



The New Era of Food and Agriculture

Lead Writer: Konstantin Tumanov

Editor: Lewis Hart

Graphic Design: Alexandru Darie

Here is some food for thought: the world will need 70% more food by 2050, when our population is set to reach 10 billion. This means that we will have to produce more food in the next 40 years than in the previous 10,000 combined. At the same time, the food industry presently accounts for 26% of greenhouse gas emissions, and agriculture uses up to 70% of the global freshwater withdrawals. If we are to preserve our planet, we will have to produce more with less.

The task before the sector is enormous. As the President of Bayer Crop Science Division Rodrigo Santos summarizes: “Over the last two decades, we saw a major revolution with increasing yield and productivity. But in the next two decades we will witness two

simultaneous revolutions and with that a major transformation of agriculture: we need to produce more food to meet the 70% rise in demand while – at the same time - fighting climate change.” As if that were not enough, this twofold hurdle is aggravated by recent crises, such as the COVID-19 pandemic, which perturbed global supply chains, and Russia’s illegal invasion of Ukraine, which caused spikes in fertilizer prices, resulting in increased food insecurity around the world. Simultaneously, long-lasting grievances, notably aging labor force and food waste, persist. The good news is that major players in the sector, from farmers to flavorists to engineers, are all in a state of restless productivity, conscious of what lies ahead. We spoke with more than 100 of these industry leaders, and here we report on their latest work to feed the world and conserve the planet.

In This Report...



HON. MARIE-CLAUDE BIBEAU
| MINISTER OF AGRICULTURE
AND AGRI-FOOD OF CANADA

Canada is a global leader in agricultural innovation. New technologies such as genome editing, robotics and AI offer potential solutions while addressing key challenges, such as labor shortages, supply chain resilience and climate change.



BETH BECHDOL
| DEPUTY DIRECTOR GENERAL,
UN FOOD AND AGRICULTURE ORGANIZATION

Today, 222 million people across 53 countries are classified under IPC Categories 3 through 5, namely Category 3 – crisis; Category 4 – food-related emergencies; Category 5 – famine. These are the highest figures we have seen since we started reporting.

READ THE FULL INTERVIEWS @
investmentreports.co

New promise for Earth’s oldest crop.
Investing in Better.

Science for Better
Bayer.com



LAURETTE RONDENET |
OWNER AND CEO, EDLONG &
PRESIDENT, FEMA



The real question here is: how can we become the food heroes of our generation? What legacy are we going to leave behind? How will we feed the world and protect the Earth's resources? The key mindset is to remain open to all kinds of solutions, while being careful not to inflict further damage.

READ THE FULL INTERVIEWS @ [investmentreports.co](https://www.investmentreports.co)

Ready to Regenerate

Producing more while preserving the environment requires new ways of thinking about our food, and one of the most promising trends in that sense is the concept of regenerative agriculture. "This is a new movement - it takes the foundations of traditional organic agriculture, and layers on top new standards for fair labor, animal welfare, as well as quantifying the benefits good organic practices have in aiding soil health and soil carbon sequestration," says Jyoti Stephens, VP of Mission and Strategy at Nature's Path Foods, a Canadian organic cereal producer.

Russell Stokes, CEO of KIND Snacks, adds in the same vein that his company plans to source 100% of the almonds in their snacks from regenerative farms by 2030: "We partnered with one of our largest suppliers to develop a three-year pilot program, where we are testing various regenerative practices on a 500-acre plot. The goal is to create a set of guidelines for our suppliers so that they can farm almonds using only regenerative practices, such as employing green fertilizers and less water inputs." Emphasizing the importance of regenerating soil, Craig Stevenson, CEO of Lundberg Family Farms, tells us: "We have prioritized the health of the soil, and healthy soil can be more resilient in the face of climate change than soil that has been degraded by conventional farming practices."

Regenerative agriculture, however, cannot be envisaged without the right incentives for farmers. More than anyone, farmers are deeply committed to conserving their land and protecting the environment, as their sustenance depends on it. But if growers are to transition to a greener model, given historically low margins, they will need more support to make it happen.

the world will need

70% **MORE FOOD**
by **2050**

Among the most encouraging developments in that sense is the emergence of a market for carbon credits in the industry. "The carbon market has allowed for an alignment between advocates of the ESG framework and conservation-minded farmers, who are mutually interested in reducing crop inputs, GHG emissions, and soil erosion. And it has done so by enabling farmers to receive payment for reinventing their production models," the owner of Blue Diamond Farming Company, Ben Riensche, highlights.

To make this a reality, businesses have started offering solutions for farmers to earn more from carbon-smart practices. Ron Hovsepian, CEO and President of Indigo Agriculture, exemplifies: "Our Carbon by Indigo program pays participating farmers 75% of the value of the carbon credit, whether they are based in the U.S. or are a smallholder farmer in India. To date we have generated over 130,000 high quality carbon credits, and we aim to grow on that substantially."



DAVID CHAVERN | PRESIDENT & CEO,
CONSUMER BRANDS ASSOCIATION
Consumers want a sustainable model to deliver their three basic needs: good-quality nutrition, convenience, and value.



CARRIE VOLLMER-SANDERS |
SUSTAINABILITY DIRECTOR,
U.S. FARMERS & RANCHERS IN ACTION
Farmers and ranchers must have a voice in discussions surrounding the environment because growers are at the heart of climate solutions.



What is the legacy you want to leave behind?

Owning Your Legacy is a podcast for those seeking inspiration on leadership and what it takes to courageously leave your mark on the world.

Join Laurette Rondenet, Owner & CEO of Edlong, an innovative, globally-recognized food flavoring company, as she hosts intimate discussions with fellow leaders, visionaries, and trailblazers who are making an impact in their space.

LauretteRondenet.com



Made of More™

NOVUS is the intelligent nutrition company that creates innovative solutions and services to give farmers the ability to do more with less. [NOVUSINT.COM](https://www.novusint.com)

NOVUS®

©2023 Novus International, Inc. All rights reserved.



“

RODRIGO SANTOS |
PRESIDENT, BAYER CROP
SCIENCE DIVISION



Over the last two decades, we saw a revolution with increasing yield and productivity. But in the next two decades we will witness two simultaneous revolutions and a major transformation of agriculture: we need to produce more food to meet the 70% rise in demand while - at the same time - fighting climate change.

[READ THE FULL INTERVIEWS @ investmentreports.co](https://www.investmentreports.co)

Similarly, Daniel Ryan, CEO of CIBO Technologies, is focused on connecting more farmers to grower-incentive programs. He tells us: “Our software platform allows growers to upload field boundaries in the program engine and instantly see programs and incentives for which they are eligible. These programs may be sponsored and funded by private companies in the form of Scope 3 emissions reductions, carbon project developers, or by governments.”

New developments in our understanding of the soil’s composition can also help farmers take better care of it and have better data on the carbon they sequester into the soil. “Through our sustainability rating, we offer customers data on carbon and integrated genomics-chemistry on biodiversity, impact on water and resource usage – the latter two are particularly important for optimizing fertilizer use to minimize pollution,” says Poornima Parameswaran, CEO of Trace Genomics, a company offering precision soil analysis based on genomics.

Animals and Alternatives



The future of animal agriculture is amongst the most pressing matters in the industry. On the one hand, about 16.5% of GHG emissions come from animal farming, which is one reason for the rapid development of alternative protein. On the other hand, rising incomes in developing countries means that traditional meat and dairy consumption is far from outdated.

When it comes to traditional protein sources, animal nutrition is key to achieving sustainability. As Dan Meagher, President and CEO of Novus International explains: “The ever-growing global demand for food can only be met if all the players in the food system participate with solutions.” Novus, an animal nutrition company, develops products that support health and reducing environmental impact: “Our technology has direct effects on the environment in that we can produce the additives directly into grains, like corn, that make up the bulk of an animal’s diet. By eliminating some steps in the nutrition production chain, we can feed animals in a way that decreases the carbon footprint.” By improving animal health, such practices can also reduce reliance on antibiotics.

Automation equally has a twofold effect on animal agriculture: improving sustainability and reducing the need for labor. André van Troost, CEO of the Dutch dairy machine and robots manufacturer Lely, tells us: “Our products robotize a variety of tasks carried out in the dairy barn, including milking, feeding, and manure-cleaning. We have machines which mow and transport fresh grass into the barn for feed, and robots that work on the farm to reduce ammonia and nitrogen emissions. These innovations reduce the number of



A climate change solution **right beneath our feet.**

Investing in Better.

Science for Better
Bayer.com



full-time employees needed for barn tasks and enable farmers to spend more time ensuring that individual cows are well nourished.”

Concurrently, there is excitement on the alternative protein front. We spoke to a number of companies using fungi as a source of alternative protein, which turns out to be particularly viable due to its natural potential for scaling. The CEO and Co-Founder of Nature’s Fynd, Thomas Jonas, tells us: “The proteins in fungi are highly digestible, similar to beef, as well as rich in protein. They also contain all the essential amino acids.” To exemplify the unique scalability potential, the CTO and Co-Founder of Meati, a producer of alternative meat based on mycelium, Justin Whiteley quantifies: “Right now, in only the first phase of our new Mega Ranch, we can make about five cows of mycelium in three days from a teaspoon of spores.



Once the ranch is fully commissioned, that equivalent potential will be more like hundreds of cows, which gives you an idea of how fast we are able to grow.”

The flavor industry works alongside both traditional and alternative protein producers. “A substantial part of our efforts, probably more than 50% of the projects we are currently working on, are in the alternative dairy space. Interestingly, even the big dairy companies have started making plant-based products now,” explains Laurette Rondenet, Owner and CEO of Edlong, a producer of dairy flavors. Despite these trends, Rondenet echoes a message we have heard from various industry leaders: “I am convinced that this should be an ‘and’ conversation... Dairy and alternative dairy products should complement each other, rather than be in competition.” At any rate, flavors are set to play a pivotal role in satisfying consumers.

Since becoming the President of the Flavor and Extract Manufacturers Association, Rondenet’s mission has been to educate that the flavor industry is a sine qua non of food production: “All food needs flavor. There are less than 600 flavorists in the entire world, which means there are great opportunities for kids in STEM to find a home in our industry.”

Greener Ag



HUGH WELSH | PRESIDENT, DSM NORTH AMERICA
Part of that movement to sustainability is ensuring we use less antibiotics and create more antimicrobial products and practices. One way to do that is through appropriate nutrition of animals.



NIELS PÖRKEN | CEO, SÜDZUCKER AG
If production is to become more sustainable, it will be essential in the medium term to switch to biobased raw materials.



Fertilizers Revisited

Fertilizers are indispensable: half of the world’s population relies on them to get food. Russia’s invasion of Ukraine, however, has led to a dramatic surge in traditional plant nutrient prices, making it difficult for many and virtually impossible for some farmers to carry on with their regular business. Nitrogen-based fertilizers represent the largest segment of the market, whereby the predominant raw ingredient is natural gas, which explains why Russia supplies 20% of the world’s fertilizers. An additional problem facing the sector is that the carbon emitted during the full life cycle of fertilizers is substantial and contributes approximately 5% of all GHG emissions.

Giants of the fertilizer industry are well aware of the challenges ahead. Ahmed El-Hoshy, Group CEO of OCI, summarizes the dilemma: “Knowing that your company is providing the essential product (nitrogen fertilizers) to feed around 4 billion people – half the world’s population, is highly fulfilling. But agriculture accounts for nearly 30% of GHG emissions and, although it is no easy task, we



REDUCED DAIRY? NO DAIRY?

no problem.

When it’s mission-critical to get the taste of your enhanced-dairy, reduced-dairy, or dairy-free product just right, trust the **singular focus** of the world’s leading dairy and dairy-type flavor experts.



VISIT
EDLONG.COM



EDLONG
Everything Dairy Can Be.



certified
WBENC
WOMEN'S BUSINESS ENTERPRISE

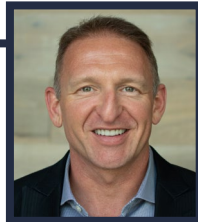


Developing sustainable plant growing solutions together

Sustainable and accredited solutions that can improve your productivity with convenience.



ROD VAUTIER | PRESIDENT, BIOWISH TECHNOLOGIES



Today, as a result of our decade-long research program, farmers using BiOWiSH® enhanced fertilizers can obtain the same crop yield using between 10 to 20% less fertilizer than their peers, or an average 7.7% yield increase when maintaining their current fertility program.

READ THE FULL INTERVIEWS @ investmentreports.co

must find the best ways to decarbonize this industry in an affordable way - without increasing the price of fertilizer and therefore the price of food too much.”

Bio-fertilizers have been developed for years, but not until the war in Ukraine and the consequent contraction of supply of traditional formulations did they attract so much attention. BiOWiSH is a company offering a solution that creates a symbiotic relationship between the plant and its microbiome, boosting its growth. As its President, Rod Vautier, explains: “Fertilizers exist to disperse nutrients onto the soil and then into the plant. The science here is a bit complicated but, essentially, we saw the potential for an entirely new way to improve nutrient uptake via leveraging the biotic synergy of these microorganisms with the native soil biology and the plant.” Likewise, Ray Chyc, CEO of Azotic North America, totes the benefits of utilizing nitrogen-fixating bacteria as a solution: “With our product, nitrogen is retrieved directly from the air, which can translate to yield increases of between 0%-20%, or on average eight bushels of corn per acre. Moreover, we know that our solution does not just capture nitrogen from the air, but also brings in CO2 to the plant in order for the plant to make that extra yield.”

Similar microbial solutions might be propagating but, as Ben Riensche cautioned from his family farm, traditional fertilizers are still far from being replaceable: “For us, it will be a decade-long experiment to see if we can find ways of maintaining fertility and productivity while replacing conventional fertilizers with biofertilizers.” Rather, as Rod Vautier adds, these products are to complement traditional applications, improving yields and sustainability: “BiOWiSH is at the forefront of biostimulants having developed a technology that can be seamlessly integrated into current agricultural practices. Because the technology is coated onto the fertilizer the farmer is already using, it requires no additional on-farm processes to gain the benefits of the microorganisms.”

Same Trusted Fertilizer.
Cutting-Edge Bio-Enhancement.
Better Yields for a Sustainable Future.



The BiOWiSH® Fertilizer Enhancement is a unique blend of microbial cultures coated onto dry fertilizer or mixed with liquid fertilizers, designed to optimize yield potential by improved nutrient uptake.



biowishtech.com |



CHRIS JAHN | PRESIDENT, AMERICAN CHEMISTRY COUNCIL (ACC)
Chemistry is the science behind sustainability. Ending hunger and addressing climate change issues also pertain to our domain since there are so many applications where we can contribute.



AHMED EL-HOSHY | GROUP CEO, OCI
The war in Ukraine subdued the fertilizer demand in 2022 and led to increased grain and gas prices. The conclusion from this disruption is that the green transition needs to not only focus on sustainability but also on cost competitiveness and energy security.

Beyond a mere momentary fashion, the movement toward bio-fertilizers and other biological solutions indicates a more global revisiting of plant health. Fertilizers help crops grow faster, but crops also need protection from pests, diseases and the elements. Erik van den Bergh, Managing Director of Van Iperen International, is a producer of a new breed of specialty fertilizers and biostimulants: “In a nutshell, biostimulants help crops overcome certain stress conditions like extreme drought or soils with a high pH. Even in very fertile conditions, crops always have certain periods of stress and boosting their metabolism could improve the yield and quality.”

Local for Local

The pandemic demonstrated the advantages of shorter supply chains. In the words of the President of DSM North America, Hugh Welsh: “Regionalization gives you protection not only against supply chain disturbances, but also currency and climate risks while enabling access to markets at sufficient scale.” More than a security question, localized production is becoming a trend for ecological reasons, and also since food waste is a function of the distance between the supply and demand sides. As Martin Brock, CTO of Cambridge Consultants, puts it: “The big secret is that we can already produce enough food. The problem is that a large chunk is produced inefficiently, or is wasted or not delivered where it is needed.”

Amongst the surest ways to reduce food waste, shorten supply chains, and minimize the environmental footprint from transportation is to rely on local-for-local production. The CEO of Jiffy Group, Thorleif Hals, insists on the promises that indoor farming, or CEA (controlled environment agriculture), holds for transforming agriculture into a more localized practice. Hals tells us of Jiffy’s project in Qatar that demonstrates the potential of CEA in harsh climates as compared to outdoor farming: “The results were 5 kg per sqm outdoors and 100 kg per sqm indoors; moreover, the water and mineral consumption indoors was 99% less than that outdoors. In other words, because of indoor farming they can now have local tomato produce in Qatar. That signifies a new era.”

Greenhouses (the most common form of CEA) are nothing new, being a centuries-old Dutch invention. Yet, new technologies have transformed the way food is grown indoors today, allowing for greater produce, more efficiency and climate and geographical independence.



HARALD DUTZLER | PARTNER, PWC

Today, a variety of small businesses, companies, and even countries are reviewing their impact and footprint in the global food supply chain, particularly regarding topics like localization and self-sufficiency.

When we speak of the smart farm of the future, the Netherlands is still at the forefront. Dirk Aleven, the CEO of FoodVentures – a company exporting innovative indoor farms to developing countries, - shares: “It baffled me how the Dutch greenhouse concept was so well established in the Netherlands, but quasi-unknown in many other markets. Having witnessed how a local Ukrainian grower was producing roses at 70% of the capacity found in the Netherlands and was still being profitable, I immediately saw the huge pool of opportunity in these frontier markets.”

Referring to the great potential for CEA to address growth in food demand, Wouter Kuiper, CEO of glass greenhouse builder KUBO, envisions: “CEA allows us to grow between 20 to 35 times more produce per square meter than outdoor farming. If you let that figure sink in, you quickly realize the massive long term efficiency it can bring.” One bright innovation in the indoor farming space is the introduction of high-tech LED lighting. Alexander Gerfer, CTO of Würth Elektronik, explains: “Instead of using the powerful light sources that imitate the sun inside greenhouses, it would be much more efficient and sustainable to find out the precise light



WOUTER DUIJVESTIJN |
OWNER,
BEYOND CHRYSANT

At Beyond Chrysant we are always looking to the future, and we implement the latest technologies in an eco-friendly way. We use GreenSwitch from Van Iperen International because it’s the perfect match with our vision.

[READ THE FULL INTERVIEWS @ investmentreports.co](https://www.investmentreports.co)

Future farm tech you can use today.
Investing in Better.
[///Learn more at Bayer.com](https://www.bayer.com)

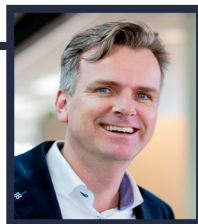
LET'S GROW!



Next level farming and new food systems
26-28 September 2023 | Messe Dortmund, Germany
www.vertifarm.net



CEA allows us to grow between 20 to 35 times more produce per square meter than outdoor farming. If you let that figure sink in, you quickly realize the massive long term efficiency it can bring.



WOUTER KUIPER | CEO, KUBO

[READ THE FULL INTERVIEWS @ investmentreports.co](https://www.investmentreports.co)

intensity needed by plants in different growth stages. Cultivation with light-emitting diodes saves around 70% energy and minimizes CO₂ emissions by up to 90%.”

Perhaps the most ambitious segment of indoor agriculture is vertical farming. Its aim is to optimize plant growth by growing crops vertically, saving space and water, and not using pesticides, soil and sun. David Rosenberg, Co-Founder and CEO of AeroFarms, shares his vision: “Vertical farming holds immense opportunities, and it can span several areas of food production. In our case, we decided to focus on leafy greens where we have up to 390 times greater productivity annually and use up to 95% less water vs. traditional field farming. But the vision is to have a platform that has high utility across many different plants.” Many vertical farms now integrate sophisticated technologies, data learning and AI that allow for greater automation and the precise application of crop nutrients.

Nevertheless, vertical farming is still a nascent industry, experiencing profitability issues due to its considerable energy consumption and substantial capital costs. Many, therefore, see vertical farming as a complement rather than a supplement to horizontal CEA. As things stand, agriculture uses around 50% of all habitable land. Mirjam Boekestijn, GM of Dutch Greenhouse Delta tells us: “Depending on the climate, there are different solutions and types of installations to create the best indoor conditions. In Singapore, where almost no agricultural land is available, vertical farms are a viable option to produce local foods, while in Kazakhstan, where there is a lot of land available, indoor farming is not necessarily the best direction.”



BRADLEY NATRASS | CEO, URBAN-GRO

The technology used in urban greenhouses is mainly concentrated around proximity and full automation, and it ranges from small robots that move the proprietary racking systems around the facility to pest management done exclusively through biological insects.



BARRY MURCHIE | PRESIDENT & CEO, TRULEAF SUSTAINABLE AGRICULTURE

Vertical farming is a capital-intensive venture, so the fact that we had the partners available to be able to build the infrastructure to do this properly made me push all my chips to the center of the table and say "I am in! "

Imagine sustainable jet fuel you can grow.

Investing in Better.

[///Learn more at Bayer.com](https://www.bayer.com)



The Agritech Edge

As curious as it may sound, the new devotion of many tech entrepreneurs is agriculture - a trend making the sector look increasingly futuristic. Humanless vertical farms, AI adjusting water and nutrient inputs for each individual plant, or drones hovering over crops to closely monitor their development - these are just a few details of the picture that innovators in the agri-tech space paint as the farm of the future. Whereas some of these innovations are still at an early stage of testing, others, like autonomous tractors or data analytics are already in established practice.

Traditionally marked by uncertainty, agriculture can be revolutionized by precise information. The advent of agri analytics, therefore, is most welcome. James Heneghan, SVP of Gro Intelligence, says: "We have been gathering our data from quality public sources but we are also licensing it from vendors or private sources. Some of the yield forecasts that we offer can be up to ten months ahead of official government statistics." Another analytics company chooses space as its observation point: "Agriculture is an omnipresent field around the world and one that could greatly benefit from a planetary perspective. If we were to look at the planet as a living organism, the only way to take care of it would be to measure its vital signs in a holistic manner," tells us Artiom Anisimov, CEO of EOSDA, who uses satellites to observe changes in climate and agri-variables. Indeed, one of the major issues with similar high-tech solutions remains their price and inaccessibility for most small-scale farmers.

Smart Farming



THIERRY KLEIN | PRESIDENT,
BELL LABS SOLUTIONS RESEARCH,
NOKIA BELL LABS

The smart farm of the future means being able to know everything that is taking place in the farm, and then having the corresponding decisions implemented in a productive, sustainable and safe fashion.



JOHN RAINES | PRESIDENT,
TELUS AGRICULTURE AND CONSUMER GOODS

In production agriculture, you need to be able to assess performance and crop needs in real time. The trick is to make all these tools user-friendly.



Our most important output is our graduates; they are key to enabling the research engine to remain strong, key to meeting the labor demands in the modern era of agriculture and key to continued innovation for the sector.



RENE VAN ACKER | PROFESSOR AND DEAN,
UNIVERSITY OF GUELPH

READ THE FULL INTERVIEWS @
investmentreports.co



ONTARIO
AGRICULTURAL COLLEGE

Turning our attention back to the ground, autonomous agri vehicles are gaining momentum as they can boost farmers' profitability and reduce the need for manual labor. Jorge Heraud, VP of Automation & Autonomy at John Deere, explains "We started by automating tillage, one of the easiest operations on a farm where the farmer is preparing the ground for planting by simply driving back and forth, covering the entire field. We took already existing technologies, like to automatically steer the vehicle and added six pairs of cameras to create a 360° view to detect obstacles." Praveen Penmetsa, CEO and Co-Founder of Monarch Tractor, mentions that "less than 42% of U.S. farmers run a profitable business since they are stuck between meeting emission and chemical regulations, and doing so with a limited workforce. Our driver-optional solution allows farmers to run up to eight tractors at a time."

The future of agriculture hinges first and foremost upon the new generations of farmers and innovators who will choose to commit themselves to this challenging but rewarding sector. "One of the greatest challenges for the sector is finding enough highly qualified people. We need to recruit far beyond our traditional pool of people who, like me, grew up on a farm; that pool is dwindling, and the general public has a notion about agriculture that typically does not go beyond farming," says Rene Van Acker from the University of Guelph. Yet, agriculture is now a high skills industry, with innovation transforming its every aspect. Precisely this, Van Acker hopes, can attract more young talent. At any rate, all the inspired voices and exciting developments brought to light in this report demonstrate that agriculture is not antiquated; it is teeming with life and fresh ideas.



NOURISHING THE CONNECTIONS BETWEEN FOOD, FLAVORS, AND PEOPLE

Edlong Flavors congratulates our Owner & CEO
Laurette Rondenet on becoming the 87th President
of the Flavor and Extract Manufacturers Association.



Connect
with Laurette

