppliers of green protein ingredients like legumes, algae, insects and settled companies that wish to claim their share of the fast growing meat-free business by means of innovative ‘green’ protein products. The product line is located at the production plant of Bobeldijk Food Group in Deventer.

Unit operations of the Green Protein Accelerator include mixing, shaping, heating, (pre-)frying, battering, preserving and packing. Balls, burgers, sticks, schnitzels are only a few of the concepts that can be tested. At a scale as small as 50 kg/batch, innovative ‘green protein’ concepts can be evaluated. Resulting samples are used for sampling, sensory evaluation, nutritional and functional characterization. They help identifying Unique Selling Points, detecting upscaling effects, convincing (launching) customers, inspiring investors, and more.

Bobeldijk Food Group understands the importance of industrial scale production, certainty of delivery and constant quality for meat free innovations to maximize their chance of success. Many green protein innovations fail to enter the market because shared food-grade facilities are lacking and are expensive in use. When available at large production sites, minimal ordering volumes need to be granted.

The Green Protein Accelerator aims to take away these barriers and accelerate the route to market, thereby supporting the protein transition. The Green Protein Accelerator is located at an existing and renowned food producing company.

Bobeldijk Food Group has a history of more than 40 years in the development, production and distribution of innovative food concepts. Experienced production managers assure high-quality, cost efficient and flexible production. Once developed and tested, production can directly be scaled up to industrial scale and distributed to sites all over Europe.
4. Rudin® VegaCasing: alginate technology for co-extrusion processes

**Rudin® VegaCasing vegetable paste**
Rudin® VegaCasing is a 100% vegetable paste based on alginate technology. Made of seaweed extract, fibers and stabilizers, it improves food safety by avoiding risks of animal diseases. The vegetable ingredients also make it eminently suited for the production of vegetarian, halal or kosher sausages. Using a special co-extrusion technology, Rudin® VegaCasing makes it possible to stuff sausages continuously on a fully-automated line.

**VegaCasing applications**
Products made with Rudin® VegaCasing have an attractive appearance, a pleasant mouthfeel and a natural bite. This casing can be applied to meat, fish, poultry, vegetarian and cheese products, and it can be processed into fresh, cooked, dried or smoked sausages. The co-extrusion process offers a wide range of calibers. For small calibers the costs are particularly advantageous against other casings, since all sausages can be produced on the same machine with the same casing.

**Coextrusion process**
The implementation of Rudin® VegaCasing at production lines is done with the help of the technologists of Ruitenberg Ingredients. Services involved extend to ensuring the functionality on production lines, resulting in products according to the quality standards clients aim for.
5. Vivera’s tasty, nutritious and sustainably-produced soy-based products

Aware consumers are looking to replace animal proteins in their diet with vegetable alternatives: for both health and sustainability reasons. However, many vegetable-derived products lack the ‘bite’ that makes real meat so attractive. Vivera’s soy products are a nutritious, delicious and sustainable alternative.

The products are created in-house, in Vivera’s own production plant, that meets or exceeds the latest environmental footprint and labor standards. They are produced via a unique extrusion process: Soy-protein flour is mixed with water, heated - while being pressed through a mold - and then cooled. The extruded substance, which has a fibrous structure, is then cut to size. In order to make the product even more sustainable, Vivera is investigating ways to use Dutch soy as the basis, or (combinations of) other protein-rich locally-cultivated crops.

Vivera offers a broad range of soy-based meat replacers, some of them organic or even from 100% vegetable origin (vegan).

An example from the latter category includes ‘chicken chunks’, which are rich in protein (over 20%) and fiber (6%), clean label and have a fibrous-structure that closely resembles real chicken. The ‘chicken chunks’ were launched in the Netherlands and can be found in supermarkets and restaurants throughout the country. The product is also on the market in Sweden, via the ICA supermarket chain.
6. Hollands Goud rapeseed oil

Throughout Europe, there is a desire for high-quality, sustainably-sourced edible and cooking oils with beneficial fatty acid profiles (high in omega-3 fatty-acids, low in saturated fatty acids). Driven by consumer preferences, Hollands Goud rapeseed oil, supplied by Colzaco, perfectly meets this trend.

The oil, with its characteristic warm golden color, is extracted from locally-grown rapeseed. Ten times higher in linolenic acid than olive oil (9% versus 0.9%), it also boasts 50%-less saturated fatty acids.

The rapeseeds are processed in the mildest possible manner, to ensure optimal taste and nutritional value: raw seeds are pressed at low temperatures (below 40 °C), preserving naturally-occurring antioxidants and aromas. Other crucial elements in the process are the storage conditions – rapeseed moisture-content should be kept below 77% – and seed drying, which needs precise speed and temperature.

Hollands Goud rapeseed oil is sold in approximately 70% of Dutch supermarkets, and in Belgium, and is used in high volumes by food industries.

To improve the Return On Investment (ROI) of sustainable rapeseed cultivation is the mission of Colzaco, a Dutch cooperative of rapeseed growers. Established in 2006, the organization focuses on regional coordination of cultivation, processing and sales. Their approach enhances entrepreneurship among farmers. The farmers directly benefit from the revenues. And the organization supports sustainable land-use and biodiversity.

www.worldfoodinnovations.com
A fast-growing worldwide population, large amounts of land and water used to grow cattle and health issues related to high-meat intake: the need of a transition towards more vegetable-based protein sources seems obvious.

Products with green proteins often look like meat products. The name ‘meat replacer or ‘meat alternative’ refers to something second best. Therefore, a new identity has to be developed for these products. The category offers opportunities for the food sector, and companies can meet development and marketing challenges by co-creation. This can be concluded from the Green Protein summit.

Business opportunities
Willemsen – who calls himself a ‘green protein crusader’ – claims the key factor to success is meeting consumer needs: “Anticipate on what the consumer wants. Diets will change. A more plant based, sustainable and healthy diet is the diet of the future.”

Moreover, green proteins should not refer to meat replacers, meat substitutes or meat alternatives. Helen Kranstauber from Food Cabinet said those words are especially unappealing to young people who make no distinction between meat and proteins from other sources: “We need a new narrative for people who don’t carry that luggage with them.”

She also stressed the importance of communication: “If you call it vegan, you exclude people. We have to go from a diet with lots of meat intake to a more plant based diet. Vegans, flexitarians, meat lovers; we want all groups to be engaged.”

Sausage of the Future
Product designer Carolien Niebling combines, in her work, the old look of a sausage with new ingredients. The sausage has been developed over 5,000 years and now butchers can help with a new phase of development. In the book ‘The Sausage of the Future’ that she has launched on 13th of November, Niebling wrote about 100 new ingredients that would fit into a sausage. From grains, seeds and nuts to vegetables. “The ingredients are all available, butchers can start tomorrow.”
An example of a hybrid product she developed is mortadella with vegetables. It contains 40% pork meat, 18% pork back fat and 28% broccoli and carrots. Sustainability has to do with using every part of the animal. The heart fuet is a salami containing 30% lean pork meat, 30% heart meat, 25% pork belly fat and 10% herbs (nettles). “Heart is a butchers’ favorite. Why not use it?”

**Functional protein from leaves**
To meet with demands, new sources of green protein are needed. Paulus Kosters, CTO of the company GreenProtein based in Wageningen, spoke about the sourcing and extraction of a functional protein called Rubisco. It is extracted from green leaves, and has functionalities comparable to egg protein which is widely used in the food industry.

Kosters pointed out that it is a long and winding road to develop a new functional ingredient based on plants. He emphasized the importance of co-creation, as did other speakers on the Summit. He works in a partnership with industry and EU partners. The goal of the project is to realize a demo plant (TRL 7) on production scale.

**In vivo**
Jurriaan Mes from Wageningen University & Research explained people need proteins with the right balance in amino acids. He pleaded for more intervention research in humans. Bioavailability and dynamics can be analyzed postprandial for which standardized protocols should be used. These will support models to translate effects from in vitro digestion to human situation. The increased knowledge on personal digestion and intake can help to optimize nutrition of products and help to evaluate new protein sources.

Around 175 people from the Netherlands and countries as far as UK, Canada, Thailand and Indonesia participated in the Food Valley Summit Green Proteins, in October 2017.
DSM’s Rapeseed Canola protein: turning a by-product into a valuable food protein

How can we provide the growing world population with high-quality protein? Gertjan Smolders, and his colleagues at the DSM Biotechnology Center in Delft, researched the possibilities and developed a unique technology that produces high-quality protein from the inedible parts of the rapeseed plant.

“Our research team soon realized that our focus needed to be on new methods for protein production. This nutrient is essential to the body, yet, many people around the world have a protein intake that is too low,” says Smolders, RT&D Manager of DSM’s Rapeseed Protein Venture. “It also seemed smart to use an existing plant raw-material stream, in view of the growing scarcity of agricultural land.”

Animal feed
The researchers soon identified rapeseed (also known as canola), a crop grown worldwide in large volumes for
its oil. “It is normal that those parts of the plant that remain after pressing the oil out, end up as animal feed,” says Smolders. “A waste really, because it still contains high-quality proteins.”

However, the plant does not give up its prize easily. “Rapeseed contains many substances that are unsuitable for human consumption; bitter-tasting components for example,” Smolders illustrates. “It is difficult to separate-out the proteins.”

**Reverse approach**
The extraction of rapeseed oil usually involves the solvent hexane, at high temperatures – treatments that degrade the protein functionality. DSM took the reverse approach. “We took protein functionality as our starting point and developed a process in which unwanted components are removed while maintaining protein quality.”

DSM also found that the raw material for protein extraction needed to be cold pressed rapeseed, without the use of hexane. “This process ensures the proteins remain intact,” says Smolders.

**Unique solubility**
The result is a more-than-90% pure, high-quality protein with uniquely-high solubility. “It contains all the essential amino acids, something that a number of other vegetable proteins lack, illustrates the RT&D Manager. Solubility is almost as high as whey protein, all but eliminating the chance of a dry or gritty mouthfeel. “And, unlike soy protein, it also works well at a low pH.”

The rapeseed protein can be used in almost all products – from ice cream, yoghurt and mayonnaise to sports drinks, protein bars and even meringues.

DSM is bringing the product onto the market in small steps. “We have built a demo plant in Delft, where we show customers the possibilities and help them develop their own products,” says Smolders.

The production volumes are still small but, if Smolders has his way, this will soon change. “We expect that in the near future there will be a full scale production plant, where we can produce tailor-made varieties of rapeseed protein.”

**Enormous potential**
Rapeseed protein can, in time, make a significant contribution to global food security. “World production of rapeseed is currently about 70 million ton a year,” says Smolders. “If we could extract all that protein, we could feed 700 million people a year.”

At least as important is that the new protein parallels global consumer trends, emphasizes Smolders: “The demand for sustainably-produced products, that are compatible with a healthy lifestyle, is increasing. Rapeseed protein – vegetable, non-GMO, and free of gluten, milk or solvents – fits perfectly in this picture.”

**About Gertjan Smolders**
Gertjan Smolders has been Managing DSM’s Rapeseed/Canola Venture as RD&T manager since early 2016. Previously he had a number of other roles within the company. Smolders graduated from Wageningen University (Environmental Sciences) in 1989 and obtained his PhD cum laude, in 1995, from Delft University of Technology (Biochemical Engineering).
Innovation in green proteins has become a hot target for investors, with many predicting that demand for healthy, environmentally friendly protein sources is set to skyrocket in the coming years.

Robert Vreeman set up Corpeq’s Green Protein Fund in early 2016 and was one of the keynote speakers during the Food Valley Summit Green Proteins on October 11th in the Netherlands. He was first inspired to get involved in start-ups while studying for his MBA at Stanford and saw what his peers were achieving with a more hands-on investment approach. The decision to focus on green proteins came later, from observing general trends in food and nutrition, and the venture capital fund is now keeping an eye on a database of about 150 Netherlands-based start-ups in the sector.

“I believe that if you want to be successful it certainly helps to be operating in a booming industry, where macroeconomic developments are driving the growth,” he said. “Combining the global population growth with the fact that researchers project an increased protein intake per capita makes it safe to assume that the global demand for proteins will continue to increase.”

There has been a boom in agtech investment over the past few years, with about $3.2bn of venture capital investment going into the global food and agricultural sectors in 2016, up from just $0.4bn in 2010, according to a recent AgFunder report. Much of this investment has gone into US companies, and Vreeman wanted to figure out how to translate the trend to Europe, and make it relevant to The Netherlands in particular.
“We are generally becoming more environmentally aware and people see that eating meat is not necessarily the best protein conversion,” he said. “It’s more efficient and sustainable to have your protein coming from plants.”

In addition, interest in health and nutrition has surged, more people than ever claim to be limiting their meat consumption – if not cutting it out altogether – and awareness of animal welfare issues has also increased. Many of the world’s most radical alternatives have come out of The Netherlands, from insects and lab-grown meat, to innovative extrusion technologies for more meat-like plant proteins.

The CQ Green Protein Fund aims to tap into these broad trends and has so far invested in two companies: The Dutch Weedburger, a seaweed-based burger company, and Duplaco, which produces energy efficient microalgae products for food and feed. Vreeman says the fact that the fund is family owned and has no predetermined exit requirements allows it greater flexibility and opens it up to the potential of sequential rounds of investment.

So what makes a company interesting to investors? “For me, existing revenue is really important,” Vreeman said. “That’s credibility. There are already people who are willing to pay for your product.”

This should not be confused with having a product listed and in stores. While this might prove that your product is innovative, he said, it doesn’t necessarily prove that there is demand.

“The only thing that’s a proxy for demand is turnover of that product versus comparable products,” he said, but scaling up enough to boost turnover requires money. “In order to get the money, they need to have the volume, and that’s the catch-22...That’s the role of venture capital, to give entrepreneurs the means to escape this catch-22.”

About Robert Vreeman

Robert Vreeman is founder and managing director of the CQ Green Protein Fund, which invests in sustainable health food companies leading the green protein transition. Previously, he was managing director of SanoRice Italy, subsidiary of the SanoRice Group, and later was the group’s CFO. He holds a Master’s degree in Mechanical Engineering from TU Delft and an MBA from Stanford.
Flavour is important for plant-based proteins, but to spark real change in what people eat, texture is everything, says Anna-Kajsa Lidell, co-founder of Swedish plant protein firm Food for Progress.

Using a Dutch extrusion technology for soybeans, the company developed Oumph!, a range of soy-based strips, chunks and fillets, available unseasoned, or in varieties like Thyme & Garlic, Salty & Smoky, and Grill Spiced. Although the brand is clearly meat-like in its texture and flavours, its creators have deliberately avoided calling Oumph! a meat substitute.

“What makes it different is that we decided not to look at it as a meat replacer. We decided that we wanted it to be good enough to stand on its own,” said Lidell. “We don’t believe that people want to eat something that’s a substitute for something else. We believe people want to eat something that’s tasty.”

The company is driven by a mission to create truly sustainable food, and Lidell is clear that money is not its sole driver. Measuring the company’s success also involves changing the way people look at plant-based foods. “To create massive change, texture is everything. As far as we believe, we are working with the best texture and taste in the world. It is the combination of those things that is the real jackpot,” she said.

Despite disagreement over the exact environmental impact of meat – estimates of its contribution to greenhouse gas emissions range from about 10% to as much as 51% – there is a growing consensus that moving
toward more plant-based diets is necessary for a sustainable food supply. The Oumph! brand was developed with this in mind.

“Food for Progress is all about food that fits within our planet,” said Lidell. “We call it ‘one planet food’, a wording with roots in the WWF. We have to eat in a way so that one planet is enough for nine or ten billion people.”

Scandinavians have a strong interest in sustainable eating, so the brand intends to appeal not only to vegans, but also to meat-eaters looking for tasty ways to include more vegetarian foods in their diet. But with so many meat alternatives available, how is it possible to convert meat-eaters to this particular product?

“We just make them taste it,” she said. “It has such a wow effect that they want to have more of it and share it with their friends. That’s how we get the snowball rolling.”

The sector is extremely promising, she says, and Oumph! has attracted interest from around the world. It is already in major Scandinavian retail chains and is set to launch in Whole Foods Market in the UK. In addition, Lidell said that not comparing the products to meat was a powerful tool, allowing consumers to draw their own conclusions. “When they get it into their mouth, they make the comparisons themselves. That’s the strong thing: we don’t tell people what to expect.”

About Anna-Kajsa Lidell
Anna-Kajsa Lidell is co-founder of Food for Progress, a Swedish company that aims to lead a shift toward green proteins in the Nordic region, both through its own brands – Oumph! and Beat – and by bringing a new mindset to the global food sector. Anna-Kajsa and her partner Anders Wallerman aspire to implement a new food logic that can rapidly transform the market. Originally a communication strategist, she is now Head of Progress Strategy at Food for Progress.
The Protein Cluster Chain position

The Eastern Netherlands boasts more than sixty companies, research institutions and ancillary organizations working at the forefront of protein-transition technologies.
Since its establishment in 2004, Food Valley NL has built up a deep insight into the challenges of the (agri) food industry and a vast network of companies and knowledge institutions that can help in tackling these challenges effectively.

From its home base in Wageningen, the Netherlands, every day Food Valley NL works on speeding up the innovation performance of companies, both from the Netherlands and abroad.