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Theme Overview: Why Is Mechanization in Specialty Crops So Hard?

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The competitiveness of U.S. agriculture, including regional and specialty crop sectors, is impacted by multiple factors, including shifting global climate trade, and policy (see CRS, 2022; Gustafsson et al., 2022; Hammami, Guan, and Cui, 2024). During the recent COVID-19 pandemic, production and supply-chain disruptions highlighted vulnerabilities for U.S. industries and consumers (Hobbs, 2020; Peterson et al., 2023).

The call for game-changing innovation has reemerged among science and research agencies as one way to address competitiveness issues across agriculture (FFAR, 2023; USDA, 2023). Artificial intelligence, digital technologies, precision farming, and automation are foundational technologies that have the potential to transform food supply chains. Recent breakthroughs could be leveraged to affect agricultural systems positively, but realizing the benefits depends on developing feasible applications and increasing the uptake of emerging technologies (Kanioura and Andrew, 2024; IFPA Future Trends, 2023).

Since fruit, vegetable, and tree nut production is highly dependent on manual labor, Worker availability and affordability are often highlighted as one of the leading challenges for competitiveness of U.S. specialty crops (U.S. House Committee on Agriculture, 2023). Mechanized alternatives are one potential solution to labor challenges faced by specialty crop industries but progress from development to deployment to widespread use remains limited (NAS, 2019; Martin, 2024).

Decisions are not made in isolation, and one size does not fit all (Charania and Xi, 2020; Calvin, Martin, and Simnitt, 2022). While there are common interests to improve the U.S. specialty crop sector's competitiveness via research and development (R&D), unique needs among the myriad commodities, markets, and supply chains that comprise specialty crops can make finding common solutions challenging, even within seasonal markets. Funders and developers emphasize the need to de-risk new technologies to attract potential users and entice change by testing and eliminating options that are not viable in the development (or precompetitive) phase. Numerous research efforts have focused on developing technologies; however, there is a pressing need to extend the focus to the production systems and supply chains within which technologies are applied.

Articles in this Theme:

What Can Economists Contribute?

Over 30 years ago, a seminal article by John Holt in the *American Journal of Agricultural Economics* emphasized that managing change involved much more than explaining new research findings or advertising new technology. It required active engagement with people within the context of production and marketing systems. Long before the terminology was trending, Holt recognized that "participatory management places a prime responsibility to 'focus on the future, rather than on undoing the past, on the opportunities, rather than on

the problems'" (Holt, 1989, p. 872). The lessons Holt delivered and the approach he used are extremely relevant to the challenges of today. Funds have been invested and brilliant minds are developing exciting new labor-saving technologies for specialty crops. However, implementing system-wide change is difficult and mechanization for specialty crops is no exception. There are no quick fixes when building new attitudes, skills, and systems.

Holt was recognized with the Lifetime Achievement award from the Southern Agriculture Economics Association in 2000 for cutting edge contributions to professional thought about risk management in agriculture, about entrepreneurship and comparative advantage as tools for constructively managing change in agriculture, and about profitability as an integral part of sustainable agricultural systems. His even-handed analysis of, and education about, regulatory impacts in agriculture has helped decision-makers at all levels understand these enduringly important issues. (Holt, 2000, p. v)

The papers in this *Choices* theme issue utilize the foundational systems-based risk-management approach espoused by Holt to consider "why mechanization in the specialty crop sector is so hard." The papers highlight what is missing from the existing literature on this subject and explore how economists can help to de-risk labor-saving technologies for specialty crops and overcome bottlenecks in their implementation.

- In the first paper, Serviss and Thornsbury examine innovation through an investment lens and asks fundamental questions framed as relative advantage incentives that exist at both the industry and operator levels. What does it mean for a technology to be cost saving? How can economists frame the system-wide impacts from new technologies?
- In the second paper, Loor and Roka explore the dissemination of knowledge about new technologies and applications through the channels of producer and industry awareness. What information of this type is already known and what is still needed? How can agricultural extension help?
- In the third paper, Neill gauges the potential benefits of "right-sizing" technology across the many diverse farms and commodities that make up the U.S. specialty crop sectors. To what extent will new technologies fit within existing production systems? How can we encourage the development of labor-saving technologies that will address the challenges of scope and scale?
- In the fourth paper, Morgan highlights an approach that starts with human beings and asks how an economies of skill approach could be applied. What is the optimal place for new technologies and tech-savvy workers? Where are the biggest constraints? Are we asking the right questions?

For More Information

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