

ADVANCES IN SUSTAINABLE AGRICULTURE

Trends, Strategies
& Technologies



PRESCOUTER 2023



Sustainable agriculture can provide economic and environmental benefits without necessarily increasing prices for consumers. By implementing the right strategies, companies can achieve increased yields and notable cost savings while also reducing greenhouse gas emissions.

Food agriculture is a major contributor to climate change, accounting for around 30% of global greenhouse gas emissions. This is due in part to unsustainable agricultural practices that have led to soil degradation, water scarcity, and loss of biodiversity. With the world's population growing rapidly and the impacts of climate change becoming increasingly apparent, it is crucial that we adopt agricultural practices that protect our environment while still meeting the increasing demand for food.

According to the World Intellectual Property Organization (WIPO), new and sustainable ways of producing food, like vertical farming and artificial agriculture ecosystems, as well as using AI and ML to improve agricultural production, are becoming increasingly popular in the food and beverage industry.

This Intelligence Brief investigates the latest trends in sustainable agriculture, including novel strategies and technologies relating to plants and animals that lower greenhouse emissions, conserve water, and reduce soil degradation. Similarly, the report examines consumer willingness to pay extra for sustainably grown/produced food and beverage products.

Contents

Key takeaways	04
Key trends driving sustainable agriculture	05
Innovative techniques promoting sustainable agriculture	11
Precision Agriculture	12
Regenerative Farming	21
Vertical Agriculture	37
Challenges to the adoption of sustainable agriculture	47
About the authors	51
Potential next steps	52
Other reports from PreScouter	53
About PreScouter	54

6 Key Takeaways

- 1 Increased demand for sustainable food is driving advances in sustainable agriculture.
- 2 The widespread use of technology is transforming how agriculture is managed and practiced.
- 3 Precision agriculture, vertical farming, and regenerative farming are key strategies in sustainable agriculture.
- 4 Consumers' increased awareness of the environmental impacts of their food choices is driving companies towards sustainable practices.
- 5 Sustainable agriculture will play a crucial role in securing a sustainable future for the planet and its communities.
- 6 Regulations and initiatives will play a major role in driving F&B companies to adopt more sustainable practices.

Key trends driving sustainable agriculture

As consumers become more aware of the environmental impact of their food choices, they are seeking food options that have been produced sustainably. Data suggests customers are also willing to pay a higher price for these products.

Increased demand for sustainable food reflects the growing concern among consumers about the environmental impact of their food choices. For example, a 2015 Nielsen survey found that 66% of global consumers are willing to pay more for sustainably produced food.

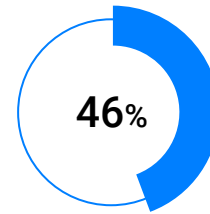
This trend is particularly evident among younger generations, who are more likely to prioritize sustainability and environmental protection when making purchasing decisions.

As a result of this growing demand, the food and beverage industry is responding by investing in innovative approaches to agriculture.

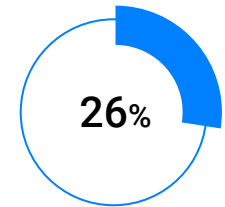
Consumers care about sustainability – and back it up with their wallets

- Products making environmental, social, and corporate governance (ESG)-related claims averaged **28% cumulative growth**
- Products that made no such claims averaged **20%**

Source: NielsenIQ



of consumers are looking to brands to take the lead on creating sustainable change



of consumers find it difficult to find sustainable options on the shelf

1. <https://www.nielseniq.com/>
2. <https://www.grandviewresearch.com>

The demand for sustainably produced foods will continue to increase, driving growth in the global sustainable food market.

Sustainability is becoming more important to consumers and a recent survey shows that more than 80% will go out of their way to make sustainable choices.

Organic agriculture is one way producers are becoming more sustainable. The organic food market, valued at \$188 billion in 2022, is expected to grow at a (CAGR) of 13.0% from 2022 to 2030.

This growth is driven by increased awareness of the environmental and social impacts of industrial food production.

Venture capitalists have become increasingly interested in investing in sustainable food production companies. This influx of capital is helping to finance the development and expansion of sustainable food production.

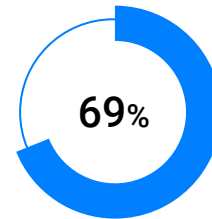


The global market for organically-grown food is expected to reach

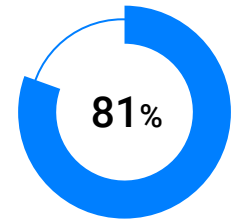
\$320BN by 2025

Source: Grandview Research

Consumer Attitudes Toward Sustainability



say sustainability has become more important to them over the last two years



will go out of their way to make sustainable choices

1. <https://www.grandviewresearch.com>
2. [https://nielseniq.com/global/en/insights/analysis/2015/the-sustainability-imperative-2/#--text=Among%20the%2088%25%20of%20global,to%20social%20value%20\(56%25\)%3B](https://nielseniq.com/global/en/insights/analysis/2015/the-sustainability-imperative-2/#--text=Among%20the%2088%25%20of%20global,to%20social%20value%20(56%25)%3B)

The increasing frequency of extreme weather events is posing a challenge to current agricultural practices and business models, driving up the costs of goods and exposing the vulnerability of supply chains.

Heatwaves and wildfires in the US and Canada

The US and Canada experienced record-breaking heatwaves during the summer of 2021, which led to wildfires that destroyed crops and farmland.

Frost in France

A late-season frost in April 2021 damaged crops such as grapes, fruit trees, and sugar beet in France, leading to significant losses for farmers and affecting global supply chains.

Hailstorms in Italy

Hailstorms in Italy during the summer of 2021 damaged crops such as grapes and kiwi fruit, leading to significant losses for farmers and affecting global supply chains.

Flooding in Europe and China

Several countries in Europe, including Germany and Belgium, experienced severe flooding in July 2021, which damaged crops and disrupted supply chains. Similarly, China experienced flooding that affected crop yields and led to food price inflation.

La Niña in South America

La Niña, a weather phenomenon characterized by cooler than average ocean temperatures in the equatorial Pacific, led to dry conditions and reduced rainfall in parts of South America. This caused crop losses in countries such as Argentina, Brazil, and Paraguay.

Drought in Brazil

A severe drought in Brazil affected the country's coffee crop, which is one of the world's largest producers. The drought led to a significant decrease in the yield and quality of coffee beans.

Cyclone Yaas in India

Cyclone Yaas hit the eastern coast of India in May 2021, damaging crops and disrupting transportation and logistics in the region.

Typhoons in Southeast Asia

Typhoons and tropical storms in Southeast Asia, including Typhoon Goni and Typhoon Vamco, caused flooding and landslides that damaged crops and disrupted transportation and logistics.

To promote sustainable farming practices, including organic food production, governments worldwide are implementing policies and initiatives to promote sustainable agriculture and reduce its environmental impact.

SUCH INITIATIVES INCLUDE



USDA's Conservation Stewardship Program (CSP)

Provides financial and technical assistance to farmers in adopting sustainable farming practices.



The European Commission's Common Agricultural Policy (CAP)

Promotes sustainable agriculture through subsidies and support for agro-environmental measures.



South Africa's Comprehensive Agricultural Support Program (CASP)

The CASP in South Africa aims to promote sustainable agriculture and improve the livelihoods of smallholder farmers by providing financial and technical support.



Australia's Sustainable Agriculture Initiative (SAI)

This provides funding and support for research and development of sustainable agriculture practices.

1. <https://www.nifa.usda.gov/>
2. <https://agriculture.ec.europa.eu/>
3. <https://agris.fao.org/agris-search/search.do?recordID=ID2021303278>
4. <https://www.saiplatformaust.org/>

New farming practices are being developed through advances in research and development. These include regenerative agriculture, vertical farming, precision agriculture, and aquaponics, among others. With the help of these new techniques, farmers are able to use fewer inputs, such as fertilizer and water, and still achieve high yields. In addition, these practices are designed to improve soil health, protect biodiversity, and conserve resources for future generations.

↪ A 60-year experiment points to the success of biofertilizers as an alternative to synthetic nitrogen

Replacing synthetic fertilizer across Brazil's soybean crop with a biofertilizer



Lowered carbon emissions by 430M tons of CO₂-equivalent each year

Cost savings of nearly **95%**

↪ California farmers reduce emissions and feed the world with regenerative farming

A handful of California farmers are embracing "regenerative" methods of no-till farming



Preventing 5.8M tons of carbon dioxide emissions each year

Save 4,160 gallons of diesel fuel annually per 1000 acres

↪ Precision agriculture technologies have allowed Canadian farmers to do more with less

This study focused on using technologies such as auto guidance, fleet analytics, telemetrics, and precision irrigation among others.



Annual crop production increased an estimated 4%

6% less fossil fuels

7% less water

Select examples of innovative techniques promoting sustainable agriculture

Precision Agriculture



This technique involves using advanced technologies to gather and evaluate data on crop, soil and atmospheric conditions, helping farmers make informed decisions.

Regenerative Farming



This approach utilizes selected conservation practices to improve soil fertility and promote ecosystem resilience.

Vertical Farming



This technique involves growing crops in a controlled environment to produce food sustainably.



Precision Agriculture

This technique involves using advanced technologies to gather and evaluate data on crop, soil and atmospheric conditions, helping farmers make informed decisions.

By integrating advanced technologies, farmers are observing increased yields.

Precision agriculture uses technology and data to optimize crop production and improve the efficiency of inputs such as water, fertilizer, and pesticides. This involves collecting and analyzing data about soil and crop conditions and using this to make informed decisions.

- ↳ **Improved food security:** Precision agriculture can help increase food production by improving crop yields and reducing losses from pests and diseases.
- ↳ **Increased yields:** A study conducted by the Food and Agriculture Organization (FAO) in Egypt found that using precision irrigation technology resulted in an average increase in crop yields of 30 percent, while reducing water use by 25 percent.
- ↳ **Better understanding of soil and crop conditions:** Precision agriculture gives farmers a better understanding of soil and crop conditions.

The global precision agriculture market size was valued at USD 4 billion in 2020 and is expected to reach USD 7 billion by 2026, growing at a CAGR of 12.0% during the forecast period (2021-2026).



Figure. Few Agro IoT areas for Smart Agriculture. Source: [Agro-Economist](#).

1. <https://www.fao.org/documents/card/en/c/cc2812en/>
2. https://www.researchgate.net/publication/321018925-Precision_farming_for_sustainable_intensification_of_cropping_systems_in_Egypt

How precision agriculture works

By utilizing digital tools, farmers can monitor soil moisture levels, temperature, and other environmental conditions in real time, allowing them make informed decisions about when and how much to water, fertilize, and spray their crops. This helps to optimize crop yields and reduce waste.

A report by ResearchAndMarkets states that digital agriculture can help increase food production by up to 70% while reducing water usage by up to 50%.

1

..... **Data Collection:** Gather farm data using sensors, drones, and GPS devices. Includes soil conditions, weather patterns, crop health, and field boundaries.

2

..... **Data Analysis:** Using AI and ML, data collected is analyzed to determine patterns and correlations.

3

..... **Decision Making:** Based on the data analysis, farmers make informed decisions, such as when to plant, fertilize, irrigate, and apply pesticides

4

..... **Implementation:** The decisions made in step 3 are then implemented in the field, using tools such as variable rate applicators and auto-steer systems.

5

..... **Monitoring and Evaluation:** After implementation, the results are monitored and evaluated to determine their effectiveness.

6

..... **Repeat:** The process of precision agriculture is an ongoing cycle of the above steps.

Case Study

Trimble Ag



Trimble Agriculture is a division of Trimble Inc. that provides precision agriculture solutions to farmers around the world. Trimble Agriculture's products and services help farmers make informed decisions about planting, irrigation, and crop management, and to improve the efficiency of their operations.

Goals:

- Provide farmers with a comprehensive platform for managing their operations and making data-driven decisions.
- Increase the efficiency and profitability of farm operations through the use of real-time insights.
- Provide farmers with a centralized database to store all their farm data, making it easier for them to access and analyze this information in the future.
- Support sustainable agriculture practices and promote sustainable farming methods.

Company Overview & Goals

Technology

Results & Impact



Website



Colorado, USA



5,000-10,000 employees



Contact form



1978

Case Study

Trimble Ag



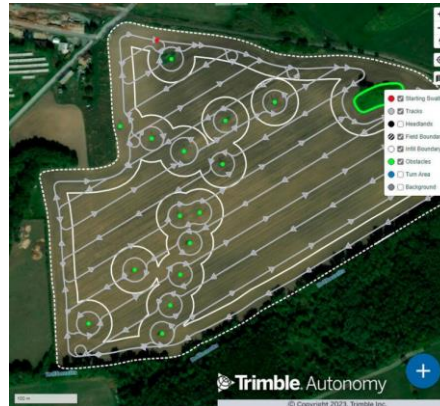
Trimble implements its precision agriculture solutions through a combination of technology, hardware, and software integrated to provide farmers with real-time field data.

Solutions include GPS guidance, yield monitoring and field management software.

Company Overview & Goals

Technology

Results & Impact



On Feb 24, 2023, Trimble announced the release of an advanced [path planning technology](#), which enables end users and equipment manufacturers to optimize and automate the trajectory, speed and path design of industrial equipment to increase efficiency.

Trimble field-tested the technology with Horsch by integrating path planning technology into Horsch's self-propelled PT and VL sprayer series to provide an autonomous, four-wheel-drive solution.

Figure. Trimble Advanced Path Planning
Technology Source: [TrimbleAg](#)

Case Study

Trimble Ag



Company Overview & Goals

Technology

Results & Impact



..... Increased efficiency

Trimble Ag's solutions help farmers make informed decisions about planting, irrigation, and crop management, leading to increased efficiency in their operations.



..... Improved yields

Using precision agriculture solutions, farmers are able to optimize their operations and improve crop yields. Trimble reports that farmers who used precision agriculture solutions were able to increase their yields by an average of 10-15% compared to those who did not use these solutions.



..... Improved sustainability

Trimble Ag's solutions help farmers better manage their resources, including water and fertilizer, which can result in lower costs and reduced environmental impact. The company reports that farmers achieved cost reductions by an average of 10-15% while also reducing their environmental impact.

Case Study

Raven Industries

RAVEN

Company Overview & Goals

Technology

Results & Impact

Raven Industries provides innovative solutions for various industries, including agriculture, energy, construction, and aerospace. In the agriculture sector, Raven Industries offers precision agriculture technologies that help farmers optimize their operations and improve crop yields.

Goals:

- Promote sustainable agriculture practices that help preserve natural resources and protect the environment.
- To advance precision agriculture by providing innovative solutions that help farmers optimize their use of resources.
- Help farmers improve crop yields and quality by providing solutions that promote optimal growing conditions.
- Increase farmers' profitability by providing innovative solutions that reduce costs, improve yields, and enhance farm productivity.



Website



South Dakota, USA



500+ employees



Contact form



1956

Case Study

Raven Industries

RAVEN

Company Overview & Goals

Technology

Results & Impact

Raven Industries implements its strategy for precision agriculture by providing innovative technologies and products that allow farmers to predict crop yields, optimize resources, and reduce waste.

Solutions include variable rate technology, soil sensing equipment, and high-efficiency irrigation systems.



One of Raven's key precision agriculture technologies is the [Viper® 4+ field computer](#), which provides real-time data on crop performance, soil moisture levels, and weather patterns. For example, by connecting the device to soil moisture sensors placed throughout the field, farmers can receive real-time data on soil moisture levels. This information can be used to determine when irrigation is needed, thus optimizing water usage.

Figure. Raven Viper® 4+ field computer Source: [Ravenind](#)

Case Study

Raven Industries

RAVEN

Company Overview & Goals

Technology

Results & Impact



..... Increased Efficiency and Productivity

Raven Industries' precision agriculture solutions have helped farmers improve their efficiency and productivity, allowing them to produce more with fewer resources.



..... Reduced Environmental Impact

Practices such as precision application of inputs and soil health monitoring have helped reduce the environmental impact of farming by limiting the use of chemicals and minimizing waste.



..... Improved Food Quality and Safety

Raven Industries' precision agriculture solutions have helped farmers produce higher-quality and safer food through optimized resources and growing conditions.



..... Technological Innovation

Raven Industries' precision agriculture solutions have contributed to the overall advancement of the agriculture industry and are paving the way for future innovation in the field.



Regenerative Farming

This approach utilizes selected conservation practices to improve soil fertility and promote ecosystem resilience.

These practices form the foundation of regenerative agriculture by improving soil health, increasing biodiversity, and enhancing ecosystem function.

Regenerative agriculture is a collection of techniques that work together to restore soil health and foster environmental sustainability.



Cover cropping

Growing cover crops between cash crops helps protect the soil, prevent erosion, and enhance its health through nitrogen fixation and adding organic matter.



Reduced tillage

Conservation tillage practices include no-till, and minimum tillage, minimize soil disturbance and maintain soil structure and fertility.



Integrating livestock

Incorporating livestock into farming systems can provide a source of fertilizer, help control pests, and promote soil health.



Agroforestry

Agroforestry combines crops and trees to create a more diverse and resilient agroecosystem that increases biodiversity and water retention.



Upcycling

This refers to practices aimed at reducing waste on the farm. For example, making fertilizer from plant waste.

1. <https://www.nrdc.org/stories/regenerative-agriculture-101>

Data suggests that regenerative agriculture practices are generally effective and promote sustainability.

AgEvidence provides the following insights indicating the environmental benefits associated with various regenerative agriculture practices (data is from the Midwestern US):

- ↳ Data suggests that tillage management leads to a significant increase in the **storage of carbon**.
- ↳ **Pest and nutrient management** have demonstrated the most favorable impact on crop growth and quality.
- ↳ Data also suggests that cover crop use, **reduced tillage**, and **nutrient management** help to improve water quality in the surrounding environment.

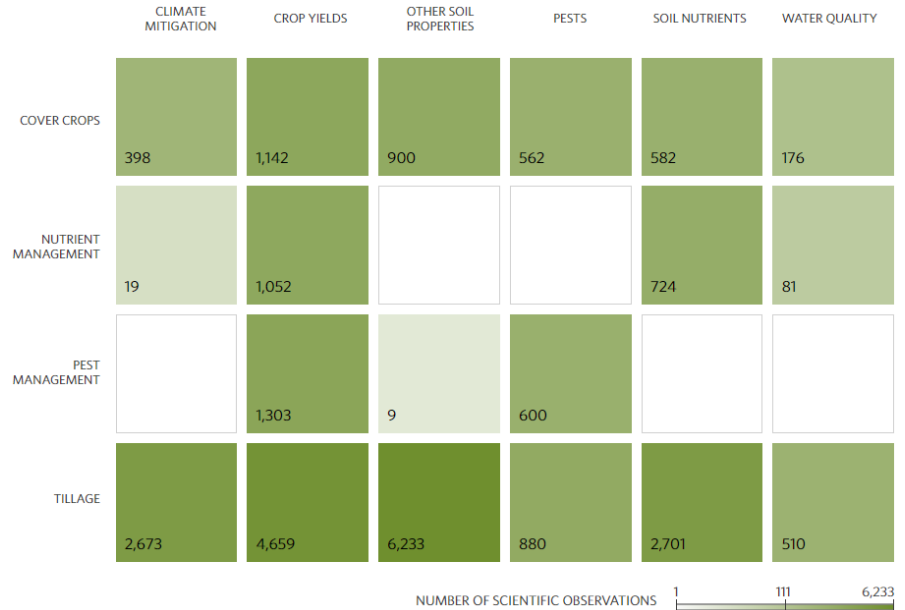


Figure. Observations by Agricultural Practice & Outcome. Source: [AgEvidence](#)

1. <http://www.agevidence.org/#/us-corn-belt/Tillage/Climate%20Mitigation>

In addition to the previously mentioned data, a number of studies further support the benefits of regenerative agriculture.



Soil Health

A study by the Rodale Institute found that **regenerative agriculture** practices can **increase soil organic matter by up to 50%** over a period of just 20 years.



Biodiversity

According to the World Agroforestry Centre (ICRAF), **agroforestry systems** can **support up to 60%** more plant and animal species than monoculture systems.



Carbon Sequestration

The Soil Association found that **regenerative agriculture** practices can **sequester up to 1.7 times more carbon** than conventional agriculture practices.



Economic Sustainability

A report by the USDA found that **regenerative agriculture** practices **can reduce input costs and increase profitability for farmers.**

1. https://rodaleinstitute.org/wp-content/uploads/FST_40YearReport_RodaleInstitute-1.pdf
2. <https://www.fao.org/publications/sofa/2022/en/>
3. <https://www.fao.org/3/tb001e/tb001e.pdf>

Case Study

Anheuser-Busch



Anheuser-Busch is a leading American brewery widely recognized for its signature brand, Budweiser. Founded in 1852, the company has become one of the largest brewing companies in the world, with a portfolio of more than 500 beer brands, including popular brands such as Stella Artois, Corona, and Michelob Ultra.

Goals:

- ↳ Reduce resources required for rice farming: 10% less water, 10% less nitrogen, and 10% less methane emissions (compared to regional averages).
- ↳ To source 100% of its barley from regenerative agriculture farms by 2025.
- ↳ To meet the growing demand for sustainable products while also improving overall efficiency and profitability.

Company Overview & Goals

Technology

Results & Impact



Website



Missouri, USA



5,000-10,000 employees



Contact form



1852

Case Study

Anheuser-Busch



Company Overview & Goals

Anheuser-Busch has teamed up with Indigo Ag and The Nature Conservancy to implement regenerative agriculture practices on a larger scale. The partnership with Indigo Ag includes a program called the Terraton Initiative, which incentivizes farmers to implement regenerative agriculture practices. Meanwhile, the partnership with The Nature Conservancy involves a pilot program to test regenerative agriculture practices on barley farms in Idaho.

Solutions include cover cropping, reduced tillage, and carbon sequestration through the Terraton Initiative.

Technology

Anheuser-Busch has also developed a "SmartBarley" platform, which uses data and analytics to help farmers improve their yields and sustainability. The platform also provides farmers access to agronomists and other experts who can provide guidance and support.



Figure. Screenshot of the SmartBarley platform. Source: Anheuser-Busch InBev.

Results & Impact

Case Study

Anheuser-Busch

Company Overview & Goals

Technology

Results & Impact



..... Increased biodiversity

Anheuser-Busch's regenerative agriculture practices have led to increased biodiversity on its farms. The company has created habitats for beneficial insects and wildlife, which can help control pests and improve crop yields.



..... Decreased greenhouse gas emissions

Anheuser-Busch has incentivized farmers to adopt practices that sequester carbon in the soil. By doing so, the company has reduced its greenhouse gas emissions and contributed to global efforts to mitigate climate change.



..... Improved water quality

Practices, such as SmartBarley, have helped farmers optimize their water use and reduce the risk of water pollution from excess fertilizer or pesticide runoff.



..... Improved soil health

By implementing practices such as cover cropping and reduced tillage, Anheuser-Busch has improved soil health on its farms. Healthier soils can support higher crop yields, require less water and are more resilient to environmental stress.

Case Study

Cargill



Cargill provides food, agriculture, and industrial products and services to customers worldwide. In the agriculture sector, Cargill is involved in the production and processing of a wide range of commodities, including corn, wheat, soybeans, and cotton. The company works with farmers worldwide to help them improve their productivity and sustainability.

Goals:

- ↳ Improve the livelihoods of 10 million farmers by 2030 through training in sustainable agriculture practices and better access to markets.
- ↳ Promote responsible water management in its agricultural supply chains, including reducing water use and improving water quality.
- ↳ Reduce its greenhouse gas emissions by 30% per ton of product by 2030.
- ↳ Develop sustainable supply chains for agricultural commodities, including soy, cocoa, palm oil, and beef.
- ↳ Restore degraded land and promote biodiversity.

Company Overview & Goals

Technology

Results & Impact



Website



Minnesota, USA



100,000+ employees



Contact form



1865

Case Study

Cargill



Cargill RegenConnect™ connects farmers, customers, and experts to create a regenerative agriculture supply chain. It provides a platform for farmers to learn about regenerative agriculture practices along with technical support to help them implement these practices on their farms.

Solutions include: Cover cropping, Reduced tillage, Rotational grazing, Nutrient management, CRASA tool

Company Overview & Goals

Regenconnect's platform has a marketplace and carbon credit feature that connects farmers with sustainable crop buyers. This incentivizes regenerative agriculture practices and helps farmers earn additional revenue streams by sequestering carbon in their soil.

Technology

Results & Impact

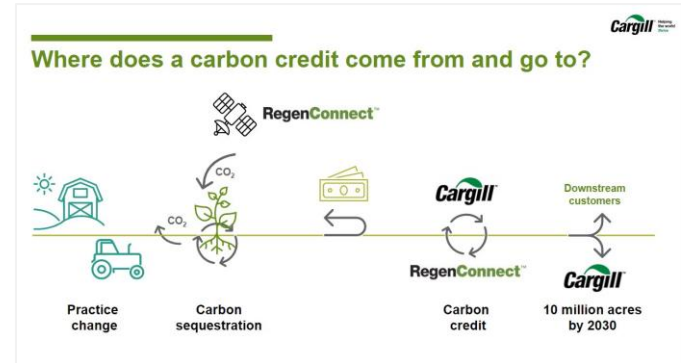


Figure. A flow chart of the Regenconnect carbon crediting process. Source: Cargill.

Case Study

Cargill



Company Overview & Goals

Technology

Results & Impact



..... Reduced carbon emissions

In a study of 100 US farmers who implemented the recommended regenerative practices by the program, an average reduction of 10-15% in greenhouse gas emissions was observed.



..... Increased crop yield

Farmers who implemented regenerative agriculture practices, as recommended by Cargill RegenConnect™, experienced an average increase in corn yields of 10-15%.



..... Improved farmer profitability

RegenConnect has improved farmer profitability by introducing novel revenue streams and assisting them in optimizing their practices.



..... Increased adoption of regenerative agriculture practices

By providing farmers with new revenue streams through carbon credits and sustainable crop markets, RegenConnect incentivizes the adoption of regenerative agriculture practices.

Case Study

Full Circle Microbes



Full Circle Microbes is focused on upcycling through the use of microbes. They aim to create sustainable solutions for waste management in agriculture by transforming organic waste into valuable products such as compost and fertilizer.

Goals:

- Promote sustainable practices in agriculture and reduce the need for synthetic fertilizers.
- Provide farmers with natural solutions to soil problems, such as nutrient deficiencies, plant diseases, and soil erosion.
- Reduce waste in the agriculture industry by converting organic waste into useful products.
- Improve crop yields and quality through the use of microbial products that enhance plant growth and nutrient uptake.

Company Overview & Goals

Technology

Results & Impact



Website



Vermont, USA



<50 employees



Contact form



2019

Case Study

Full Circle Microbes



Company Overview & Goals

Technology

Results & Impact

Full Circle Microbes strategy involves using microorganisms (bacteria and fungi) to convert cannabis residues into biofertilizers. This is possible since cannabis plants retain a large amount of nitrogen. Mixing the microorganisms with the stems and biomass of the plants results in a nutritious substrate from the recycling of organic matter.

Solutions include: Soil health and plant growth products, disease and pest control, nutrient management.



By using cannabis residues to produce biofertilizers, Full Circle Microbes creates a closed-loop system that is both sustainable and environmentally friendly.

Figure. Steps involved in recycling and retaining cannabis plant nutrients include 1) retaining stems and residual plant matter; 2) chop the stalks and place the remaining biomass in the pile; 3) inoculate the stack with the Full Circle Microbes microbial mix; 4) cover with a tarp and let the microbes work for 3 weeks; 5) mix the soil or growing substrates and cure for 2 weeks; 6) fertilize the plantation using recycled biomass. [Source](#).

Case Study

Full Circle Microbes



Company Overview & Goals

Technology

Results & Impact



..... Increased biodiversity

The use of biofertilizers helps to improve soil biodiversity, which can have a positive impact on the overall health of the ecosystem.



..... Decreased greenhouse gas emissions

The use of biofertilizers instead of synthetic fertilizers helps decrease greenhouse gas emissions.



..... Increased crop yield

Biofertilizers boost crop yields by 10 to 40% by enriching the soil with essential nutrients like proteins, amino acids, and vitamins.



..... Reduced waste

Biofertilizers help reduce waste by turning organic materials into usable compost and fertilizer, reducing the amount of waste that goes to landfills.

Case Study

Circulus Agtech



Circulus Agtech harnesses waste materials, including manure and compost to produce liquid organic fertilizer

Goals:

- Reducing the amount of organic waste that is sent to landfills, where it can contribute to greenhouse gas emissions.
- Reducing dependence on artificial fertilizers, lowering costs.
- Promoting soil health and plant growth by providing nutrient-rich liquid organic fertilizer to farmers.
- Promoting the use of hydroponic growing systems to increase crop yields and reduce water usage.

Company Overview & Goals

Technology

Results & Impact



Website



Montreal, Canada



5,000-10,000 employees



Contact form



1852

Case Study

Circulus Agtech



Company Overview & Goals

Technology

Results & Impact

Circulus Agtech's strategy involves harnessing residual fertilization material (FRM), including manure and compost, to produce liquid organic fertilizer suitable for soil and hydroponics. The company has developed its own technology, an aerobic digester capable of processing organic waste.

Solutions include: Organic Fertilizer Production, Waste Management, Education and Outreach.

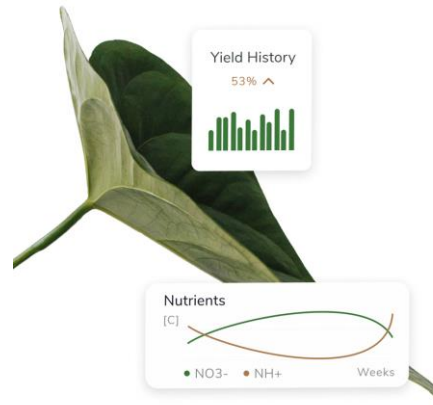


Figure. High-Tech Nutrient Monitoring.
Source: [Circulus Agtech](#).

Circulus Agtech uses advanced technology to monitor specific ions in liquid extracts of organic matter, like manure and compost, to create concentrated liquid organic fertilizers suitable for soil and hydroponic systems.

Case Study

Circulus Agtech

Company Overview & Goals

Technology

Results & Impact



..... Reduced greenhouse gas emissions

The upcycling process helps in reducing the amount of organic matter that would have otherwise gone to waste, thus promoting sustainability.



..... Production of high-quality fertilizers

By utilizing advanced technology, Circulus Agtech produces high-quality organic fertilizers that can be used in soil and hydroponic systems.



..... Cost-effectiveness

Using concentrated liquid organic fertilizers is a cost-effective alternative to traditional chemical fertilizers, which can be expensive and harmful to the environment.



..... Promoting hydroponic growing systems

By providing high-quality liquid organic fertilizer, Circulus Agtech helps farmers switch to hydroponic growing systems, which are more water-efficient.



Vertical Farming

(Controlled Environment Agriculture)

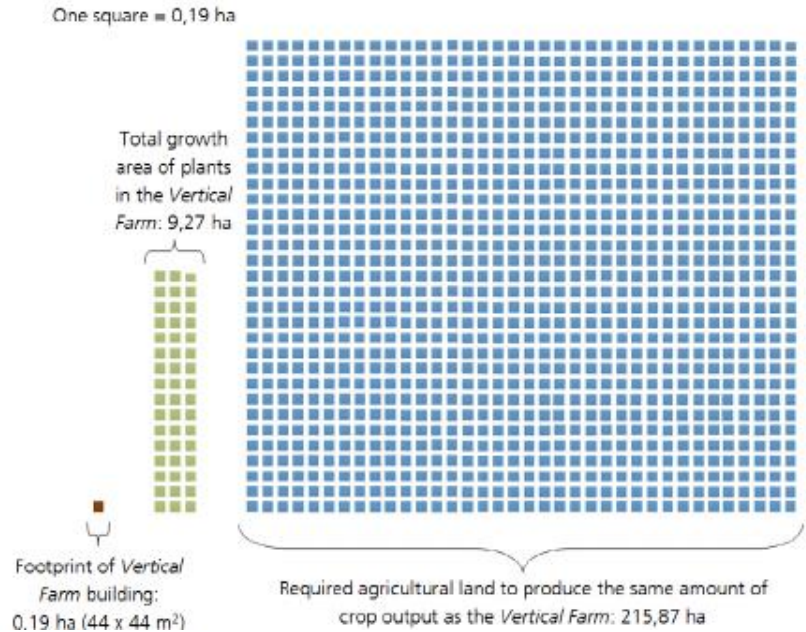
This technique involves growing crops in a controlled environment to produce food sustainably.

Vertical agriculture can produce up to 30 times more crops per square meter compared to traditional agriculture methods.

Vertical agriculture refers to the practice of growing crops in vertically stacked layers, typically in a controlled environment, using hydroponic or aeroponic systems.

This type of agriculture aims to maximize the use of limited land and resources while minimizing the negative environmental impact of traditional agriculture methods.

- ↳ **Reduced Water Use:** Vertical agriculture methods have the potential to conserve up to 70% of water in comparison to conventional agriculture practices.
- ↳ **Reduced Pesticide Use:** Reduces the use of pesticides by up to 90% compared to traditional agriculture methods, as the controlled environment allows for better pest management.
- ↳ **Reduced Food Miles:** Shortening the distance that produce travels from the farm to consumers, resulting in constant fresh produce with an extended shelf life.



Vertical agriculture has the potential to revolutionize the way we grow food in urban areas and mitigate the effects of climate change on traditional agriculture.

SUBCATEGORIES OF VERTICAL FARMING



Hydroponic and Aeroponic systems

These systems are designed to **grow crops** in a controlled environment **without the use of soil**.



Aquaponic Systems

This combines hydroponics and aquaculture to create a closed-loop system in which **fish waste** is used to provide **nutrients for the plants** while the plants help to **clean the water for the fish**.



Vertical Greenhouses & Wall gardens

These systems **utilize walls or other vertical surfaces** to **maximize growing space** and take advantage of natural light and heat.

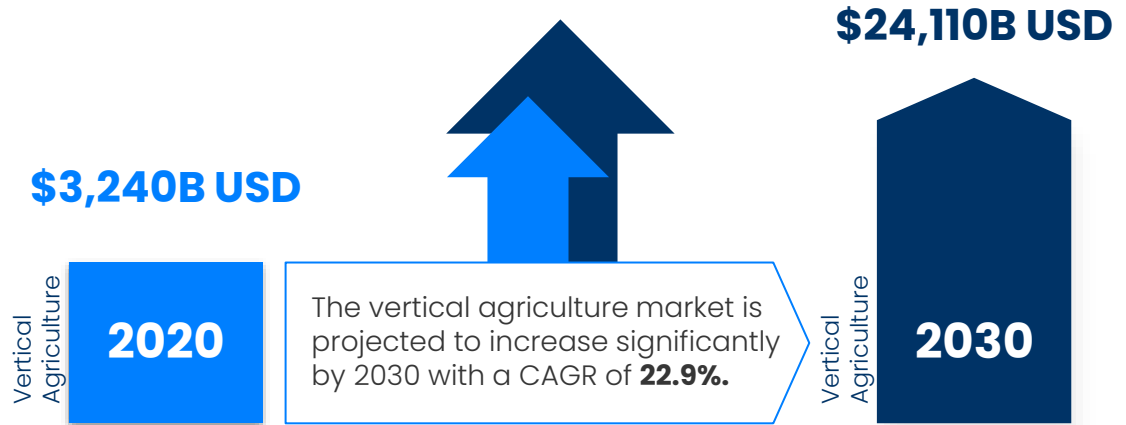


Container Farming

This subcategory involves **growing crops** in shipping containers or other small, portable units that can be **transported to different locations**.

1. <https://www.fao.org/land-water/overview/covid19/homegardens/en/>

With increasing global population and the need for food security, the vertical agriculture market is expected to continue its growth trend in the near future.



1. <https://www.prnewswire.com/>
2. <https://www.alliedmarketresearch.com/>

Case Study

Bowery Farming



Bowery Farming utilizes various technologies to grow fresh produce in a controlled indoor environment year-round. The company employs a combination of automation, machine learning, and software to manage every aspect of the farming process, from seed to harvest, resulting in more efficient use of resources.

Goals:

- Producing fresh, flavorful, and sustainable produce year-round in a controlled indoor environment.
- Reducing the carbon footprint of food production by using less land, water, and pesticides in agriculture.
- Providing consumers with locally grown produce that is free from harmful chemicals.
- To revolutionize the way we think about and produce food by utilizing technology and data-driven approaches to farming.

Company Overview & Goals

Technology

Results & Impact



Website



New York, USA



500-1000 employees



Contact form



2015

Case Study

Bowery Farming

Company Overview & Goals

Technology

Results & Impact



Bowery Farming maximizes its space for farming by growing crops on top of each other in a controlled indoor environment. This increases productivity per acre as it uses the same land size to grow more crops than traditional horizontal farming.

Solutions include: Vertical farming, AI-powered farming, Sustainable farming practices, Food traceability.

Bowery possesses a proprietary AI software, BoweryOS, which collects data from an integrated network of sensors and cameras to monitor and optimize growing conditions in real time.



Figure. Bowery Farming facilities.
Source: [Bowery Farming](#)

Case Study

Bowery Farming

Company Overview & Goals

Technology

Results & Impact



..... Sustainability

Bowery Farming has reported that its farms use 95% less water and up to 100 times less land than traditional agriculture, greatly reducing its carbon footprint.



..... Year-round crop production

Controlled indoor farming enables year-round crop production, ensuring a consistent and reliable food supply.



..... Consistent quality

Bowery's technology-driven approach to farming results in produce that is consistently high-quality in terms of flavor, appearance, and nutrition.



..... Improved food safety

Indoor environment minimizes the risk of contamination from pests, pathogens, and other sources, leading to a safer food supply.

Case Study

Eden Green Tech



Eden Green Technology develops and implements advanced vertical farming systems using a combination of hydroponics and controlled environment agriculture techniques.

Goals:

- Increase food security by providing a reliable and consistent source of fresh produce, even in areas where traditional farming methods are not feasible.
- Ease access to fresh produce by reducing the need for transportation.
- Reduce the environmental impact of agriculture by using less water and pesticides.
- Reduce the carbon footprint associated with traditional agriculture by reducing water usage, waste and the need for transportation.

Company Overview & Goals

Technology

Results & Impact



Website



Texas, USA



51-100 employees



Contact form



2018

Case Study

Eden Green Tech



Eden Green technology uses microclimate and smart greenhouse systems that allow for efficient and sustainable food production. These systems require 90% less light energy compared to traditional greenhouses, allowing for a significant reduction in energy consumption.

Solutions include: Cover cropping, Reduced tillage, Carbon sequestration through the Terraton Initiative.

Company Overview & Goals

Technology

Results & Impact



Eden Green's patent-pending design is an innovative solution to the challenges of traditional farming methods. It allows for more efficient use of space, optimal crop growth, and a more sustainable and environmentally friendly approach to food production.

Figure. Eden Green Technology's hydroponic system. Source: [Eden Green Technology](#)

Case Study

Eden Green Tech



Company Overview & Goals

Technology

Results & Impact



..... Sustainable food production

Eden Green's technology uses significantly less water and energy than traditional farming methods, making it a more sustainable option for food production.



..... Increased food production

With vertical farming large quantities of fresh food can be produced in smaller spaces, which is ideal for urban areas.



..... Water Efficiency

Vertical farms use less water than traditional farming methods, and the recirculating system of water use reduces the overall amount of water needed.



..... Food security

Eden Green's vertical farming technology provides a reliable source of fresh produce that is not dependent on external factors such as weather or transportation, ensuring greater food security and stability.



Challenges to the adoption of sustainable agriculture

The adoption of sustainable agriculture is facing various challenges, and addressing them is essential in securing the future of our food systems.

SOME CHALLENGES INCLUDE



Financial constraints

Compared to traditional agriculture methods, sustainable agriculture can be **more expensive to implement**, which can be a barrier for farmers, especially small-scale farmers, who may not have access to **financial resources**.



Resistance from the Traditional Farming Sector

Many farmers are resistant to change, and the traditional practices they have used for years are deeply ingrained. This makes it difficult to **change their practices** and embrace new, **sustainable techniques**.



Lack of Government Support

Sustainable agriculture requires a **significant investment from the government** to provide technical support, financial incentives, and training to farmers. However, many governments lack the resources and political will to **support sustainable agriculture**.



Market demand not high enough in some markets and geographies

The demand for sustainably grown produce may not be high enough in some markets to make it **economically viable** for farmers to switch to **sustainable agriculture practices**.

1. <https://www.fao.org/3/i06583e/i06583e.pdf>
2. https://www.researchgate.net/publication/358358071_Barriers_to_sustainable_agribusiness_a_systematic_review_and_conceptual_framework

- ↳ Adopting sustainable agriculture practices can come with a higher cost compared to traditional agriculture methods. According to the World Bank, the cost of adopting sustainable agriculture practices can range from 10-30% higher than traditional methods.
- ↳ A study by the FAO found that only 20% of countries have specific policies and regulations to support sustainable agriculture. This means there is a lack of policies and regulations to guide and support farmers in adopting sustainable practices.
- ↳ A report by the International Food Policy Research Institute (IFPRI) showed that only **20-30% of farmers are willing to adopt new and innovative practices**, with the majority preferring to stick to their traditional methods.
- ↳ A study by the Natural Resources Defense Council (NRDC) found that only 25% of consumers are familiar with the concept of sustainable agriculture.

Sustainable agricultural practices cost **10-30%** more than traditional methods.

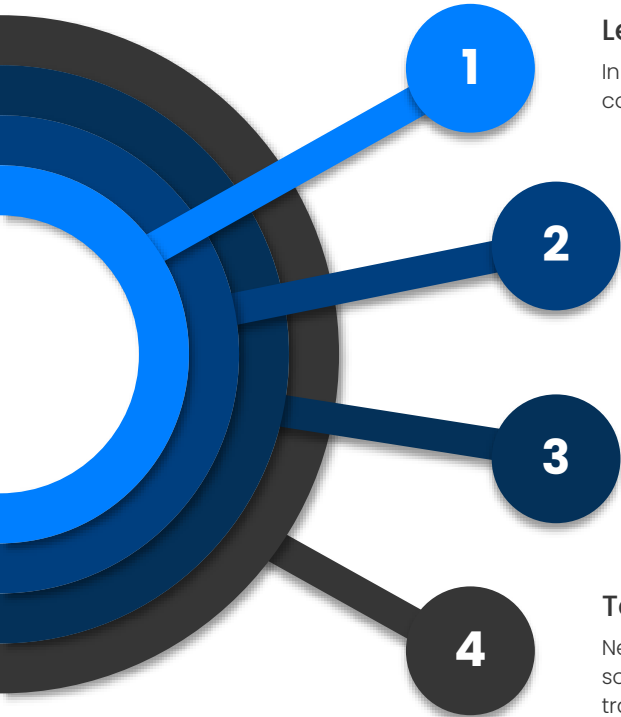
Only **20%** of countries have sustainable agriculture policies.



75% of consumers are not familiar with the concept of sustainable agriculture.

1. <https://documents1.worldbank.org/curated/en/645981468189237140/pdf/100046-WP-PUBLIC-discose-7am-10-8-15-Box393216B.pdf>
2. <https://www.fao.org/3/CA3129EN/CA3129EN.pdf>
3. <https://www.ifpri.org/publication/2019-global-food-policy-report>
4. <https://www.nrdc.org/sites/default/files/wasted-food-IP.pdf>

What the Future Holds



1 Legislation

In 2023, legislation and governance will be the primary drivers of sustainability action as companies face a demanding legislative schedule for sustainability reform and requirements.

2 Consumer Wants

In 2023, consumers will hold brands accountable for driving sustainability progress, with 46% of consumers looking to brands to take the lead in creating sustainable change, according to a recent survey by NielsenIQ.

3 Results

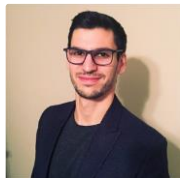
In 2023, companies and consumers will move beyond purpose statements and demand tangible evidence of progress towards meaningful change. The onus will shift from regulatory bodies monitoring compliance to companies proving their sustainability status.

4 Technological Advancement

New technologies are crucial for creating improvements in sustainability reporting. Watch for tech solutions that help businesses meet reporting requirements, including advancements in supply chain tracking, validation, and transparency using sensors, Web3, AI digital twins, and blockchain tools. These innovations are gaining momentum and will have a significant impact on sustainability efforts.

1. <https://www.fao.org/3/i8583e/i8583e.pdf>
2. https://www.researchgate.net/publication/358358071_Barriers_to_sustainable_agribusiness_a_systematic_review_and_conceptual_framework

About the Authors



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Technical Director

Gareth has been with PreScouter since 2015, and specializes in the Food & Beverage and Life Sciences industries. Since joining the PreScouter team, he has worked across multiple topics ranging from product and process improvement and development, and sustainability throughout the food and beverage industry as well as healthcare. Gareth's research background at the University of Alberta is in the biochemistry of membrane proteins in health and disease. Prior to joining the PreScouter team, he was a project coordinator for the Cancer Research Institute of Northern Alberta (CRINA).



Gloria Wada

Project Architect

Gloria is a microbiologist and science writer with 6+ years of collaborative interdisciplinary drug discovery research experience designing and modifying assays to determine the antifungal effects of plant extracts on fungal physiology. She has developed and optimized various microbiological assays and analytical chemistry lab protocols for the separation of plant products via HPLC and flash chromatography. She also has previous environmental toxicology and molecular biology research experience.



Paola Campos

Analyst

Paola is a biologist and has a PhD in Microbiology, with an emphasis on clinical microbiology, genetics and pathogenesis. She has experience in the implementation and development of assays in molecular biology, especially in the development and application of PCR, real-time PCR, sequencing methods, diagnostic methods and ELISA. She is currently developing her scientific writing skills.



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Paromita is a biotechnologist with a research focus on protein biochemistry, drug discovery, preclinical oncology, and food science. She earned her Ph.D. in Biotechnology from the University of Calcutta, followed by postdoctoral research at the University of California, San Francisco. She has worked in the oncology drug discovery space overseeing multiple drug combinations translating to the clinic. Paromita is currently a Senior Research Scientist and Global Product Research Lead at Seagen.

Potential Next Steps

PreScouter can conduct anonymous interviews with companies profiled to help you learn more about their technologies, processes, and partnership potential.

PreScouter can identify sustainable agricultural practices that align best with your company's processes and needs.

PreScouter can identify additional precision agriculture technologies specific to your region.



TECHNOLOGY
LANDSCAPING



TRENDS
MAPPING



TECHNOLOGY
ROAD MAPPING



INTERVIEWING
STARTUPS



IP
LANDSCAPING



SUPPLIER
OVERVIEWS



COMPETITIVE
INTELLIGENCE



MARKET
ANALYSIS



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