

# The future of plant protein

## Potential game changers



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A Givaudan white paper,  
in collaboration with the  
[University of California, Berkeley](#)

Our thanks go to UC Berkeley's Product Development Programme Director, Keith Alexander; PDP Coach, Sudhir Joshi; and the field project team which conducted the research: Cheryl Chan; Samdisha Punjani; Tirth Patel

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# From niche to mainstream

## Demand for alternative proteins, particularly in nutritional beverages, is at an all-time high.

Consumers are looking for healthier, more sustainable choices and major scientific studies<sup>1</sup> have recommended an increase in production of nutritious plant-based foods for human and environmental health. Feeding the world of tomorrow, in a healthy way will require a more efficient use of resources such as land, water and energy.

Alternative protein products have moved from niche to mainstream with new products regularly appearing on the market. Consumers expect these new products to be high-quality, nutritious, sustainable, affordable, and crucially, provide a delicious and satisfying final product.

Consequently the protein space in the food industry is now incredibly diverse, making it difficult for food

manufacturers to anticipate future trends. There is also a growing need to meet increasing pressure on supply.

So how can food manufacturers see into the future to find the 'next new protein'? One that is versatile, effective, commercially viable and most importantly that works in their process and products?

As a global leader in the protein space Givaudan has been at the forefront of shaping the future for alternative proteins for many years. We engage with many partners, looking for new ideas, solutions and collaborative innovation opportunities to help tackle alternative protein's complex technical challenges. As part of this we have been working with the University of California, Berkeley through its Product Development Program to explore the landscape of current and rising proteins. This cutting edge research is helping us decipher the future of alternative proteins, particularly in nutritional beverages, for our customers.

**\$13.7 B**

Global Plant Protein market to grow at 8% CAGR to \$13.7B by 2021<sup>2</sup>

**57 %**

of global consumers are actively seeking protein sources<sup>3</sup>

**92 %**

growth in sales of plant protein products over the last year<sup>3</sup>

1) Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems, 2019

2) Source: Techavio

3) Source: Institute of Food Technologists (IFT)

# Mapping the proteins of the future

We tasked the students at UC Berkeley with the challenge of identifying up-and-coming proteins that could be potential game changers for the food industry.

These needed to be able to be sourced sustainably at scale and deliver quantities of high quality proteins, cost-effectively, when processed. Ideally any new protein would be suitable for a range of applications and feature wider health and wellness benefits.

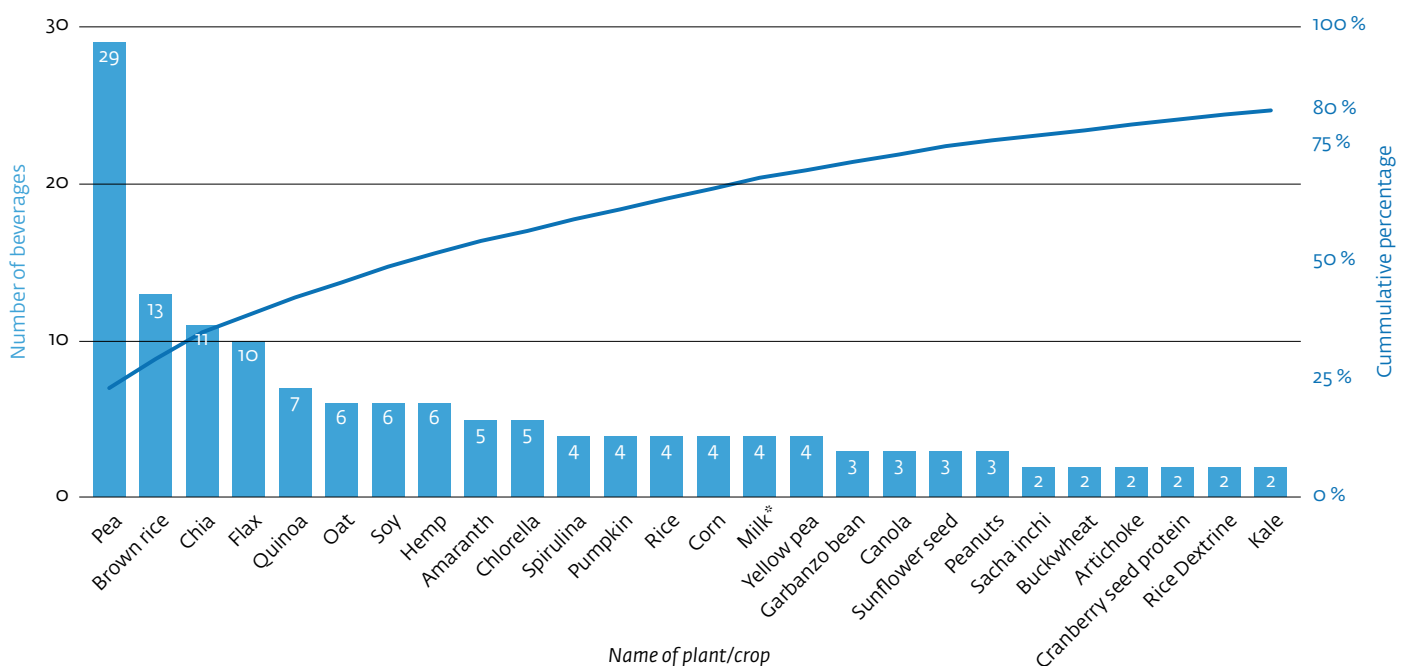
The team started by mapping the landscape of alternative proteins. They looked at an initial pool of 44 different

protein beverage market products and 42 unique plant proteins. Each protein candidate was profiled against several filters including characteristics of the crop: protein content, yield per hectare, land availability for cultivation, fertilisers, water requirements and climates required for successful yield; and characteristics of the protein: colour, flavour, allergenicity, nutritional value, and protein purification process. The research also explored how these new proteins could help the food industry to meet wider challenges such as UN development goals in sustainable agriculture, as well as delivering healthy and affordable nutrition.

Using a process of elimination based on the key criteria above, 6 key proteins were selected and profiled as potential candidates for the next leading alternative protein. Each of these six proteins offer a host of benefits and as such, have high potential to drive the next generation of protein beverages and other alternative protein products.

## Frequency analysis

How many times a plant protein shows up in a drink – 44 brands analysed (pareto analysis)



\* Although not a plant protein, milk was considered as a common ingredient in some nutritional beverages

# Profiling the leading contenders

The six leading candidates come from three distinct commodities: cereals, legumes and oil seeds.

All scored highly against both the commercial and sustainability factors and offered attractive additional health benefits making them an appealing option for product developers in the future.

## Cereals

Oat, the seventh most abundant cereal produced in the world, is used for food applications worldwide. There has also been a rising interest in using oat in beverages.

## Legumes

The three types of legumes profiled (Mung beans, Garbanzo beans and Lentils) are cultivated and consumed in many parts of the world. Wide cultivation around the globe results in less transport energy and as a result, a lower carbon footprint than many other protein sources, an attribute that is appealing to many stakeholder groups including product developers and consumers.

## Oil seeds

Both sunflower and flax seeds have intrinsically unique properties that offer high potential for this market.

	Supply	Nutritional value	Environmental impact	Functional properties	Taste and colour	Regulatory
Oats	●	●	◐	◐	●	●
Mung beans	◐	●	●	●	◐	●
Garbanzo beans	●	◐	◐	◐	●	○
Lentils	◐	●	●	●	●	◐
Flax seeds	○	◐	●	◐	●	○
Sunflower seeds	●	●	◐	◐	◐	●

● Highly favourable      ◐ Somewhat favourable      ○ Not favourable

# Protein #01

## Oats

### Key benefits

Health and wellness  
Versatility  
Resource efficiency

**Family**  
Cereals



### Nutritional value

PDCAAS: 0.60  
Protein (g/100g): 16.90

As a widely cultivated, staple foodstuff which offers attractive health claims, oats were a key candidate. Nutritionally, oat is an excellent source of vitamins, minerals, fibre, antioxidants, as well as essential amino acids. It is also easily digestible and thanks to its beta glucans, has been clinically shown to be beneficial in reducing the risk of heart disease by lowering cholesterol<sup>4</sup> providing the opportunity for attractive health claims for product developers and consumers.

Oat can be used also as a functional ingredient. Thanks to diverse ingredients intrinsic to oat like high-quality protein, starch, and beta glucans, it helps deliver desirable mouthfeel in beverages or ready to drink oat milk. Oat oil is an excellent emulsifier which can be used in spreads, ice cream and chocolate.

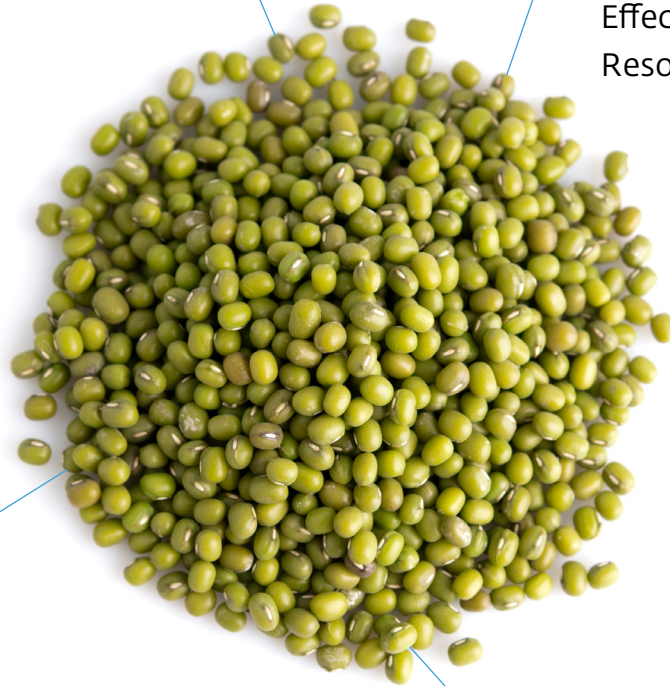
4) SWE OAT™ – a Givaudan company – is a pioneer in this field undertaking number of clinical trials into the impact of oats on cholesterol levels.

# Protein #02

## Mung beans

### Key benefits

- Health and wellness
- Cost effective
- Effectiveness in application
- Resource efficiency



### Family

Legumes

### Nutritional value

PDCAAS: 0.55

Protein (g/100g): 23.86

Naturally rich in protein, folate, fibre, and antioxidants, mung beans provide a wealth of health benefits, as well as providing very little waste, making them highly cost effective as an ingredient. Well-suited to

beverage applications, mung beans have high water solubility, water holding capacity and emulsification properties, making them effective in use.

# Protein #03 Garbanzo beans

## Key benefits

Health and wellness  
Effectiveness in application



## Family

Legumes

## Nutritional value

PDCAAS: 0.72

Protein (g/100g): 20.47

Garbanzo beans also have good water solubility as well as superior water and fat absorption and emulsifying potential, making them flexible and effective in applications. From a health perspective, they are naturally high in fibre, essential

amino acids, and crucially, selenium which plays an important role in the health of the immune system. These offer the opportunity for attractive health claims for producers and consumers.



## Protein #04 Lentils

### Key benefits

Health and wellness  
Cost effective



### Family

Legumes

### Nutritional value

PDCAAS: 0.71

Protein (g/100g): 24.63

Lentils provide a fantastic and, importantly, economical source of essential amino acids, polyphenols, minerals and antioxidants making them a highly attractive option for consumers and food manufacturers. Additionally, lentils have the added benefit

of association with numerous health effects according to recent research, including lowered risk of high cholesterol, diabetes, cancer, and cardiovascular diseases. They are well-suited for use in beverages.

## Protein #05 Flax

### Key benefits

Health and wellness  
Versatility

### Family

Oil seeds

### Nutritional value

PDCAAS: 0.60

Protein (g/100g): 18.00

Flax seeds benefit from many of the same intrinsic properties as sunflower seeds. They are a good source of omega-3 fats, with healthy heart benefits and are a good source of dietary fibre. With a higher lipophilic nature and good emulsifying properties,

they are ideal for beverage formulations. While production of flax seed is currently limited to certain regions, its agricultural production is much more efficient than pea protein and is easily scalable.

# Protein #06 Sunflower seeds

## Key benefits

- Health and wellness
- Cost effective
- Versatility
- Resource efficiency



## Family

Oil seeds

## Nutritional value

PDCAAS: 0.60

Protein (g/100g): 21.00

Sunflower seeds were identified by the study as particularly interesting and one of the most promising candidates for future use. They are extremely versatile due to their physiochemical properties, making them suitable for use in a wide variety of product

formulations and produce very little waste. They are also naturally sustainable with a rich catalogue of health benefits such as antioxidants and anti-inflammatory ingredients, as well as being a good source of minerals and essential amino acids.

# What does this research mean for the protein space?

Protein is fundamental to proper nutrition and health and the place of plant protein in the formulation of beverages and foodstuffs is undoubtedly here to stay.

It makes environmental sense and will help meet the challenge of access to healthy and nutritious food for the world's growing population.

It was important to us that the research could help point toward potential solution areas for some of the UN Sustainable Development Goals (SDGs). For example, SDG 2 on Zero Hunger particularly around access to nutritious food, and SDG 12, on Responsible Production and Consumption through sustainable management and efficient use of natural resources. The Givaudan/Berkeley partnership was itself a demonstration of a multi-stakeholder partnership that mobilised and shared knowledge, expertise and technology, in line with SDG 17; Partnerships for the Goals. This ground-breaking study has highlighted those proteins most likely to be the next major, new, ingredient-of-choice for the food industry. Offering versatility; ease of use in a range of applications;

and attractive health benefits to consumers; these six new proteins will provide many opportunities for product developers.

The paper provides a top line snapshot of the research undertaken. The full report provides much more detailed information on each of the six protein sources, analysing how these proteins rate against a number of criteria such as supply, nutritional value, factors that accelerate use, the protein extraction process, cost, environmental impact, functional properties, taste and colour, and regulatory approval. It looks particularly at the lower land and water impact of protein production compared to the physical space, pollution, and energy requirements needed to raise and care for animal protein sources.

While each of the plant proteins in the report show differences in energy consumption, optimal terrain, irrigation/water availability, fertiliser, and weed prevention practices, a common theme is their potential for cultivation across many areas of the world, offering sustainable sourcing and a diversified supply chain. This benefits local economies and provides mitigation against supply disruption from outside factors such as natural disasters and crop failure. These factors are all incredibly important in enabling high-quality protein intake and nutrition across the globe in the future.

# Your strategic partner for the future

As consumer demand in this space increases, Givaudan will continue pioneering protein ingredient and flavour solutions, driving innovation for food companies and consumers alike.

Our Science & Technology teams are able to profile specific proteins, giving customers a detailed view of their viability and advising on the right profile for their product and application needs.

By continuing to profile protein solutions across current and rising proteins, like those reviewed in this report, we will remain a key strategic partner for protein enablement in the food industry, not only in beverages but across categories.

## Our solutions



### **Taste and mouthfeel**

- Maskers to reduce off-tastes, astringency and bitterness
- Mouthfeel solutions to modulate protein dryness and chalkiness
- Taste solutions for sweetness quality and challenges of high-intensity sweeteners
- Dairy-free flavours for plant protein drinks



### **Flavour**

- Selection of flavours for enjoyment and inspiration



### **Consumer preferred concepts**

- Concept development from shakes to hydration
- Blends of flavour, protein, and other ingredients to simplify product development

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If you are interested in finding out more about the research or would like to talk about how we can support your protein product development, contact us at:  
[global.protein\\_solutions@givaudan.com](mailto:global.protein_solutions@givaudan.com)

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Your innovation partner for protein