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Controlled Environment
Agriculture 1

Industry Snapshots Update
Fall 2017 3

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Controlled Environment Agriculture

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Controlled Environment Agriculture (CEA) is a technologically advanced and intensive form of hydroponic/soilless based production of vegetables and small fruits. There is no one definition of what constitutes CEA; but more broadly, it represents the range in technology between protected cultivation (such as is high tunnels, which we term Modified Environment Agriculture [MEA]) and highly sophisticated greenhouses with control of temperature, light, relative humidity and carbon dioxide.

CEA is a capital-intensive business with high operating costs. Production benefits of CEA include a focus on high plant quality/yield, predictable crop timing and ability to produce year round in challenging climates. Regarding plant yield, on average MEA/CEA operations produce 10 times more than their field grown counterparts (about 100 tons per acre for tomatoes/lettuce in CEA/MEA versus ten tons per acre in the field).¹

Tomatoes are the most popular crop followed by cucumbers, fresh cut herbs and lettuce (See Table 1). Leafy greens and herbs are typically

Crop	Production (tons)	Hydroponic production (tons)	Value (\$ million)
Cucumbers	36,310	33,101	78
Herbs (cut fresh)	17,761	3,811	71
Lettuce	10,965	7,719	56
Peppers	3,851	-	6
Strawberries	353	-	1
Tomatoes	96,265	82,797	401
Other	95,461	36,791	184
Total	260,966	165,557	796

Table 1: U.S. Food Crops Grown under Protection¹

¹ USDA Census of Horticultural Specialties

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Production benefits of CEA include a focus on high plant quality/yield, predictable crop timing and ability to produce year round in challenging climates.

grown in deep water culture (transplanted in rafts floating in shallow ponds) or using nutrient film technique (in shallow channels with continuously recirculating water).

Tomatoes, cucumbers, pepper and eggplant are referred to as high wire crops (meaning their tall canopy is trellised to string attached to wire). High wire crops are typically grown in a soilless substrate (rockwool, coir or perlite) with drip irrigation.

Year	Number of Operations	Sales in U.S. Dollars (millions)
1998	1,015	\$223
2009	1,476	\$553
2014	2,521	\$797

Table 2: Wholesale Value of U.S. Food Crops Grown under Protection²

In 1998 there were 1,015 MEA/CEA operations producing wholesale farm gate value of \$223 million; by 2014 there were 2,521 producers with a wholesale value of \$797 million in the U.S. (See Table 2).

What is driving growth?

Market demand for local food (including produce, meat, dairy, etc.) has grown from a \$1 billion to a \$7 billion industry from 2006 to 2015.³ CEA producers in the Northeast are well-positioned to take advantage of this trend due to their close proximity to urban centers. Because Northeast CEA crops are grown much closer to the consumer, they require less time and expense in transportation and often stay fresh longer than their field-grown counterparts grown thousands of miles away.

Increasing weather uncertainty and risks associated with pests and disease outbreaks have also driven interest in CEA. While these risks cannot be entirely mitigated, careful control of the growing environment can allow for a uniform, consistent, year-round crop that wholesale/retail produce buyers prefer. Previous years' drought in the western states has also led to increased interest in Northeast CEA. Water in CEA is typically captured and reused, so its use can be up to 20 times more efficient than irrigated fields.

Barriers to CEA

Like any form of agriculture, CEA production is a high-risk, low margin enterprise. At Cornell University, we have convened a group of stakeholders in semi-annual meetings to discuss barriers and opportunities in CEA.⁴ The greatest challenge to establishing or expanding a CEA operation is the high level of capital investment required. New producers cite difficulties establishing a long-term stable market channel for their crops. Ideally, supermarkets and wholesalers would sign long-term contracts with price and volume guarantees. Other challenges include difficulty finding well-trained employees and affordable manual labor as well as high costs of energy (especially supplemental lighting in the Northeast).

Future of CEA: 2017 and beyond

Despite increasing CEA production in the U.S., we import large quantities of greenhouse-grown vegetables from Mexico and Canada. In 2016 we imported \$1.64 billion worth of tomatoes, bell peppers and cucumbers from Mexico and \$560 million from Canada. A revocation of NAFTA, as currently being considered by the Trump administration, could lead to significantly increased domestic production of CEA vegetables if high tariffs were imposed on Mexican/Canadian produce. Regardless of NAFTA, technology advancements will continue to be important in U.S CEA production.

² USDA Census of Horticultural Specialties

³ Indoor Crop Production Feeding the Future. March 2015. Newbean Capital. Accessed online 10 March, 2016

⁴ CEA meeting minutes can be found at: <https://tinyurl.com/y7yzyfar>

Labor is the #1 operating cost in CEA. Increasing hourly wages as well as lack of available labor will drive increased automation in CEA. Already some of the more sophisticated CEA operations use robotic systems to seed, move plants around the greenhouse, harvest and package. In some instances, a human hand never touches the crop.

LED lights can dramatically lower electricity costs (energy is usually the #2 operating cost). While high upfront costs for LEDs has limited their current adoption, prices of LED fixtures will continue to go down and efficiency will continue to go up.



Example of CEA crops

Another trend in CEA is the adoption of more diverse crops as standard crops, such as tomatoes and cucumbers. CEA crops increasing in popularity include a wider variety of leafy greens (kale, swiss chard, mustard, cress), microgreens (leafy greens harvested at the first true leaf stage), ethnic vegetables and small fruits (such as strawberries, blackberries and raspberries).



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Industry Snapshots of Major Loan Sectors: Fall 2017

Overall Outlook

Margins remain tight for many commodity producers. Dairy and cash field crops in particular, are dealing with pricing that is close to cost of production. Bright spots in the outlook include vegetables, nursery and greenhouse, which have had improving economic conditions the past few years and reported relatively good results this year.

Labor is perhaps the single most consistent challenge across sectors. An improving general economy has benefitted ag retail businesses but made finding and keeping good employees more difficult. Increases in the minimum wage in several states has raised costs, and increased the pay expectations of employees.

Dairy

Northeast dairy farms continue to show a wide range of operating results, with many farms managing to remain profitable, while others struggle after several years of low prices. Most are operating slightly above break-even. An increase in milk prices has been beneficial to many farms, but little in the way of continued increase is seen for next year.

- 2017 milk prices have averaged about \$1.65/cwt above last year. 2018 prices are expected to be relatively unchanged, even slightly lower, compared to 2017.

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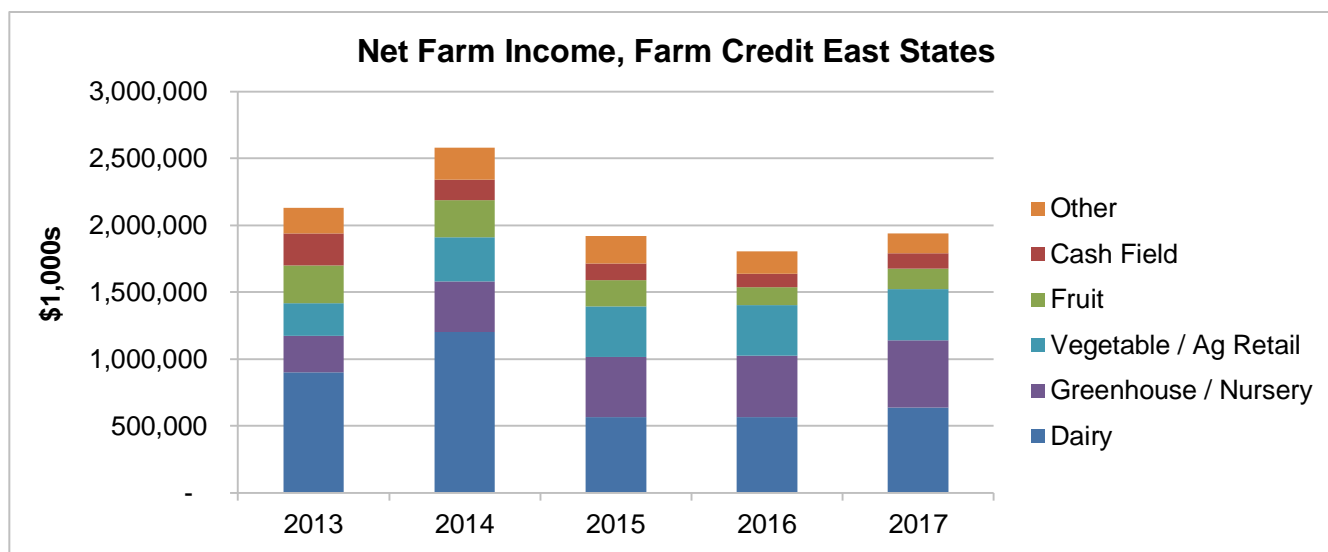


Figure 1: U.S. States Included: CT, ME, MA, NH, NJ, NY and RI; *Farm Credit East Knowledge Exchange Estimates*

Dairy...continued

- The U.S. dairy herd continues to grow, and milk production was up 2.1 percent (nationally) and 1.9 percent (NY) in August, year-over-year.
- Increases in milk production vary significantly by region, with some Western states down or flat (California is 0.7 percent lower), while Midwestern and Eastern states show increases. This adds more milk to already saturated regional markets.
- There is still a lot of “softness” in milk marketing arrangements. Milk handlers are continuing to struggle with oversupply and transferring the costs of excess milk back to producers.
- USDA reported cheese and butter inventories are down from last year, which may support dairy commodity prices somewhat.
- Global milk production has resumed positive growth, with major exporting regions such as the EU and New Zealand showing production increases of two to three percent. China and other major importers have increased buying, but it may not be enough to absorb expanding global production. While U.S. exports reached a three-year high in the first half of 2017, abundant global supplies will be a headwind to further increases.¹

Timber

There is a tremendous diversity of businesses in the forest products industry, and their economics often do not track together. We are currently seeing a divergence in financial performance within the industry, driven heavily by the regional impact of a significant number of pulp and paper mill closings in Maine.

- Softwood Lumber Dispute - The counter-veiling duty (CVD) on Canadian lumber has been suspended as it was only effective for 120 days. It will stay suspended until a final ruling by the U.S. Department of Commerce which is slated for November 14. Contrary to what the market expected, lumber prices did not drop after the suspension of the CVD but have actually moved up, indicating stronger demand than expected.
- Lumber prices have continued to move upward. Spruce/Fir hit a recent high of \$540 per million board feet (mbf) fob Boston, up from \$410/mbf a year ago. Tight supplies around the country have kept order files long and price movement upward.

¹ US Dairy Export Council, Global Dairy Market Outlook, August 30, 2017

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Timber...continued

- Eastern White Pine has benefitted as well from improving demand and, with constrained supply, prices have been at very favorable levels since early 2016. Hardwood prices are more variable and location dependent driven by species and market mix.
- Sawmills continue to struggle with the limited markets and significant price reductions for sawmill residuals, but recent lumber price improvements have more than offset this shortfall.
- Biomass generation plants have struggled as natural gas and wholesale electricity prices remain low. Consequently three biomass plants in Maine ceased power production in mid-2016.
- Low oil prices and a relatively mild 2016-17 winter resulted in an oversupply of wood pellets and the idling of several mills. Wholesale pellet prices remain low.

Pulp and Paper

Maine has seen four pulp and paper mills close in the last 18 months, and one slow to half of its capacity. This has impacted both pulpwood prices and sawmill residuals negatively.

Logging

Loggers in Northern Maine have faced substantial challenges. Many contractors have been unable to harvest sufficient volumes of wood to generate positive cash flows, with some idling their operations. Contractors further south have generally fared better.

Cash Field Crops

For 2017, farmers planted four percent fewer acres in corn (90.0 million acres), and seven percent more acres in soybeans (a record high of 89.5 million acres). It was a good growing year for much of the country, which means ample supplies. Cash field growers in general should be modestly above break-even this year, depending on their individual yields and marketing strategies.

- 2017 U.S. soybean production is estimated at a record 4.43 billion bushels. Continued robust demand from China should support prices. Hurricane damage will impact supplies of peanuts and cottonseed but will not materially affect soybean supply.
- If realized, U.S. projected corn yields of 169.9 bu/acre (down from a record 174.6 in 2016) would result in 14.18 billion bushels, the third-highest crop ever. This will result in large supplies and possibly the lowest prices since the 2006 crop. Domestic and foreign demand remains strong, but large supplies both from the U.S. and South America means limited upside potential.
- New York is finishing the crop year with 67 percent of corn and 70 percent of soybeans rated “good” or “excellent” by USDA. Yields generally look good, although there is a great deal of variation within the region. Some areas report exceptional yields, others slightly below normal.
- USDA puts 2017/18 season average prices at \$2.80-3.60 for corn; \$8.35-10.05 for soybeans.²

Livestock

This is a very diverse sector ranging from beef or other protein producers, both full and part-time, as well as equine, which itself can be broken down into racing/breeding, and boarding and training enterprises.

- USDA Forecasts prices for Choice Steers at \$118-120/cwt. for 2017, slightly below 2016. 2018 prices are forecast at \$111-120/cwt. However, many Northeast beef producers serve specialty markets and receive significantly higher prices than national averages.

² USDA ERS, Oil Crops Outlook, September 14, 2017; Feed Outlook, September 14, 2017

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Livestock...continued

- Hurricane Harvey impacted a cattle-producing area representing approximately four percent of all mature cows in the U.S. There has been minimal impact on cattle prices to date, but the long-run impact remains to be seen.
- Recreational equine markets are supported principally by local recreational demand and nonfarm income, and have been tracking upward along with the general economy. The New York horse racing industry has been doing well, with strong purses and breeders awards.

Fruit

Tree Fruit

- New York's 2017 apple production should come in better than last year, at 28 million bushels. Despite some severe weather, New York's Hudson Valley and some other regions are expecting a large crop.
- The total U.S. apple crop is expected to be down by eight percent, partly due to a sharp reduction in Michigan's crop caused by a late-spring freeze.³ The fresh market for apples is becoming more bifurcated, with newer varieties commanding premiums, while older types have become commodities. Average prices received have been good so far this year, coming in above 2016 levels.

Juice Grapes

- Favorable growing conditions led to an above average crop for the second year in a row. A supply-demand imbalance of grape juice continues to be an issue, and has kept cash prices low, with some buyers offering pay prices below cost-of-production.
- New York wineries reported a somewhat slow spring for sales, but stronger performance over the summer. There are some concerns that the craft beverage market is starting to become saturated with an increasing number of wineries opening, as well as farm distilleries and breweries entering the market. Many wineries report lower visitor counts, but higher average sales per customer. It has been a good growing season for wine grapes.

Small Fruits

Excellent prices for highbush blueberries in New Jersey due to freezes in other growing regions. Meanwhile, in Maine, the wild blueberry market is oversupplied with prices at a 10-year low. A wet spring made for a difficult year for other berries.

Cranberries

- The cranberry market continues to struggle with oversupply, and low prices from independent handlers, below cost of production. The economics of cranberry producers are mainly influenced by how they market their product.
- In August, the Cranberry Marketing Committee unanimously voted for a 15 percent handler withholding for the 2017 crop and a 25 percent marketing order for the 2018 crop. This must be approved by the Secretary of Ag. It is uncertain at this time if it will be approved.

Greenhouse and Nursery

Greenhouse and Nursery growers throughout the Northeast generally reported an average-to-good 2017 season. Spring was cool and rainy, but most growers were able to recover the bulk of lost sales.

Greenhouse and Nursery...continued

- Growers have reported that demand and pricing trended slightly higher this season, particularly in nursery crops. Landscapers are very busy.
- Energy costs have remained moderate, helping keep greenhouse production costs in line.
- Big box chains continue to dominate the retail market. Growers who sell to them must be able to be very efficient and manage tight margins in order to survive. These major retailers are increasingly demanding more services from vendors, raising the cost to producers.
- There is growing interest in new technologies in Controlled Environment Agriculture (CEA), primarily for vegetable production, such as roof top structures, vertical greenhouses etc, particularly in metropolitan areas.
- Shortages of some plant materials, especially caliper-sized trees, are being experienced, this situation will largely resolve itself over the next couple of seasons as new plantings come up to size.

Aquatic / Fishing

Lobster

- Landings continue to increase, prices remain strong and most operators had another good year.
- Exports to Asia continue to grow.

Scallops

- Prices in 2017 are down slightly from last year due to exceptional catch levels.
- The stock remains strong, is considered to be sustainable and we do not anticipate any severe regulatory changes in the near future.

Groundfish

- Although the stocks of many protected species of groundfish are rebuilt, regulations and quotas remain limiting for the industry.
- Permit trading continued to be limited in 2017 as regulations continued to ratchet down quotas and days-at-sea. The Northeast groundfish fleet is aging and with stringent regulations and an unclear future, reinvestment is difficult. That being said, there are some large multi-national corporations looking to buy existing groundfish boats in order to vertically integrate their business models. A significant groundfish fleet owner in Massachusetts has been convicted of serious violations of NOAA regulations, and it is unclear what will happen with their vessels and quota.
- Prices have held steady, and the catch has been good on the species they are allowed to land.

Vegetables

- In the New York processing market, vegetable acres appear at this point to remain stable in the coming year. Pricing, in general, has been stronger than 2016 for some crops, but a few varieties face gluts.
- In South Jersey, fresh market vegetables had strong early season pricing with above average yields. Processing vegetables and potatoes had good yields, but market may be soft for production above contracted levels.
- Throughout most of the Northeast, crops were slow to get going, due to a cool, damp spring. Prices have been average to good, depending on the specific variety and week. Yields were above-average. Overall a good season for fresh market growers.

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Vegetable...continued

- Wholesale buyers and consumers increasingly seek out local product. “Buy local” has become a significant trend, especially in metro areas. However, this does not necessarily translate into a willingness to pay higher prices.
 - It remains to be seen how the growing battle between Amazon/Whole Foods and Walmart in food retailing will play out and how it will affect producers and ag retail businesses.
 - The 2017 Maine potato crop is looking better than expected, and pricing has been good except for open chipstock.
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