A Tale of Two Valleys: The Salad Bowl of the World Goes Digital

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On a late summer morning in 2021, I found myself in a dewy romaine lettuce field in California's Salinas Valley. The massive frame of an automated lettuce harvesting machine towered over me, making the lettuce heads look more like peas. Multiple robotic arms extended from the machine at once, some using a knife to swiftly cut the crop, others picking up the severed lettuce heads and placing them onto a conveyer belt to be sucked up for processing. Glimmering green leaves shot into the air. Though the machine used artificial intelligence and machine learning, its movements looked uncertain and choppy. The lettuce appeared crushable in comparison to the hard, shiny metal. Perhaps picking up on my unease, the farm's head roboticist, who kindly showed me around, yelled over the machine's loud, shrill sound, "It's usually a humbling point for an engineer. You still need human interaction and human decisions on the ground. What we can do with robots is amazing, but they can't do what a person does. You don't get that feedback in that robotic grip that you can get with a person's hand." Indeed, I could clearly see farmworkers doing quality checks, monitoring the machine, and packing the picked lettuce. In the next field over, a group of farmworkers working for the same company harvested romaine lettuce by hand.

Four years after my first experience in the lettuce fields, the push to automate the harvest of specialty crops like lettuce, broccoli, and berries continues, but its success remains uncertain. Nonetheless, prominent Silicon Valley-style discourse insists automation is a straightforward technical matter where humans are seamlessly replaced by algorithms and robots. However, by taking a closer look at a particularly delicate agricultural commodity—romaine lettuce—my research provides a counternarrative. Through field visits, interviews, and focus groups, I am finding that a fully automated romaine lettuce harvesting process remains highly unlikely given the detail, skill, and care that it requires. While this essay troubles capitalist dreams of a fully automated agriculture, it also raises serious questions about

the future of farm work.

Silicon Valley Comes to the Salad Bowl

Silicon Valley is hungry for a digital agricultural revolution. Since 2013, its entrepreneurs and investors have taken a particular interest in food and agriculture as a space to bring its cultures of disruption, innovation, and problem-solving.[1] Silicon Valley has led the charge to bring data-driven tools such as drones, sensors, software, and robots into the fields with the aim of increasing efficiency, productivity, and environmental sustainability.[2] The global agricultural technology (ag-tech) industry was valued at $15.49 billion in 2023 with a projected growth estimate of $56.6 billion by 2032.

A key promise of Silicon Valley's farming future is to make the industry less reliant on human workers. Advertisements and pitch decks for ag-tech contain images of fields filled with robots and drones. If humans are present in these depictions, they are often faceless figures holding an iPad in the corner, pointing to an idealized vision of human-free farming.

While technology in agriculture is nothing new, scholars and activists have raised concerns about this latest wave of digital agriculture and its potential to exacerbate social inequities.[3] However, little attention has been paid to its implications for US farmworkers, especially in California's Salinas Valley, where delicate specialty crops that require careful human labor dominate the landscape.



Lettuce is one of the most important crops to the economy of California's Salinas Valley. Photo

source: David A. Litman/Adobe Stock.

The Salinas Valley is known as the "salad bowl of the world" for its high-volume, high-value specialty crop production of delicate commodities such as lettuce, berries, and broccoli. Unlike sturdier crops such as wheat or corn, romaine lettuce is watery and heat-sensitive, while strawberries are soft and crushable. However, these risky crops reap high rewards. In 2024, Monterey County, where the Salinas Valley is located, reported a gross specialty crop production value just shy of five billion dollars. The valley consistently accounts for at least 70 percent of the nation's leafy greens production, which is also shipped around the world.

In addition to cool coastal temperatures that leafy vegetables and berries love, two other factors have made the Salinas Valley a prolific specialty crop growing region: technological innovation and labor exploitation. Scholars of California agriculture have shown that a constant supply of cheap, racialized workers transformed the landscape to suit highly technical and efficient production processes.[4] Growers have often achieved increased efficiency and productivity using technologies that speed up or streamline the labor process.[5] For example, non-automated harvest machines for crops such as lettuce and broccoli keep farmworkers moving through the fields at a certain pace and provide a moving platform with basic packing implements.

At present, Salinas Valley growers are feeling squeezed by labor woes, prompting Silicon Valley to seize on specialty crop agriculture as a problem they are keen to solve. Labor issues include increased overtime laws[6] and the cost of bringing in H-2A workers, or temporary migrant workers, through a temporary work program that some argue resembles human trafficking. Major Salinas Valley agribusiness players say that the labor situation, combined with increased regulatory pressure from the state, is putting the region's specialty crop industry in jeopardy as growers and shippers look to fully move their operations to more deregulated terrain in places such as Peru, Chile, and Mexico.

The push to bring the Salinas Valley into the digital age thus appears to be a last-ditch effort to save the region's historic specialty crop industry. One solution appears to entail importing Silicon Valley's cultures of innovation and disruption to Salinas Valley fields. As one article states, "Silicon Valley and Salinas Valley are about an hour away, but they need not be different worlds." The first Forbes Salinas Valley AgTech Summit was held in 2015, representing one of the first material efforts toward a shared commitment between Silicon Valley and the Salinas Valley. Since then, there have been hundreds of similar events and new partnerships formed between vegetable growers and shippers, ag-tech investors and entrepreneurs, and other key industry players. But the outcomes of this union remain tenuous at best.

Lettuce and the Labor Process

Despite desire and effort from major players in both Silicon and Salinas Valleys to solve labor issues with automation, there has been little success. Romaine lettuce, one of the Salinas Valley's top crops, provides a more granular insight into the material challenges Silicon Valley faces when it comes to agricultural

automation. Romaine is noteworthy for a few reasons. First, it is wildly popular among consumers, in large part because it is fundamental to the Caesar salad. Second, it is of high value, accounting for almost one billion of the county's five-billion-dollar specialty crop revenue. Finally, romaine's fragile, leafy qualities require a highly skilled and intensive yet delicate harvest labor process that growers and entrepreneurs are struggling to automate.

Though farmworkers are not often asked about automation, their circumstances and experiences give them unique insights into its limits. When I interviewed farmworkers about their opinions on or experiences with ag-tech, details of their highly skilled labor process during the lettuce harvest were almost always front and center. While different companies may have slightly different harvest practices, one romaine harvest that I witnessed required fourteen farmworkers across seven rows of lettuce, which breaks down into two farmworkers per row. Aided by a basic harvest machine that spans all seven rows and does little more than dictate their speed, farmworkers work in pairs wherein one "cutter" uses a knife to cut the lettuce head and remove its outer leaves. For cutters, two of the most important harvest skills are choosing—within seconds—ripe lettuce that is not too young, damaged, or yellowing and then harvesting it without harming the tender, watery vegetable. Farmworkers consistently emphasized the need to handle the lettuce with extreme care. One said, "As we cut [the lettuce], we always try to do it well. We always try not to squash or crush the lettuce too much or mistreat it." The harvested lettuce is then placed onto the table-like surface provided by the machine, where the second farmworker of the pair, is behind the machine, cleaning the lettuce, checking for quality, and sealing it into packaging right there in the fields. Other farmworkers pack the lettuce into boxes for transport.

This process is known as field pack and is higher risk for growers. Whereas sometimes leafy greens such as baby lettuces or spinach used in salad mixes are sent to a processing facility for further inspection, cleaning, and sorting prior to bagging and shipping, the field pack system puts immense pressure on farmworkers to rapidly harvest, process, and assess quality in real time. However, many Salinas Valley growers continue to use this system because of the unique freshness and quality it guarantees customers.



To ensure freshness, lettuce is packaged soon after its cut, right on the field, using a conveyor belt system. Photo source: David A. Litman/Adobe Stock.

Harvest: The Holy Grail of Automation

While some farming tasks such as weeding and thinning are becoming increasingly digital in the Salinas Valley and elsewhere, harvesting of specialty crops remains the elusive "holy grail" of automation.[7] Salinas Valley growers have been experimenting with automating the head lettuce harvest, especially of iceberg lettuce, since the early 1960s to various degrees of success.[8] Recently, however, the focus has shifted toward romaine. The latest iterations are distinct for their use of artificial intelligence, machine learning, and high-tech features such as soft, robotic fingers or precision water jets that cut the lettuce.

While some engineers have succeeded in designing an implement that can perform lettuce cutting, drawbacks include the machine making far more mistakes than a skilled farmworker, such as picking a bad quality lettuce or passing over a ripe one. The machines using water-jet knives spew mud into the harvest process and ruin otherwise good product. Other issues include food safety concerns, such as bacteria buildup at the machine's joints, where water and material can pool but which are difficult to clean.

The few farmworkers who have witnessed automated romaine lettuce harvesting machines have come away with the sense that the machines cannot replicate the care they put into their labor. To briefly quote one farmworker, "When they tried a machine that cut the lettuce, the lettuce was cut upwards and they tore it apart, the one with hearts [romaine]. . . . Then I had to fix it. So, people are always going to

be needed."[9]

Silicon Valley tech interviewees were also keenly aware of this problem, offering colorful insight into the difficulties of automating the lettuce harvest. One said, "You need hands to cut lettuce. Think about a robot with a knife. That's not happening. . . . It's just so delicate. It's a really hard nut to crack."[10]

In addition to the technical complexities, these machines have cost growers an untold amount of money, in the multiple millions. Take for instance the robotic fingers on one of the existing romaine lettuce harvesting machines. Each robotic finger costs $500, and these frequently need replacing due to leaks and cracks within the soft material.[11] As it stands right now, hiring farmworkers for the romaine lettuce harvest is still cheaper and more reliable than the existing automated harvesters. When I explicitly asked someone who promotes automation in the Salinas Valley how much of its head lettuce is harvested by machines, he said, "Zero percent."[12]

Farm Work and the Future of Work

Despite a long history of agricultural experimentation in the Salinas Valley that has been re-energized by Silicon Valley interest and capital, the automation of romaine lettuce harvesting remains incomplete. This is due to the crop's fragility and meeting the quality expectations necessary to bring it to market, suggesting that even agriculture's highly manufactured ecologies create barriers to technology. These tenuous dynamics also raise questions about how increasingly vulnerable farmworkers may fare amid this slow, uneven, and partial introduction of automation into the lettuce fields.

The ongoing attempts to automate romaine lettuce harvesting demonstrate the continued and unquestionable need for careful farmworker labor within so-called digital agriculture. It follows, then, that they need to be paid, treated, and valued according to the value they produce —the Salinas Valley lettuce industry would wilt without farmworkers.

Footnotes

1 Julie Guthman, *The Problem with Solutions: Why Silicon Valley Can't Hack the Future of Food* (Oakland, CA: University of California Press, 2024).

2 Madeleine Fairbairn, Zenia Kish, and Julie Guthman, "Pitching Agri-Food Tech: Performativity and Non-Disruptive Disruption in Silicon Valley," *Journal of Cultural Economy* 15, no. 5 (2022): 652–70, https://doi.org/10.1080/17530350.2022.2085142.

3 See Madeleine Fairbairn et al., "Digital Agriculture Will Perpetuate Injustice Unless Led from the Grassroots," *Nature Food* 6 (2005): 312–15, https://doi.org/10.1038/s43016-025-01137-8; "Food, Data and Justice Dialogues: A Critical Approach to the Digitalisation of Food Systems — What's There to Know? Introductory Teach-Ins," ETC Group, June 21, 2022, https://www.etcgroup.org/content/food-data-and-justice-dialogues.

4 Tomás Almaguer, *Racial Fault Lines: The Historical Origins of White Supremacy in California* (Berkeley and Los Angeles, CA: University of California Press, 1994); Richard Walker, *The Conquest of Bread: 150 Years of Agribusiness in California* (New York: New Press, 2004).

5 Don Mitchell, "Taylorism Comes to the Fields: Labor Control, Labor Supply, Labor Process, and the Twilight of Fordism in California Agribusiness," *Economic Geography* 99, no. 4 (2023): 341–62, https://doi.org/10.1080/00130095.2023.2188188.

6 "California: Overtime," *Rural Migration News* 30, no. 3 (July 2024), https://migration.ucdavis.edu/rmn/more.php?id=2956.

7 This phrasing has come up in multiple interviews as well as at conferences.

8 William H. Friedland, Amy Barton, and Robert Thomas, *Manufacturing Green Gold: Capital, Labor, and Technology in the Lettuce Industry* (Cambridge University Press, 1981).

9 A farmworker who works predominantly in the Salinas Valley lettuce industry, during a focus group in December 2025.

10 A roboticist who worked with a team to build a prototype romaine harvester that has yet to be brought to market, interviewed by the author, February 2025.

11 According to an agricultural engineer who works on automated lettuce harvesting in the Salinas Valley, interviewed by the author, June 6, 2025.

12 Salinas Valley agricultural automation expert, interviewed by the author, April 18, 2025.