



## EXECUTIVE INSIGHTS

# The Controlled Environment Agriculture Opportunity Is Ripe for Investment

As the impact of climate change becomes more pronounced and labor becomes increasingly scarce, the need for methods of growing produce more efficiently is becoming more urgent. At the same time, consumer and retailer demand for local, lower-cost produce is growing. Together these broader macro trends are spurring demand for greenhouse and vertical farm-grown produce (leafy greens, tomatoes, peppers, cucumbers and, most recently, strawberries), all of which offer a raft of benefits to both camps, from consistency of quality and taste to supply chain resilience.

But while demand for controlled environment agriculture (CEA)-grown produce is on the rise, U.S. production — both per capita and overall — remains limited and well below that of other countries such as Canada, Spain, Israel and the Netherlands. So, how will the U.S. meet the rising demand for CEA-grown produce?

Investment in the near term is unlikely to come from retailers, who for the most part still aren't committing capital to growing their own produce, whether indoors or outdoors. Traditional open-field produce players are also unlikely to invest, given both the need for different capabilities and the significant investment requirements.

The result is a notable opportunity for outside investors, who are well aligned with the return profiles of this asset class and as such can act as a potential accelerator of CEA-grown crop adoption in the U.S.

## The benefits of CEA

The majority of produce is still grown outdoors in open fields. But the benefits of controlled environment agriculture have come to be seen as especially attractive in recent years by consumers and retailers alike.<sup>1</sup>

### Benefits to consumers

- **Consistent appearance and taste.** Controlled environment production returns the most consistent level of quality and nutrients, which leads to consistently better-tasting produce. The appearance and shape of the produce can be more tightly controlled as well.
- **Year-round supply.** Because planting and harvesting of CEA produce are not dependent on weather and seasons, consumers can have access to high-quality CEA-grown produce year-round.
- **Locally and sustainably grown.** Consumers are increasingly interested in locally grown/sourced produce due to the environmental and social benefits it yields, and CEA produce can be grown and sourced close to end markets. It also uses less water and land than open-field produce.
- **Chemical-free.** Growing produce indoors in controlled environments eliminates the need for pesticides.
- **Food safety peace of mind.** The controlled environments in which CEA produce is grown make it less prone to recalls, and — when they do occur — make that produce easier to trace.

### Benefits to retailers

In addition to year-round supply, retailers benefit from the following:

- **Supply chain resiliency and consistency.** CEA produce gives retailers a consistent supply chain, one that is not dependent on weather or other uncontrollable factors that come with traditional agriculture.
- **Lower costs and less shrinkage.** Because CEA produce is sourced locally, shipping costs are lower for retailers. And because that produce arrives more quickly and its quality is more consistent than that of traditionally grown produce, retailers' shrinkage is lower.
- **Consistent quality and heightened safety.** Retailers can reliably provide their consumers with high-quality CEA produce, regardless of adverse weather or other uncontrollable factors. CEA produce is also shielded from exposure to animals and agricultural water that

can lead to food safety issues, and any issues that do arise can be more easily traced than those associated with field-grown produce.

- **Consumer appeal and consumers’ willingness to pay.** Retailers can sell CEA produce at prices that are twice as high as those of open-field produce, if not more. Some consumers will pay a premium for high-quality CEA produce.
- **Alignment with environmental, social and governance (ESG) criteria.** As retailers increasingly seek to align with ESG principles, CEA produce provides them with multiple avenues, including:
  - Local sourcing<sup>2</sup>
  - Lower water usage
  - Reduced carbon footprint (cultivation, distribution, etc.)

Figure 1 shows the ESG benefits of greenhouse-grown lettuce (which is significantly more water, land and transport efficient) versus open-field-grown lettuce.

**Figure 1**  
Overview of ESG benefits of greenhouse-grown lettuce relative to open-field-grown lettuce

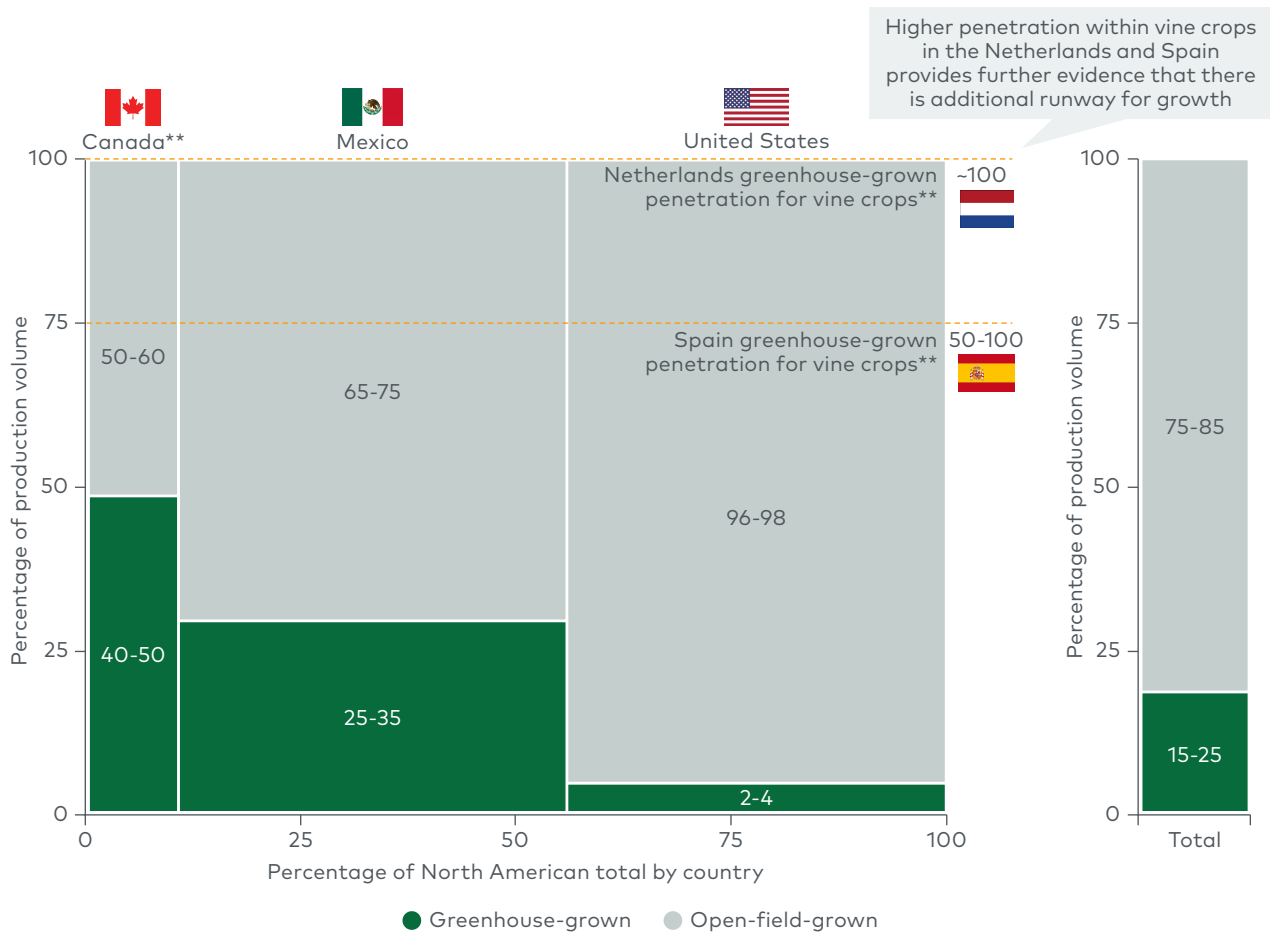
	Unit of measurement	Open-field-grown	Greenhouse-grown
<b>Water</b>	Liters of water usage per kg lettuce	13-250	20
<b>Land</b>	Kg of crop yield per square meter per year	3.9	41
<b>Energy</b>	kWh/kg of lettuce	0.3	70 (Netherlands) 111 (UAE) 182/211 (Sweden – with and without additional artificial illumination)
<b>Transport</b>	Food miles*	1,500-2,500	Varies

\*A food mile is a mile over which a food item is transported during the journey from producer to consumer  
 Note: kg=kilogram; kWh=kilowatt hour; UAE=United Arab Emirates  
 Source: Hoekstra, AY. (2008). The Water Footprint for Food; EIT Food, DNB Markets (2021); Barbosa, et al. (2015). Comparison of Land, Water, and Energy Requirements of Lettuce Grown Using Hydroponic vs. Conventional Agricultural Methods; Graamans, et al. (2018). Plant factories versus greenhouses: Comparison of resource use efficiency

### The CEA opportunity

While the list of benefits that CEA-grown produce offers both consumers and retailers is long, CEA production in the U.S. is currently limited and well below that of other countries. Broadly speaking, the penetration of greenhouse acreage in North America overall is significantly below penetration levels in other markets, such as the Netherlands and Spain; penetration in the U.S. is much lower than in both Canada and Mexico (see Figure 2).

**Figure 2**  
North America greenhouse-grown produce penetration\* (2021E)

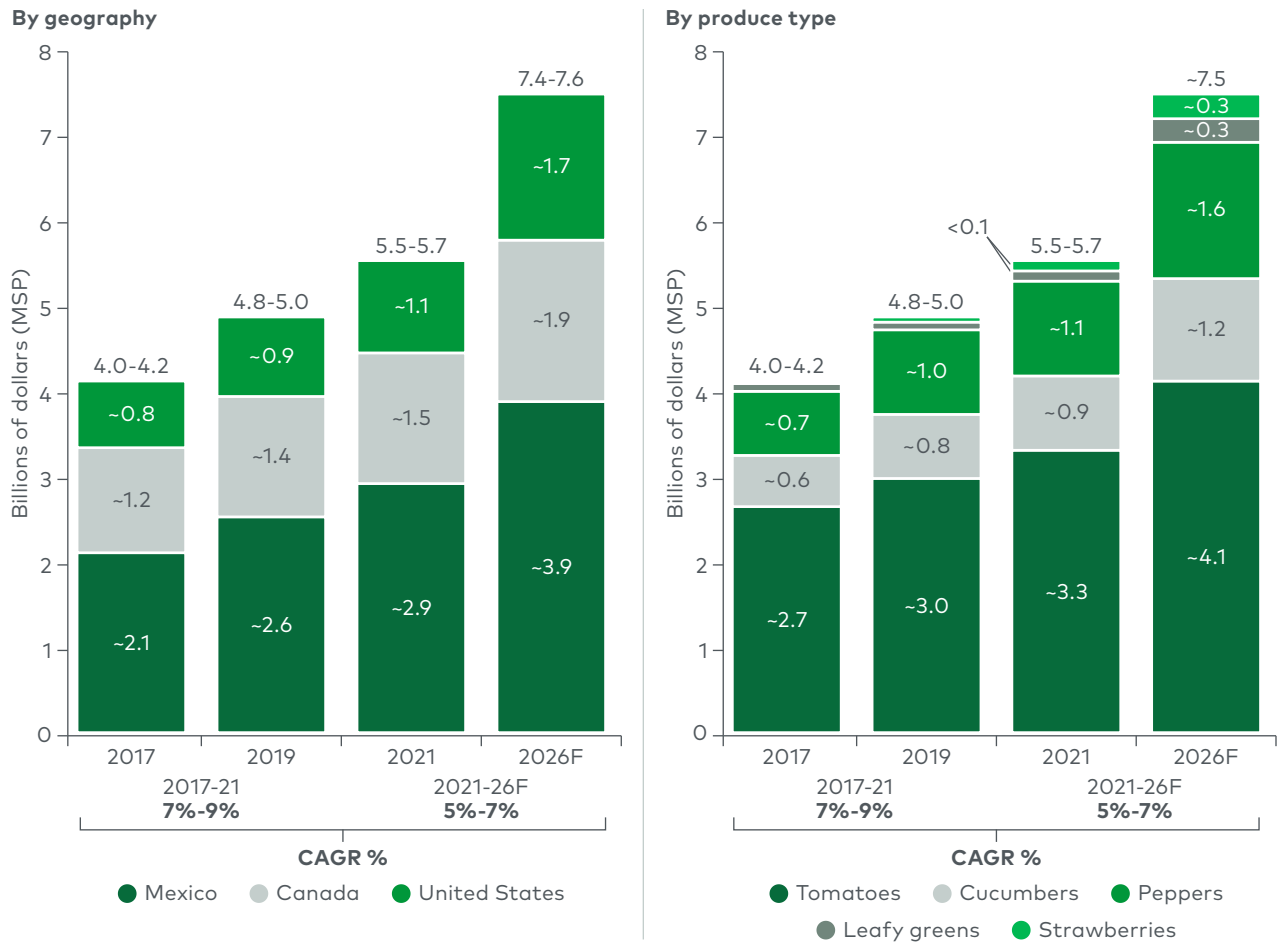


\*Includes total production volume for cucumbers, tomatoes, peppers, leafy greens and strawberries  
 \*\*Includes tomatoes, peppers and cucumbers  
 Source: United States Department of Agriculture (USDA); Statistics Canada; Produce Business; L.E.K. research and analysis

Indeed, of the five widely available greenhouse-grown commercial crops in North America – cucumbers, tomatoes, peppers, leafy greens and strawberries – most of the supply is coming from Mexico and Canada. For example, while the U.S. accounts for 64% of North American greenhouse-grown tomato consumption, it accounts for just 16% of greenhouse-grown tomato supply, with the difference supplied by Mexico and Canada.

Even at an estimated value of between \$5 billion and \$6 billion in 2021 for these five common greenhouse-grown crops – a number that is expected to rise to between \$7 billion and \$8 billion by 2026 – greenhouse-grown production only accounts for an estimated 20% of total North American production, which means the market has substantial runway for growth and, by extension, investment. Figure 3 shows a strong forecast for greenhouse-grown produce production, particularly in the U.S.

**Figure 3**  
North American greenhouse-grown produce production (value) 2017-26F



Note: MSP=manufacturer selling price  
Source: USDA; Statistics Canada; L.E.K. interviews, research and analysis

However, even with the increased capacity planned for the near term, supply is expected to continue to lag demand given the build-out time for new greenhouse capacity.

### The opportunity for investors

While there is clearly demand for CEA-grown produce and it has many advantages, the economics are notably different than those of traditional open-field produce due to the significant investment required in infrastructure, technology, and research and development. The types of management teams needed, and their respective skills and capabilities, are also distinct. As a result, traditional open-field produce farmers have not yet begun to meaningfully invest in CEA-grown produce.

While interested in the benefits provided by greenhouse and vertical farm-grown produce, retailers also have yet to invest more broadly, with a few exceptions. For example, Walmart at

the start of 2022 did make an early investment in vertical farming company Plenty,<sup>3</sup> part of a broader strategic partnership with the San Francisco-based company to deliver fresh produce to Walmart's retail stores using Plenty's vertical farming technology platform.

Thus, outside investors — pension funds, infrastructure funds, impact funds, etc. — have an opportunity to drive investment in a market with significant tailwinds. This includes investment not only in production but also in supporting systems and infrastructure (e.g., greenhouse development, technology) for the industry. Examples include:

- Gibraltar's acquisition and unification of multiple growing and processing companies under the Prospiant brand name<sup>4</sup>
- Cox's strategic investment in Mucci Farms, which builds on its more than \$1 billion investment in sustainable technologies since 2007<sup>5</sup>

In the meantime, CEA startups like greenhouse growers AppHarvest, Gotham Greens and Little Leaf Farms have entered the market (AppHarvest, notably, has since gone public), while large wholesalers like Mastronardi Produce and Mucci Farms have been buying up smaller independents. In August 2021, Mastronardi and AppHarvest inked a nonbinding letter of intent to form a joint venture, dubbed FarmCo, to develop a portfolio of CEA facilities.<sup>6</sup> In the vertical farming space, industry-leading Bowery Farming has secured over \$472 million in funding to date and has experienced more than 750% growth at brick-and-mortar retailers since January 2020.<sup>7</sup> Another vertical farming innovator, AeroFarms, raised \$100 million to expand its warehouses and branch out into different products.<sup>8</sup>

Direct investments are also being made. Last year, Taylor Farms, the largest grower and producer of leafy greens in North America, invested an undisclosed amount in greenhouse grower Pure Green Farms.<sup>9</sup> The month prior, Equilibrium Capital raised more than \$1 billion for its second North American greenhouse food-focused fund.<sup>10</sup> There is also increasing interest from infrastructure and impact investment funds in this market evolution.

## Looking ahead

The need — and by extension, the demand — for greenhouse-grown crops is already outstripping supply. But since traditional open-field farmers and retailers are unlikely to lead investment in this space, the greenhouse-grown opportunity needs capital from outside investors in order to meet its potential. Given ongoing productivity gains in the industry as well as the rising real costs of open-field cultivation, returns are expected to improve over

time, making CEA an especially attractive area for those investors who have the capital and management expertise needed to generate ROI from CEA-grown produce.

For more information, please contact [industrials@lek.com](mailto:industrials@lek.com).

## Endnotes

<sup>1</sup>L.E.K., "Controlled Environment Agriculture: A Futuristic Fix for the Food System." <https://www.lek.com/insights/ei/controlled-environment-agriculture-futuristic-fix-food-system>

<sup>2</sup>Farm to Institution New England, "Measuring Up: When, How, and Why to Define 'Local.'" <https://www.farmtoinstitution.org/blog/measuring-when-how-and-why-define-local#:~:text=The%202008%20Food%2C%20Conservation%2C%20and>

<sup>3</sup>Walmart, "Walmart and Plenty Partner to Lead the Future of Fresh Produce." <https://corporate.walmart.com/newsroom/2022/01/25/walmart-and-plenty-partner-to-lead-the-future-of-fresh-produce>

<sup>4</sup>HortiDaily.com, "Gibraltar Growing and Processing Companies Unify as Prospiant." <https://www.hortidaily.com/article/9317957/gibraltar-growing-and-processing-companies-unify-as-prospiant/>

<sup>5</sup>PR Newswire, "Cox Makes Strategic Investment in Controlled Environment Agriculture Company Mucci Farms." <https://www.prnewswire.com/news-releases/cox-makes-strategic-investment-in-controlled-environment-agriculture-company-mucci-farms-301560651.html>

<sup>6</sup>PR Newswire, "Mastronardi & AppHarvest – AgTech CEA Venture to Feed America." <https://www.prnewswire.com/news-releases/mastronardi-appharvest---agtech-cea-venture-to-feed-america-301353198.html>

<sup>7</sup>PR Newswire, "Bowery Farming Secures \$300 Million in Series C Funding to Accelerate Growth." <https://www.prnewswire.com/news-releases/bowery-farming-secures-300-million-in-series-c-funding-to-accelerate-growth-301298237.html>

<sup>8</sup>AeroFarms, "AeroFarms raises \$100m as investors rush to indoor farms." <https://www.aerofarms.com/2019/09/17/aerofarms-raises-100m-as-investors-rush-to-indoor-farms/>

<sup>9</sup>HortiDaily.com, "Gibraltar Growing and Processing Companies Unify as Prospiant." <https://www.hortidaily.com/article/9317957/gibraltar-growing-and-processing-companies-unify-as-prospiant/>

<sup>10</sup>Equilibrium, "Amid Record Heat, Equilibrium Capital Raises \$1 Billion for Second Greenhouse Fund." <https://eq-cap.com/amid-record-heat-equilibrium-capital-raises-1-billion-for-second-greenhouse-fund/>

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