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Pea Protein's Market Future Is as Specialty Protein, Says Pea Supplier

The pea protein market may never reach the large size of the soy protein market, but that's okay, says one pea protein supplier. At IFT, pea-ingredient supplier Cosucra (Warcoing, Belgium) said pea protein will remain a leading specialty vegetable protein in its own right, with significant nutritional and sustainability advantages above and beyond many other plant proteins.

"Pea protein won't become as large a market as soy protein and wheat protein. That's for sure," Cosucra CEO Jacques Crahay told *Nutritional Outlook* at IFT. "I don't think the pea industry will become the soy industry of the 21st century." Cosucra has specialized in pea ingredients, including protein, for the past 25 years.

Pea protein is still an unfamiliar ingredient to some as the larger pea protein market emerges, and formulators are figuring out better and best ways to formulate with pea as a protein, including managing any off notes. Soy, by contrast, has been used as an alternative protein and meat analogue ingredient for decades, and formulators have devised advanced ways to work with the ingredient to maximize its impact and acceptability. One of the reasons soy also remains popular is because of its high Protein Digestibility-Corrected Amino Acid Score (PDCAAS) of 1.0, which is on par with other high-quality protein sources such as egg protein and milk/whey dairy proteins.

Pea protein's protein content is lower than soy's, although not significantly. Cosucra estimates that its Pisane pea protein ingredients have a PDCAAS of 0.94. Pea protein does, however, lead in some crucial nutrients. It is, for instance, the plant protein highest in the amino acid leucine, even above soy. Leucine is an essential amino acid for muscle protein

synthesis. Pea protein is also rich in arginine and lysine.

"Our leucine is the highest of all plant-based protein, and our arginine is the highest of all plant- and dairy-based protein," Frank Truong, general manager, Cosucra, told *Nutritional Outlook* at IFT. In addition, pea protein sidesteps any allergen concerns surrounding soy.

Another area where pea protein stands above other protein sources, plant and otherwise, is in its sustainability. Truong said that, in part, this is where pea protein will continue to shine over other plant protein sources because it outperforms all others on efficiency in water consumption, energy consumption, and land yield (the amount of usable protein produced per hectare of farmland).

For instance, he said, Pisane pea protein's land yield is over 500 kg; the protein that comes in the next closest is soy, at less than 400 kg, followed even farther behind by rice, wheat, milk, egg, and meat proteins. Pea protein also requires less water to grow. According to Cosucra, pea protein requires 3200 liters of water to produce 1 kg of protein, compared to 5882 liters required for soy, 6923 required for wheat, and 27,286 required for rice. Pea also requires less energy to produce (9880 kilojoules to produce 1 kg of protein) compared to, for instance, wheat protein (18,923 kJ/kg). (Soy does outperform pea in energy efficiency, however, requiring just 8853 kJ/kg to pea's 9880 kJ/kg.)

For these reasons, the pea protein market will continue to grow successful in its own right, Cosucra says. "It will become a specialty vegetable protein for very nice

applications in meat analogues and in nutritional applications because of its amino acid profile," Truong said.

Market researchers also predict a rosy future for pea protein. Grand View Research last year predicted the global pea protein market will grow at a 17.4% CAGR to reach \$313.5 million by 2025.

Cosucra itself is doubling down on pea. In July, the company inaugurated a new spray dryer at its Warcoing, Belgium, processing facility, part of a €35 million investment. The company says this spray dryer will double the firm's capacity to produce pea protein isolate by doubling the speed of the drying process. The company is also now making moves to expand its presence and to establish subsidiaries in the United States, Canada, and Mexico, with sights also on Asia-Pacific.

Meanwhile, pea protein still has a leg up on other plant proteins outside of soy. Even as competing plant protein sources emerge in the market, the pea protein market is farther ahead in terms of a developed market and supply, Cosucra says.

"The availability of this crop is very large in Canada, in France, and in Europe, and it's one of the lowest-cost crops for vegetable proteins," Crahay says. "If you go with other pulses, you need industrial availability and then a price that is similar to pea; otherwise, the price of the protein will be much higher."

But even as Cosucra and other companies grow interest in pea protein, challenges for scaling up pea protein supply remain.

One of those challenges is tied to the fact that only a small fraction of the pea is actually protein, with the rest made up of pea starch



and pea fiber. Truong says Cosucra's peas comprise 16% protein, 48% dietary fiber (the company's Swelite ingredient), and 36% starch (the company's Nastar ingredient).

So, while expanding the pea protein crop is not a problem, "the problem is," Crahay says, "that the market for these co-products are not expanding as fast as pea protein." In order to efficiently scale, stakeholders need to find new markets and uses for the fiber and starch fractions of the pea. "This industry needs to value all the components of the pea at once," Crahay says.

Cosucra is focused on increasing the valuation of these co-ingredients, Crahay says. In the meantime, "we're struggling to market these products at the same pace as the pea protein."

Fiber Innovation Resumes Now that FDA Has Approved Fiber Petitions

Innovation in the fiber market is alive and kicking again now that FDA has accepted citizen petitions to classify inulin and other non-digestible carbohydrates as legal dietary fibers. In June, the agency said it will bring eight additional fibers, including inulin and polydextrose, within the legal definition of a dietary fiber, allowing these fibers to contribute to the total fiber listing on the Nutrition Facts label. Prior to that, companies selling or formulating with those fiber ingredients had waited over two years for FDA's decision, debating whether or not they might eventually need to reformulate with other fibers in order to continue making a fiber claim. FDA's mission to finally establish a legal definition for dietary fiber, and to determine which fibers meet that definition, is part of the agency's overall revision of the Nutrition Facts label, which goes into full effect beginning in 2020.

Andrew Estal, director, customer technical service, Americas region, at Beneo (Manheim, Germany), said innovation around the fibers in question had ceased as companies waited for FDA's verdict. This included a pause in innovation around

improving scientific methods to test and quantify fiber content, he said.

"Development of everything stopped dead for two-and-a-half years until the FDA decided what was going to be what," Estal told *Nutritional Outlook* at IFT. "Our customers didn't know what they were going to do, so a lot of them just kind of stopped new developments."

He said progress on improving test methods also stopped "because if nothing was going to be fiber, there was no need for a method improvement." (Beneo's Orafit chicory root inulin and oligofructose were among the fibers whose petitions FDA recently approved.)

Mervyn L. de Souza, PhD, vice president, health and wellness, global R&D, innovation and commercial development, for Tate & Lyle (Hoffman Estates, IL), said that Tate & Lyle's clients were relieved to hear FDA's positive

benefit from it. A lot of customers were on the fence because they wouldn't have been able to make dietary fiber claims if the ingredients weren't going to be included [in FDA's fiber definition]."

FDA has so far not ruled positively on outstanding citizen petitions for two fibers: isomaltooligosaccharide (IMO) and xylooligosaccharide (XOS). Companies who had been using these two fibers, or any other fibers so far not on FDA's official fiber list, may now be looking to reformulate, de Souza said. "A lot of customers are looking to reformulate as they're looking to get IMO out and the dietary fibers in," de Souza told *Nutritional Outlook*. In fact, Tate & Lyle is starting to get business requests from some of those customers, he said. "We're actively engaged with a lot of customers who were using IMO," he said.



decision on the company's Promitor soluble corn fiber (a resistant maltodextrin) and Sta-Lite polydextrose. (Tate & Lyle's PromOat oat beta-glucan was already included in FDA's initial fiber definition.)

"We're obviously really, really excited about the FDA ruling, with our fiber portfolio—both our soluble corn fiber as well as our Sta-Lite polydextrose—both being included as dietary fibers," said de Souza. "We weren't surprised, but we were glad to have the ruling so that now that it's out there, our customers can

The prospect of replacing certain fibers was often unwelcome, as some fibers are not easy to find comparable replacements for, Estal said. Of some Beneo customers, he said, "They looked at existing products, and none of the fibers that were approved would work because they were all highly viscous fibers. They would have turned the product into a viscous mess at the level you'd need to use them at in order to get a claim."

So, these companies "were out in limbo land for the last two-and-a-half years," he

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said, waiting to make the decision whether or not to reformulate.

Denisse Colindres, manager of nutrition communication, North America, Beneo, told *Nutritional Outlook* that Beneo had been fairly confident that FDA would ultimately include Beneo's Orafit chicory root inulin and oligofructose in its definition, largely due to the body of scientific evidence Beneo has to support those ingredients. In setting the new fiber definition, FDA said that in order for a fiber to be approved as a dietary fiber, fiber manufacturers must be able to prove that the fiber provides a physiological benefit in humans.

"We were confident because of the science that we have and [because] we've been pioneering in the field of prebiotic and fiber research since the 1980s," Colindres said. "We have so many clinical studies: 25 human intervention studies on prebiotics, all of the studies on aiding calcium absorption, and all of the studies on weight management."

Now, Beneo's Estal said, formulators can go back to using the fibers as they originally had been. "They can continue to label it as dietary fiber as it was before. We are good to go. Customers are very happy now," he said.

Stevia Suppliers Talk Reb M and the Future of Stevia

Reb M is the buzzword in stevia these days. With more suppliers launching Reb M (rebaudioside M) ingredients, stevia companies at IFT spoke about ongoing efforts to commercialize and scale up supply.

Cargill (Minneapolis) said it is finally now shipping EverSweet, its Reb M and Reb D sweetener produced through fermentation, to customers after many years of working toward commercialization. "We've gotten orders and have already shipped our first shipments," Mandy Kennedy, Cargill's senior marketing manager, told *Nutritional Outlook*.

Kennedy said Cargill expects products containing EverSweet to start hitting store shelves fairly soon. In other recent news, she added, EverSweet recently gained non-GMO certification from NSF International's Non-GMO True North program.

Kennedy commented on the growing market interest in Reb M. "I think as more people

are tasting Reb M, they're realizing how good it tastes. EverSweet is mostly Reb M and Reb D. That's why we went down this path and have invested so much money into creating this. We saw such a significant difference in taste between the two [Reb A versus Reb M/Reb D] and knew how hard it is to get Reb M from the leaf."

Formulators who may have had trouble sourcing leaf-based Reb M can now turn to EverSweet, she said. "Availability and ability to scale up is one of the [challenges] we've been hearing a lot about lately, with [formulators saying], 'I formulated [my product] around this, and now I can't get my hands on any Reb M, so how do I get my hands on it?' We have so much more flexibility with the fermentation-produced product versus a crop."

PureCircle (Chicago), whose Reb M ingredients are produced only from stevia leaf extraction, has a different take on leaf-derived stevia. The company says Reb M supplies are plentiful and that the firm has greatly increased its Reb M supply for the food and beverage market. This increase is the result of increased acreage of the company's proprietary Starleaf stevia leaf,

"PureCircle can now supply enough Reb M to sweeten about 500 million cases of zero-calorie carbonated soft drinks," the company said in a press release, adding that in three years, the firm anticipates being able to supply enough Reb M to sweeten one billion cases of zero-calorie carbonated soft drinks.

Not only that, the company said, "PureCircle further estimates that, depending on amounts purchased and terms of purchase, companies buying Reb M from PureCircle will find the cost of using it to sweeten a beverage or food equivalent to their cost of using sugar to achieve the same level of sweetening."

Carolyn Clark, head of global marketing, PureCircle, also spoke about the food and beverage industry's growing interest in Reb M. "I think what you're seeing out here [at the IFT show] is playing out kind of how we've been talking to our customers. When Reb A was first introduced, it had its taste challenges. It had some linger, some metallic aftertaste. Reb M becomes a fantastic option" because it is more sugarlike, without many of the off notes associated with Reb A, she said.

PureCircle is also now using enzyme technology to speed up the rate at which the glycosides in the stevia leaf progress from Reb A to D to M.



which is said to contain greater amounts of Reb M compared to conventional stevia plants, which typically contain only small amounts of Reb M in each leaf.

"As the leaf ages, some Reb A molecules grow up and mature into Reb D molecules and then to Reb M molecules. That's how the leaf works naturally, and so by really studying

and understanding the leaf, we were able to find an enzyme that's able to achieve a similar process for us," Clark explained. "We're able to accelerate the process and do that at scale, which allows us also to plan our ability to scale up Reb M for our global brands."

Also at the show, ingredient supplier Tate & Lyle (London) and stevia supplier Sweet Green Fields (SGF; Bellingham, WA) highlighted their new Reb M ingredient, Tasteva M. In May, Tate & Lyle announced it had acquired a 15% stake in SGF.

Reb A Innovation

Not all stevia talk involved Reb M. Tate & Lyle and SGF spoke about two other latest stevia launches: Optimizer Stevia 4.10 and Intesse Stevia 2.0.

Optimizer 4.10 blends Reb A glycosides, yielding a Reb A ingredient that is more sugarlike but also still affordable, the companies said. By optimizing the ratio of glycosides, Optimizer Stevia costs up to 30% less than a more expensive, high-purity Reb A ingredient like Reb A 99% (RA 99%), they said. "A lot of customers use RA 99% for some significant Brix reduction, but RA 99% is an expensive item, and if I can get equal or better performance characteristics by just knowing which combinations work in the applications that RA 99% works in, then I have an advantage and the customer has the advantage," said Mel Jackson, PhD, SGF's chief science officer.

Like Optimizer 4.10, Intesse 2.0 is an optimal combination of specific steviol glycosides. The ingredient is suited for high sugar replacement at a cost 20%-50% lower than other premium stevia ingredients, the companies said.

The Future of Stevia

Jackson said this science of tinkering with the ideal ratio of glycosides to achieve certain desirable performance characteristics may well be the future of stevia itself: moving forward, the best-performing stevia ingredient might not be a singular steviol glycoside but rather a blend of ingredients that, depending on ratios, can be adjusted to optimize taste, cost, performance, and supply according to a company's needs and budget.

"We've found that certain steviol glycosides really have a synergy, and if you know which ones to look for, then you can enhance



them or reduce others," Jackson said. "There are many ways to skin that cat."

Different glycosides have different strengths, he pointed out. "If you look at Reb A, Reb D, and Reb M, you're looking at three very different glycosides. They have very different characteristics, ranging from taste to solubility. Reb D is not very soluble. It's a very difficult molecule to use in applications where you need a lot of it. There are different characteristics of different glycosides, and so thinking about Reb D or Reb M as a sole sweetener—it's a good thing in some ways, but there's so much more that we can do there because Reb A and Reb M, for example, have a fantastic synergy."

"There are all sorts of combinations we can come up with, and they're going to be quite application specific," he concluded. "So, I think that Reb M, Reb D, all of the newer [glycosides] are going to fold in here as we go through product development. They can increase the applications spectrum."

Top Flavor Trends for Food and Beverage at IFT 2018

The biggest flavor trends of 2018 were on parade in the food and drink samples exhibitors distributed at IFT. Ingredient firms talked to *Nutritional Outlook* about trending flavors, including the rise of florals plus the marriage of sweet and spicy, and much more.

Florals

Floral flavors continue to gain traction in food and drink products, and especially in beverages. "Florals are very popular," said Nina Hughes-Likins, global marketing director, Prinova Group (Carol Stream, IL), at IFT.

"All of our research says you're going to see more and more florals because that's where the market is headed," said Parveen Werner, director of marketing at Synergy Flavors (Wauconda, IL). "People are looking for more natural, clean-label botanicals and

herbs because people can associate them with real food, with simple ingredients that are good for you.”

Elderflower, hibiscus, rose, violet, honeysuckle, and lavender are just a few of the florals suppliers say are gaining steam. Lavender lends a “calming” element, even through food, Werner said—something that some other florals can also do. Meanwhile, although hibiscus doesn’t contribute intense flavor, it does provide a “bright kind of pinkish/purplish color that people love,” she added. To exemplify the botanical trend, during IFT, Synergy provided samples of floral-flavored cookies and chocolates (salted cherry blossom and orange honeysuckle).

Whole Foods Market named florals as the retailer’s number-one flavor trend at the end of last year, Werner said. In November 2017, Whole Foods said, “Foragers and culinary stars have embraced edible petals for years, but floral inspiration is finally in full bloom. From adding whole flowers and petals into dishes to infusing botanical flavors into drinks and snacks, this top trend makes for a subtly sweet taste and fresh aromatics. Look for flowers used like herbs in things like lavender lattes and rose-flavored everything. Bright pink hibiscus teas are a hot (and iced) part of the trend, while elderflower is the new MVP (most valuable petal) of cocktails and bubbly drinks.”

To ease consumers into accepting florals in their food and drink, formulators often pair floral flavors with more familiar ones, Werner said. In fact, she said of many floral flavors, “You’ll never see it on its own; it’s always with a twist. So, you might see a floral with a particular fruit that people are more familiar with. It’s taking the familiar and adding a twist with something that’s a little more uncommon, because people are more willing to try when there’s some familiarity with the product.”

Sweet Plus Spicy

Being sweet just isn’t enough these days; formulators are looking to give sweet a spicy kick. “People are not looking for overly sweet flavors anymore,” said Mukul Juneja, vice president, marketing, Archers Daniel Midland Company/Wild Flavors & Specialty Ingredients (ADM; Erlanger, KY), at IFT.

Sensient Natural Ingredients (St. Louis) calls this new trend of marrying sweet and

spicy “sweet heat.” “Sweet heat is something we’ve been seeing in the past years as a trend,” said Kristie Hung, marketing specialist, Sensient Natural Ingredients. “People are looking for that spicy kick at the end of their flavors. And it’s also a very adult flavor. It’s something that’s exciting. It’s something new.”

Jalapeno and ancho chili peppers are among the spices giving sweet a kick. At IFT, Sensient sampled cake-pop dessert prototypes with jalapeno and ancho flavors added to the chocolate. Hung said that sweet heat is also a trend taking place in the yogurt industry, with marketers combining sweet yogurts with spicy, savory toppings. At Sensient, she said, “We’ve worked on a peach habanero, mango habanero, and pineapple jalapeno flavor.” She also pointed to the growing trend overall of Mexican chocolate, which often features chilis and spices.

Renata Ibarra, senior director of taste, Americas Region, Kerry (Beloit, WI), said her company has also done work blending sweet and spicy. “We have done some peppers, like habanero, but also some of the higher-intensity flavors—cinnamons, cardamoms, nutmegs—that complement some of the fall flavors as well.”

At IFT, Prinova handed out samples of a cardamom pear-flavored sparkling water prototype.

Again, ADM’s Juneja said, this adventurousness is all a reflection of the consumer’s broadening palette. “Those sensations of sweet and salty, or botanicals, definitely help broaden our palette a little bit. We’re also seeing quite a bit of activity around sours, too—sour beer, for example. We’re seeing flavors that are a little more complex from that perspective, as well.”

Fruits Rule

Fruit flavors, including tropical notes, will never go out of style.

Varietals, mangoes, pomegranate, passion fruit, and dragon fruit are among the flavors that continue to see high demand, said ADM’s Juneja. “Tropical flavors have always been very popular, especially in beverages, but it’s evolving beyond that pineapple and coconut space now,” he added.

Mango and starfruit are always popular flavors, said Prinova’s Nina Hughes-Likins. At IFT, the company handed out samples of a mango rooibos tea targeting brain health.

Juneja said ADM is also still getting a lot of requests for darker berries, which he noted are often marketed for their antioxidant benefits. “A lot of projects we’re working on are trying to bring that healthy halo of darker berries—blueberries, raspberries, cranberries, etc.”

At Kerry, calamansi is a growing trend, Ibarra said. Watermelon is also emerging in sports drinks, she added. “I think the sports market is welcoming more of this type of refreshing summer flavor,” she said. Cucumber lemon is another example, she added.

“There’s more of those really juicy fruits, like watermelon and some underlying tones, or some tea notes behind some of these peach flavors or the watermelons. So, adding some complexity without interfering with the refreshing sense of a sports drink,” Ibarra said.

Reducing Undesirable Ingredients: Salt, Sugar, MSG

In addition to the numerous companies showcasing zero-calorie sweetener options like stevia, flavor companies also demonstrated how their ingredients can help formulators cut sugar, salt, and other unwanted ingredients.

At Lycored’s (Be’er Sheva, Israel) IFT booth, the company, along with chef Charlie Baggs, president of Charlie Baggs Culinary Innovations, demonstrated how Lycored’s tomato-based flavor enhancers, Sante and Clear Tomato Concentrate (CTC), bring out natural umami and kokumi notes while at the same time enabling formulators to use less salt and cream, including in a prototype curry, carrot, and apple soup; a roasted red pepper sauce; and a Tom Yum soup. Both flavor enhancers are non-GMO and label as either “tomato concentrate” or “natural flavor,” depending on regional regulations.

“Sante is a flavor enhancer that allows a reduction in sodium from salt by 30% to 65% in some applications. It is the perfect solution for removal of MSG, yeast extracts, or artificial flavors while giving a great taste boost. CTC is a liquid serum that harnesses the balance of acidity and high Brix sweetness of tomatoes to bring smoothness and complexity to savory products,” Lycored said in a press release.

Sensient showed how SensaSalt 2G, part of the company’s SensaSalt yeast extract-based flavor enhancers for savory

applications, allows formulators to reduce the level of salt by up to 50%.

Another IFT exhibitor, sea salt firm Salt of the Earth Ltd. (Atlit, Israel), highlighted a solution for reducing not only sodium but also replacing another undesirable ingredient, monosodium glutamate (MSG). At IFT, the company showcased a Ranch dressing using the company's Mediterranean Umami ingredient, which is an all-natural sodium-reduction ingredient comprising vegetable extracts and sea salt. According to the company, the ingredient "keeps the 'craveable' flavor of Ranch dressing, without MSG, while reducing sodium at the same time."

At IFT, companies also showcased their sugar-reduction strategies. Among them, Kerry highlighted its new TasteSense Sweet ingredient, introduced in the U.S. earlier this year and part of the company's TasteSense flavor-modulating technology that can help mask off notes. The company describes TasteSense as "based on flavor-building blocks derived from natural botanical, fruit, and vegetable extracts, distillates, and essences" and says it labels as a natural ingredient.

At IFT, Kerry highlighted findings from a recent consumer research survey the company performed that found that 71% of consumers polled read ingredient labels to check a product's sugar content, while 55% wanted a reduced-sugar product that still tastes as sweet as a full-sugar product, all while showing a preference for natural sweeteners. The company says TasteSense Sweet allows formulators to reduce their use of sugar to meet these needs while maintaining sweetness. The company showcased a beverage featuring TasteSense Sweet. "We can go as far as a 30% sugar reduction without adding in any high-intensity sweeteners," Ibarra said. The survey was conducted on over 760 American consumers.

The Origin Story

As tastes grow more sophisticated, consumers are wooed by the regional flavor nuances that can color the story behind an ingredient—for example, transforming a simple, standard orange flavor into an exotic "Sicilian blood orange" flavor.

Consumers increasingly want these provenance associations, said Roger Lane, marketing manager, savory flavors, North America, Sensient. "'Orange lavender' sounds so much better than regular lavender," he said. "We've

actually polled consumers to ask them which they prefer, and they really like a natural extract with a provenance claim."

Similarly, said Lane's colleague, Kristie Hung, consumers want to know where their spicy ingredients originate. "It's about calling out where that jalapeno and ancho come from," she said, referring to the sweet and spicy cake-pop samples Sensient displayed at the show. She also talked about the popularity and uniqueness of the Hatch chili, which is grown in the Hatch Valley region of New Mexico. "You can only get Hatch chili peppers from there. It's kind of like Champagne [in France]. It's very, very specific to its growing source. I think consumers appreciate that information."

And, above all, the origin of a flavor these days should be clean label. All of the companies in this story highlight natural, clean-label solutions that consumers demand as a given these days.

Ancient Grains Market Small but Growing with Help

Despite the popularity of ancient grains in the healthy foods market, the supply of ancient grains in the U.S. still pales in comparison to that of commodity grains (corn, wheat, rice, barley, oats, and the like). As more customers clamor for ancient grains and heirloom wheats like quinoa, amaranth, millet, sorghum, spelt, and teff, to name a few, flour and grains supplier Ardent Mills (Denver) is working with its farmers and customers to grow grain crops and to help ensure that these specialty grains will find a home in the end market.

At IFT, *Nutritional Outlook* met with Shrene White, general manager, The Annex by Ardent Mills. The Annex by Arden Mills, first launched by Ardent Mills at the Natural Products Expo West trade show in March, is the company's new business unit whose mission is to develop "next" grains and plant-based ingredients.

"Right now, Ardent is known for white, conventional flour. The Annex is a dedicated space where we can focus on the specialty grains and innovation around those grains," White explained. "We have products like

quinoa, our barley program, our ancient grain gluten-free program, and our heirloom grains like White Sonora, einkorn, emmer, and spelt." The Annex not only focuses on emerging specialty grains; it is also helping to innovate new forms of those grains, including crisps (such as for bars, baking, and snacks), flakes, and Individual Quick Frozen (IQF) ingredients that expand applications for ancient grains.

Farmer relationships are integral to The Annex. White said Ardent Mills works very closely with farmers to increase ancient grains acreage. "We work with a lot of family farms," White said. "We've been able to build on those relationships and bring new opportunities to our farmers. We have farmers growing some of our heirloom grains for us—einkorn, emmer, spelt, triticale. We also work with public and private breeding companies to help us breed new varieties, such as our Ultragrains flour developed by Colorado State University." (The Annex program nurtures university research partnerships.)

Part of what Ardent Mills helps farmers do is diversify their farms with ancient grains and expand beyond commodity grains. "We've had a lot of farmers come to us and say, 'Hey, I want to diversify. I want to add value to my farm. What grains are you guys interested in?' We've been able to give them guidance and direction, whether it's helping them transition from conventional to organic, or just trying something new, like quinoa," White said.

Ardent Mills also lets farmers know there will be a buyer for that grain. "When Ardent Mills comes to the table with something new, the farmers know that we're going to support them or help them get that grain to market," she said.

Through these partnerships, Ardent Mills has been able to help increase the size of ancient grains crop in the U.S. As *Nutritional Outlook* has reported before, North American-grown quinoa is still quite rare. But thanks to its farming partnerships, Ardent Mill is growing the supply, including through its Great Plains quinoa program, which includes Canadian-grown quinoa. "Now, we're starting to grow it in the Pacific Northwest and in Colorado, as well," White told *Nutritional Outlook*. She added that working so closely with farmers lends transparency up and down the supply chain.



Stimulating the ancient grains market doesn't just stop with the farmers, however. Ardent Mills also helps its customers find new ways to formulate with ancient grains in order to expand applications and grow demand. "We help our customers on the innovation side. We help them understand and develop new products, to help them incorporate these grains in what they might be doing," White said.

Still, White said, ancient grains naturally remain "a very, very small space" compared to the traditional grains market. But with Ardent Mills one of the players helping to invigorate both supply and demand, and with "farmers seeing that there's opportunity in this space," hopes are high that the market will grow. And partnerships remain a crucial cog in the wheel.

"It really is a partnership all the way from the farmer through The Annex through to our

customer," White said. "That's one thing that we really try to stress: this can't be a transactional relationship. It's got to be a partnership, because we have farmers who it's going to take, say, three years to convert to organic, for instance, and they want to know that if they put in that time and that effort that they're going to have a bid for that wheat in three years."

"And on the flip side," she continued, "working with our customers, we're helping build these relationships and actually becoming part of that R&D process so that our customers are coming to us and saying, 'Hey, 18 months from now, we want to launch this particular type of snack or this chip, and these are the grains we want to incorporate into that. That's allowing us to work backwards, whether it's working with a university or with a farmer to help start that supply chain.'"

The opportunity for growth is there, White said. "When you look at new introductions on menus and what's happening in the grocery story—we see a lot of runway, and a lot of these grains are just at the inception."

High-Protein Solutions Take Center Stage at IFT

High-protein food and drinks are a major driver in the healthy food industry. Manufacturers continue to seek ways to include more protein in their products without impacting performance, taste, and texture. At IFT, exhibitors showed off prototypes demonstrating the latest solutions for formulating with high protein.

Dairy Protein Innovation: Ice Pop, Savory Granola

As it does each year at IFT, the U.S. Dairy Export Council (USDEC; Arlington, VA), the nonprofit group representing the U.S. dairy industry, demonstrated innovative applications for dairy proteins, especially for healthy snacking.

USDEC's goal is to demonstrate uses for dairy proteins that formulators may not have entertained before, showing that "dairy has many, many attributes that can work for pretty much any situation," said Terri Rexroat, vice president, U.S. trade services, USDEC. "From a standpoint of flavor, functionality, and nutrition, dairy is tops in every category, and we like to continue to develop prototypes that demonstrate that and frame dairy in an unexpected light."

The first prototype USDEC showcased at IFT was a Lemon Ginger Protein Ice Pop containing 10 g of protein from whey protein isolate and less than 100 calories per serving. The product is positioned as a healthy snack for adults, "an adult spin on a classic kid treat."

"The idea here is to show dairy protein in an application where you typically would not find any protein at all," said Rexroat. "An ice pop is not typically something that really has any nutritional value from a positive standpoint, and here this has got 10 g of protein per serving, which is really significant considering that this is not a protein application normally." The ice pop could even be used

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post-workout “as a quick pick-me-up after exercise,” she said.

USDEC also showcased a Savory Asian Protein Granola containing 6 g of protein per serving and flavored with Sriracha and soy sauce, served on top of a coconut yogurt. In addition to the presence of whey protein and whey protein isolate, whey permeate provided salty flavor so that salt content could be reduced.

“This granola, because it’s savory, is a little unexpected. It can be used in a lot of different applications that you wouldn’t normally think of for granola, like on soups or salads,” said Rexroat. “You add some of this granola and get the benefit of dairy protein in applications that may not typically be high in protein, like sauces and salads, and it adds crunch and some really interesting flavors that are on trend, like Sriracha.”

The staying power of dairy proteins, whether whey or milk proteins, is powerful for one reason, Rexroat said: “The nutrition is undeniable.”

USDEC continues to seek opportunities to include dairy proteins in foods, drinks, and snacks that people can consume throughout the day. “We know that consumers are more interested in trying to find ways to get protein in their diet, and I think certainly over the

past five years, we’ve seen a lot of innovation in trying to get protein into common everyday foods that people are going to eat on a daily basis,” said Matthew Pikosky, PhD, RD, vice president, nutrition science and partnerships, Dairy Management Inc., speaking at the USDEC booth.

“Consumers don’t want to stray too far from the foods they enjoy eating, whether it be a granola or an ice pop, or oatmeal and cereal with dairy proteins added to them. They can still enjoy the foods they’ve typically enjoyed, but now they know there’s a benefit of having a higher amount of protein in their total diet and ways to get the protein in at each of their main meals and in between.”

While unusual protein concepts like the ice pops are still the “exception rather than the rule,” Pikosky said, “there does seem to be a little more innovation going on, but companies continue to need help.” He said high-protein soups would also be a good opportunity for food brands.

Functional Coffee

These days, coffee is trending and teeming with added functional ingredients—vitamins, green tea extract, even broccoli extract. So, why not protein?

Suppliers, in fact, are and continue to propose high-protein coffee concepts.

The latest came at IFT from Synergy Flavors (Wauconda, IL) whose “protein bites” prototype at the show was enhanced with hydrolyzed whey protein from Synergy’s parent company, Carbery (Cork, Ireland).

Nutrition Bar Challenges

As protein suppliers continue to dream big and devise new protein product concepts, some formulating challenges do remain for some applications.

Take high-protein bars. Formulators often still struggle to find ways to address the “hardening” that can occur over time in high-protein bars. Whey protein specialist Arla Foods Ingredients (Viby J, Denmark) introduced its latest solution for softening high-protein bars at IFT.

The ingredient is a whey protein ingredient called Lacprodan TexturePro. Arla says shelf-life tests show that when Lacprodan TexturePro is added to a high-protein bar at 5% of the total product, formulators saw 45% improved texture and 60% reduced hardness after 15 to 18 months, compared to a bar made with standard whey protein.

This new ingredient should not be confused with Arla's other ingredient for addressing hardening of high-protein bars. Last year, the company introduced Nutrilac PB-8420 whey protein, which it said enables high-protein bars to remain chewy and soft for 12 months or more in ambient storage conditions.

Peter Schouw Andersen, director, application science and technology, Arla, explained that Lacprodan TexturePro is different because it is more of an add-on ingredient that formulators can use to tweak their existing bar recipes.

"With TexturePro, with only an addition of 5% of this specific product, you will actually get a softness of the bar throughout its whole period of life," he said. "A lot of manufacturers today won't need to change their recipes. They can just take out 5% of the proteins and substitute this, and then the bar will stay soft." Adding TexturePro does not lessen the bar's protein content because TexturePro is a protein ingredient in and of itself.

The company says that TexturePro can help elevate the quality of a company's high-protein bar, setting it above other products in the increasingly crowded high-protein bar market. Inge Lise Povlsen, senior category manager at Arla Foods Ingredients, said in a press release: "With the number of protein bars on the market proliferating, it's important to ensure your product stays in the best possible condition throughout its shelf life. Consumers who have a negative experience with a product are less likely to buy it again." The ingredient is produced in the EU from grass-fed cows and is non-GMO, halal, and kosher.

"From a microbiology standpoint, some high-protein bars could have a shelf life of, say, two years, but most of the producers will put a six-month expiration date on them simply because they get too hard, too chewy. Using TexturePro, they might actually be able to extend their shelf life significant, simply by adding this at 5%," Andersen said.

Meat-Alternative Challenges

Over in the plant protein space, DuPont Nutrition & Health (Wilmington DE) talked about how the soy industry has learned to overcome plant-protein processing challenges, advancing the many ways in which soy protein can be used.

Austin Lowder, principal applications scientist, meat applications, DuPont Nutrition & Health, talked about overcoming challenges in meat alternatives. "One of the big ones is texture. Trying to mimic meat texture is extremely difficult because you need a very complex system, and there are a lot of differences even between species of meats. And you end up with a variety of different textures, flavors, in different meat products, depending on how they're processed. So, a steak is going to be very different from a hot dog is going to be very different from a meatball."

"At the same time," he continued, "most meats—chicken, beef, pork, muscle proteins—are very nutritious. It's one of the reasons they've been a staple in our diet for so long. So, when we're trying to make something to mimic that, not only do we have to try to get a similar texture but we need to try to match protein content as well as protein quality, or nutritional value, as well."

He said soy protein is a good solution on many fronts. First, it is a high-quality protein, with a Protein Digestibility-Corrected Amino Acid Score (PDCAAS) of 1.0, comparable to other high-quality protein sources such as egg protein and milk/whey dairy proteins.

In addition, soy protein's gel-forming capability means that it offers flexibility for creating textures. "For years, soy protein has been one of the major players in this space because it's able to contribute texture, whether it's [through its] gel-forming capability or it could be extruded into small pieces that would mimic ground meat, or long, fiberlike strands that would simulate meat fibers," said Lowder. "We've been able to use soy protein from both a functional standpoint as the base of those products, but also to provide a high-quality, very nutritious source of protein that provides all essential amino acids."

He said soy also tends to outperform the binding and gelling properties of other plant proteins, meaning it has a better ability to create firmer extruded products. "We just haven't seen that ability from a lot of other plant proteins," he said.

In the meat-alternatives market, soy's properties as a globulin make it a great option for creating gel textures and firm textures. Other classes of proteins might not do the same, Lowder said. "Other protein sources aren't as functional in that way," he said. "They

have their own functionalities, certainly—for instance, gluten has a unique functionality—but as far as being a robust food ingredient, we generally don't see that from a lot of other proteins."

And, he said, the simple fact is that a supplier like DuPont, which has been supplying soy proteins for more than 30 years, has garnered a lot of best practices on how to most successfully formulate with the ingredient. "We've had 30-plus years of experience processing soy proteins, and we've gotten really good at it," Lowder said.

In the end, success depends on the right protein for the right application, he added. "Whether you're processing to improve gel strength or improve suspension in a beverage, let's say, you would do that differently with a soy protein than you would with a pea protein or a rice protein or an oat protein or fava bean protein."

Also, he made sure to add, "pea protein is not a 1:1 replacement for soy." In order to be successful in meat-alternative applications, pea would need to exhibit the gel-forming capabilities of soy protein. Another option is to blend soy proteins with other proteins, he added.

In other applications where binding isn't as important, such as in a beverage, Lowder said, other plant proteins might also be able to play. "But in the meat-alternatives space, it's different," he concluded. "Because if we don't have texture building from our protein, then we have to put other ingredients in there that are very expensive. It's going to start driving the cost up. So, the best-case scenario is that we have the protein doing the work for us in terms of creating texture in those products."

"There's been a lot of trial and error in the marketplace, trying to mix things up to see what happens and see if you can get to that optimal blend," added Jean Heggie, strategic marketing lead, DuPont Nutrition & Health. "What we're trying to do is to apply more scientific rigor to that process and really understand at a fundamental level the basic flavor differences between soy, pea, rice, and whatever you want to mix together, and then find out where they're strong, where they're weak, where they're complementary, and then build something that delivers that taste, texture, experience, formed by science."

Fiber Test Methods Are Advancing, IFT Exhibitors Say

Fiber health claims are prized by food and drink makers. In order to make a fiber claim, total fiber content must meet the legal threshold, and in order to calculate a product's total fiber content, manufacturers must use accurate analytical methods. The reality today is that fiber content is often extremely difficult to quantify, for various reasons. At IFT, *Nutritional Outlook* interviewed fiber suppliers Beneo (Manheim, Germany) and Tate & Lyle (Hoffman Estates, IL) about how fiber-testing methodologies are advancing.

Why is fiber testing so challenging? One reason is the sheer gamut of dietary fiber types on the market. There are insoluble and soluble high-molar-weight fibers (cellulose, pectins, lignans, beta-glucans, etc.). Then there are resistant starches. And, finally, there are low-molar-weight fibers, including prebiotics such as inulin, fructooligosaccharides, galactooligosaccharides, polydextrose, etc. The list goes on. Analytical laboratory Eurofins (Heerenveen, the Netherlands) provides a good breakdown of fiber ingredients on its website.

Fiber molecules themselves are also complicated, Mervyn L. de Souza, PhD, vice president, health and wellness, global R&D, innovation and commercial development, for Tate & Lyle, told *Nutritional Outlook* at IFT.

"Fiber tends to be a more complicated ingredient because it's not like sodium," de Souza said. "Other ingredients, like salt (sodium chloride), are a lot simpler. Fibers tend to be larger molecules, and they have different kinds of linkages. They're just inherently more complex."

Analyzing fiber content in a finished product containing other ingredients is even more difficult "because you have more confounding issues due to interactions with the food" and with other ingredients. "You can either sometimes get a higher reading or a lower reading depending on what else is in there and how it's interacting with the ingredient," he said.

To illustrate the challenges analyzing fiber, de Souza used beta-glucan as an example: "Beta-glucan is a beta-linked fiber, if you will. So, it's glucose units linked by beta linkages.

When you do a standard fiber analysis, you also have starch present. Starch is alpha linkages (glucose linked together with alpha bonds), but very often, in the standard analysis, the starch can contribute to the carbohydrate analysis, so you get an artificially high reading when you measure beta-glucan."

One way Tate & Lyle has been able to overcome some of these challenges is to use an enzyme like alpha-amylase to "break down all the starch and then analyze for beta-glucan," de Souza said. "So, you've taken out any confounding information. You break down the contaminants that might influence the ingredient you're trying to analyze for."

Scientists' ability to analyze different fibers and to devise fit-for-purpose test methods are improving. Part of this is due to technology advances resulting in more accurate and reliable methods. "There have been a lot of advances in analytical technology just in terms of sensitivity," de Souza said.

Andrew Estal, director, customer technical service, Americas region, Beneo, added, "We used to be able to detect parts per millions of things, and now we can detect parts per trillions of things, so test methods are always being refined."

De Souza did caution that increased sensitivity can also lead to more "noise" in the results. "As detection methods get more and more, lower and lower, there's a tendency to want to get more analytical in terms of the details that you can subject a product to," he said. "The issue is, a lot of these analytical methods are also very sensitive. So, when you apply a sensitive method into a complex matrix, you can sometimes really skew the results. There's a lot of noise."

Getting on the Same Page

Fiber suppliers continue to work very closely with testing labs to refine test methods. Some of those labs include Eurofins, Medalion Laboratories (Minneapolis), Covance Laboratories (Madison, WI), and analytical test supplier Megazyme, among others. Fiber suppliers, who are experts on their individual ingredients, remain intricately involved in the process.

Many testing labs and fiber companies abide by AOAC methods, which are constantly being refined according to fiber type as well as form (liquid, powder, etc.). In fact,

now that FDA has finally accepted more fiber ingredients in its new, legal fiber definition, Estal posits that AOAC could take "renewed interest" in working on improving methods.

Fiber suppliers can help laboratories pinpoint the target. "It's using the right method and performing the method correctly," said Estal. "if you send something for fiber analysis, you actually have to tell the lab that you're looking for fiber from oligofructose or inulin, or else they will completely digest it, hydrolyze it, and they won't find the fiber."

"Testing problems only happen if you don't know what you're doing or if you use the wrong method," he continued. "The methodology takes some practice to get down, so we actually have a list of laboratories in the U.S. and globally that we've done round robin testing with, and we've come back with results that agree."

Ideally, everyone—from companies to testing labs to ingredient suppliers and, finally, regulators—will get on the same page regarding the most accurate test methods to use and when. Companies will want to make sure that they can accurately calculate the total fiber content in their products to meet requirements and ensure that results are not artificially lower or higher, lest regulators come knocking for substantiation.

Fiber suppliers also continue to help their customers understand how best to test and who to get assistance from. "It's not something that a lot of our customers are actually able to do themselves because it does take practice," Estal said. Also, he said, "it requires some equipment that is not really totally practical for every company to have, and so really the best bet is using a certified outside lab that's used to doing it on a regular basis."

De Souza said Tate & Lyle will "analyze samples for our customers, too. Very often, our customers will send us samples with our fibers, or with competitive fibers, and we'll help them and assist with the analysis." And, he added, "we're educating our customers as well on the analytical methods that are being used, for complete transparency, so they know what's going on."

"The devil is always in the details," he concluded. "As we understand and unravel more about the details that become important, then it's educating our customers on the details that really becomes the big difference."

Pea Protein's Off Notes Solved in Many Ways

Pea protein was a leading topic at IFT. At the show, numerous exhibitors distributed food and drink prototypes demonstrating formulating advances and new applications for pea protein. Yet, even as pea protein's popularity grows, challenges remain in terms of reducing its off notes. Suppliers told *Nutritional Outlook* about some of pea protein's challenges—and solutions.

Pea protein's off notes are described as "earthy," "beany," "bitter," and "chalky." Even as demand and hype around pea protein grow, these off notes remain a challenge for some formulators, who in general today are experimenting with a range of flavor-masking solutions.

"Pea protein itself is very good," said Parveen Werner, director of marketing for flavors firm Synergy Flavors (Wauconda, IL). "It's a great alternative to whey protein as a plant-based protein. But it does have off notes, so how can you mask those flavors through taste modulation? There's definitely a need for added sweeteners or modulators that can mask some of those bitter, off, vegetative notes that a pea protein would offer." Werner said one of her company's primary objectives these days is developing solutions around plant proteins, including pea, in liquid, powder, and bar applications.

Another challenge for formulators is that, often, masking solutions need to be natural or organic in origin, meaning formulators can't turn to the big, and often easier, toolbox of artificial flavors.

Even vanillin suppliers are working to see how their ingredients can help improve pea protein's taste. At IFT, vanillin expert Solvay (Brussels, Belgium) distributed samples of a control beverage: a 200-ml shake formulated with 18 g of pea protein. "It's a typical shake formulation," said Ray Routhier, North American business development, distribution, regional/global key account and lab manager, Solvay. "You'll find the typical pea notes and vegetable notes. It tastes pretty bad. It's a little bit chalky, so not really flavorful and tasteful."

Solvay then added its Vanifolia 55 natural vanillin ingredient to mask some of the pea protein off notes. Routhier said that in this



application, Vanifolia is used "as a masking technology to reduce the astringency, which is what's giving you the dryness in your mouth. It's there also to improve the bitterness aspect and then reduce the vegetative notes that come from the pea protein."

The company made sure not to entirely mask the pea protein flavor, however, he added. "You'll still notice some pea flavor because Millennials still want to be able to [taste the ingredient] to tell that it's not adulterated," Routhier said. But with Vanifolia 55, he said, "you'll definitely see an improvement in the flavor profile, up to a point where people will say, 'I could actually drink this product.'"

Other pea protein experts pointed out that starting with good source material, a high-quality pea ingredient, is essential.

Jacques Crahay, CEO of pea ingredient supplier Cosucra (Warcoing, Belgium), said that his company's 25 years of experience producing pea protein ingredients has enabled the firm to develop proprietary ways of handling the ingredient so as to preserve the best taste possible. He also pointed out that some of the flavors of a plant protein are inherent in the plant itself and cannot be escaped. But the way a processor works with the ingredient thereafter, including during heat treatment,

will make the difference in reducing any additional off notes the ingredient may incur. "The way you handle the product, from one end to the other, is very important," Crahay said.

For instance, he said, Cosucra's processing, which involves only water, heat, and pH adjustments for solubility, is designed to minimize oxidation and fermentation that can otherwise lead to off notes. He pointed out that processing must be done quickly so as "not to have fermentation during the process, because if you have fermentation during the process, it will give some aftertaste."

Spray drying is also a crucial step in processing the pea protein, Crahay said: "The final step, spray drying, is important and has to occur in a very short window of time." Cosucra recently announced the installment of a new spray dryer at its processing facility that it says will double the speed at which it can dry peas and therefore double its pea protein isolate output.

Earlier this year, Cargill (Minneapolis) and Puris (Minneapolis) announced a joint venture in which Cargill is helping support the expansion of Puris's pea protein production. Like Cosucra's Crahay, Cargill's Matthew Jacobs, global product line leader, plant proteins, talked about how a pea supplier's

know-how can make the difference in producing a pea protein low in off notes.

"From a flavor perspective, there has been some baggage with peas in general," he told *Nutritional Outlook*. "That's one thing that we're trying to do: disabuse people of the notion that all peas are gritty, or that all peas have a grassy flavor to them."

He said that Puris's pea proteins are "much more of a neutral flavor, [for] two reasons that make us distinctive in the market." First, he said, "the genetics program [Puris has been] working on for decades has really worked on breeding these peas to mute some of the off notes." Secondly, he pointed to the downstream process: "They use a very clean process."

Still, he added, "there's always room for improvement, and we're continuing to look at other ways to just refine, not so much the texture—the texture is actually very nice and smooth—but I think from a flavor perspective, just rounding off some of the notes. That's ongoing work."

Cosucra's Crahay also pointed out that the quality of pea protein ingredients can vary by market. According to Crahay, a lot of pea protein suppliers based in China, for instance, got their pea processing start by producing pea starch for vermicelli noodles. However, Crahay said, the optimal technology for producing pea protein versus pea starch is different; pea starch production may involve more of a humid process that should otherwise be avoided when processing pea protein. In addition, because the spray drying process crucial to producing pea protein is expensive, not all suppliers can afford it. "They are not very well equipped in China for the moment because it costs a lot," Crahay said, claiming that these factors can determine the quality of the protein coming from some suppliers.

"There's been a lot of press around companies saying, 'We have pea,'" said Frank Truong, general manager, Cosucra. "But I've been talking to customers and telling them,

'You need to peel the layers back two or three times and ask, 'Are you actually manufacturing your pea protein isolate?' Because what happens is that there are marketers that buy products manufactured in China, so there's a lack of farm-to-fork traceability, sustainability, and quality assurances."

Crahay added that some companies used to supplying pea protein concentrates to the pet food market are now offering these same ingredients—the concentrates, instead of isolates—to the human nutrition market. "The pet food market isn't very focused on pea protein isolate today," he said. "So, there are a lot of concentrates [out in the market] where there's less quality needed."

In general, Crahay said, "Even if we've worked with pea protein for 25 years, it is still in its infancy, and I think there's a lot of work to do. For instance, can they be texturized for meat analogues? You can have different processes to use them, for texture, in cooperation in a system...We are really in front of it, but not yet at the end." ■



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