SOY PROTEIN AND THE ECOSYSTEM

By Henk Hoogenkamp

The upside of soy is that the crop contains the highest protein and oil content. The downside is that soy has only four main harvest regions - US, Brazil, Argentina, and Paraguay – mostly due to climate restrictions.

A vast area of virgin forest is lost to the unrelenting expansion of soy agriculture in environmentally sensitive areas. The forests cover about 30 percent of the planet's landmass –but they are disappearing at an alarming rate. For example: between 1990 and 2020, there has been approximately a 4 percent decline in forested land globally –that equates to 1.3 million square kilometers, or an area roughly the size of South Africa.

Increasing meat consumption is the main driver of soy farming expansion. Depending on geographic region, a staggering 75-95% of the world's soy crop goes into animal feed. Well over 90 percent of the soy imported into Europe is used for livestock feed. The ongoing heated GMO debate makes matters more complicated, though there are clear signs of a change of focus towards an ecological and sound sustainability. Increasingly, informed consumers blame, and now voice their frustration towards soy-related destruction of wildlife habitat. To be fair and balanced, it is also true that people generally care more about their personal health than wildlife destruction and greenhouse gas emissions.

Brazil, Argentina, and Paraguay together supply 73 percent of the EU's soybean. In 2018, some 24.8 million tons of soybeans were imported into the EU, but less than 3 million tons were produced within the EU borders. In other words, it is estimated that about 16 million hectares of land are required outside the EU to feed its livestock sector. This is equivalent to approximately 90 percent of Germany's entire agricultural area.

Transparency

Leading food retailers are increasingly pushing for soy traceability, sustainability, and transparency in their supply chain. Actually, the drive towards transparency for soy is only the beginning. The only way to accomplish sustainable sourcing is through legal binding contractual long-term supplier engagement. Traceability and regionalization of soybeans will be of key importance for premium branded foods such as Alpro's (Danone) soymilk and Impossible Foods, as well as for the rapidly growing popularity of plant-based meat alternatives.

To ease consumer concerns, it will be crucial to shorten the supply chain to limit the transport footprint, as well as avoid reputational risks and social media backlash by the millennial consumers. After all, GM soy issues, health concerns related to soy's genistein estrogen facts and fiction, and deforestation are topics premium branded food and beverage companies rather avoid publicly discussing. Instead, companies using soy proteins rather tout the green credentials to create positive marketing awareness. Speaking of which, the Impossible Burger is now formulated using genetically engineered extruded soy protein concentrate and a genetically-engineered yeast to manufacture its star 'leghemoglobin' ingredient used for coloring and flavoring.

European Soy Farming

Ideally, soy and other leguminous crops should not be grown in monocultures and a diversity of varieties should be part of the scheduled annual plant rotation, while avoiding or minimizing the use of artificial pesticides. Going forward, the EU will likely boost the amount of soy grown regionally in Central and Eastern Europe and

reduce the dependency of imports from South and North America.

There are positive signs that the EU is increasing domestic production of plant proteins, including soy. Yet, the reality is that the EU is only 5 percent self-sufficient with an annual production of 2.8 million metric tons of soybeans. As diets shift towards more flexitarian and vegetarian eating, food companies can now look towards sourcing regionally-harvested non-GMO soy to be used in the rapidly increasing portfolios of plant-based meat products. Unfortunately, as demand for European-grown soybeans grow exponentially, it remains a fact that there is simply not sufficient farmland available to meet the demand. Subsequently, companies insisting on using European-grown soy protein will have to pay a premium.

Public Relation Challenges

Increased public disclosure of soybean cultivating practices does not bode well for soy protein as consumers become aware that the soy protein supply chain is linked to climate change and deforestation-related risks. In relation to deforestation, it is estimated that -by leveraging drone and satellite technology- approximately 15 percent of carbon emissions (GHG) can be associated with the typical western-style diet.

Soy protein companies can no longer hide, now that environmentalists use new drone and satellite tracking technologies to prove deforestation in real time. This can cause reputational risks for global food companies such as Nestle, Unilever, Kellogg's, as well as the many emerging "plant meat" companies.

Another issue that continually bothers the soy plant protein industry is how to successfully separate public image and awareness of soy protein in formulated processed meat products and its upscale use in health food and nutraceuticals, as well as its use in premium plant-based meat alternatives. Even though the processed meat industry is by far the largest category user, US soy protein companies go to great lengths to de-emphasize their association with their biggest market. They specifically focus on high-profile applications of soy proteins in products like nutri-bars, diet formulas, soy-based beverages, and infant food. In truth, the processed meat industry is not only considered a marginal business but also viewed as a potential public relations risk. Obviously, the US soy industry does not want to be associated with another "meat scandal" that surfaces as Breaking News. To top it off, marketing the same ingredient at vastly different prices to different market segments in the Internet age creates more questions than answers.

It is clear that the traditional marketing communications, including public relation press releases, are losing their power to educate most of the supply chain, including the consumers. The rule of thumb is that the higher the price of a food or nutraceutical ingredient, the greater the risk and volatility of the external competitive threats. Specifically, companies with few ingredients in their portfolio are vulnerable to changing consumer perceptions and expectations.

Industry observers partly attribute negative messaging as to why North American meat processors have not fully embraced functional soy protein for use in hotdogs, burgers and cooked hams. There is some truth to that observation because, even with the impact of food/feed/fuel competition, lean meat is still an affordable premium protein source that consumers in affluent societies can afford.

Yet, in most developing countries with many formulated meat products, soy protein has become a marker for cheap, highly processed, artificial, and thus, unhealthy products. For applications in highly processed food and meat products, the collective soy protein industry must go back to the drawing board to design a new platform of consumer education and communication. The main mission is to improve its lackluster reputation and image. Modern consumers are truly confused by the barrage of touted soy health benefits, which has resulted in a public relations nightmare. It will take much effort to win back the trust of the consumer. The millennial consumers in particular, have spoken and championed the shift toward a new plant protein –one that has not been GMO-treated to withstand a barrage of herbicides.

Soy Legacy

Over the years, the soy plant protein industry bombarded its consumer base with too many conflicting health messages while loading up meat products with excessive amounts of soy protein inclusions in developing countries. For these applications, soy has never been really popular, particularly in the US, Canada and west-European countries. Also, the pressure on soy protein is increasing because people associate it with allergies, the Amazon destruction and GMO -the latter still a formidable barrier. The zeitgeist has caught up with the soy protein industry, and perhaps the answer is to look into the growing trend towards more natural food, and especially the huge growth of plant-based meat alternatives. Another interesting product category to watch is the introduction of so-called hybrid foods like blends of meat and plant protein that simulate traditional meat products such as chicken nuggets and burgers.

Presently, the amount of food information sent out on a daily basis is huge. It is unfortunate that so many negative soy protein news flashes get circulated, much of which has not been properly substantiated or scientifically validated. Quite a large share of the information is repetitive and often conflicting. As a result, a majority of the consumers are simply unable to sensibly internalize the content. They get confused when weighing the pros and cons, and subsequently cannot conclude what is true or false. It is a shame –and a curious thing- that the US-dominated soy protein industry has such a myopic view of its ingredient that it fails to communicate its advantage. This has a considerably negative effect on consumer perception and trust.

Soy Going Forward

Besides the health benefits of many protein ingredients, proteins are also greatly in demand for their ability to texturize, emulsify, gel, foam, stabilize, and provide structure. Protein ingredients are either of animal or plant origin like cultivated algae. Innovative protein ingredients, usually the result of separation and purification from their original native source, are often additionally treated with enzymes. This is done to influence or modify specific amino acid sequences to obtain certain organoleptic and performance characteristics. All proteins are composed of a sequence, or building blocks of amino acids, which determine a protein's physical properties like molecular size and charge, solubility, as well as isoelectric point. The specific protein's isoelectric point is the pH, at which the molecular charge is neutral and therefore no longer soluble in water-based solutions.

Soy protein is also associated with the use of high amounts of clean water, hexane, and some chemicals during the purifications

process. The popularity of natural foods will have some damaging effects on the use of traditional soy protein ingredients. Instead, in-kind competition by modern fractioning technology to separate the plants components, i.e. protein, carbohydrates, and fiber are making rapid headway. Fractioning is a dry system in which neither water nor chemicals are needed to separate the nutritional components. Besides addressing the preferences of the consumers looking for natural food products, dry fractioning requires significantly less investment and typically allows a protein concentration between 50 and 60%.

Soy Intrinsic Value

"Once you have seen one protein, it does not mean that you have seen them all." Not all proteins are alike - some are digested and absorbed more rapidly while others may favorably impact metabolism and glucose control. Also, organoleptic and application performances are often hugely different with each type possessing specific characteristics.

Protein, being complex and intriguing, will provide both challenges and solutions for innovative research and development. In formulated foods, proteins are usually part of a complex matrix of other macro-components such as fat, carbohydrates, fiber, and flavors. The interactions among these components ultimately deliver the desired product attributes. Different amino acids produce different results and, with all things being equal, can directly influence the desirable end product specifications.

The fact is that the main value of soy protein is related to its relative low-cost structure. This is not only when compared to meat, egg and dairy proteins, but also related to other forms of plant protein ingredients derived from pea, mungbean, fava, rice and wheat. The biggest advantage of the soybean is the significant presence of both protein and oil. This allows the soy industry to capture value from not one, but two important dietary components. For global food security and affordability, the low-cost advantage is the most important key benefit of soy protein, not its perceived health benefits.

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