

# Impact Report

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## Introduction

The WTFRC Apple Technology Roadmap (Roadmap) recommends three technology areas on which to focus research resources over the two year period from 2024-2026. These priority areas are: Irrigation, Crop Load Management, and Harvest Labor. Along with the technology focus areas, the Roadmap also identifies strategies for advancing goals related to priority technologies in the short, medium, and long terms.

The main goal of the Roadmap is to focus WTFRC's resources and attention in order to make verifiable progress in the priority areas, with the overarching aim to improve the economic security and sustainability of Washington tree fruit growers.

This initial evaluation of the Roadmap provides both a benchmark for future years and preliminary data on progress towards the Roadmap's multi-year goals. Going forward, this data will help inform the develop of the 2026 Technology Roadmap.

### Is industry aware of the Roadmap?

65%

Industry participants report being very or somewhat familiar with the Roadmap\*

15,084

Site visits, downloads, and shares of the Roadmap

*"The roadmap helps researchers understand the needs of the industry, which is helpful for me."*

*-Research/Extension survey participant\**

### Is the Roadmap driving focus and prioritization?

19

Funding applications aligned with Roadmap in '23-'24 cycle

8

Funded or completed projects aligned with the Roadmap

\$674k

Spent on Roadmap-aligned projects

48

Distinct Roadmap-aligned activities

### Is the Roadmap leading to behavior change?

39%

Industry participants report that the Roadmap has influenced their approach or priorities\*

*"This is a great way to prioritize research and Extension. It would be great to have annual updates highlighting where progress has been made to avoid redundancy in efforts and enhance collaboration"*

*-Research/Extension survey participant\**

## **Primary Goal: Prioritizing Commission Resources**

In its first year in existence, key internal and external WTFRC stakeholders have anecdotally confirmed the effectiveness of the Roadmap in bringing focus to discussions that might otherwise have covered dozens of potential tech options. The sheer quantity of views of the report offers some indication of how widely the Roadmap's priorities are being shared, discussed, and applied, both within WTFRC and across the industry.

Within the Tech Committee especially, data supports this sense of increased focus. 21% of all apple-related funding was spent on Roadmap-aligned activities in the 2023-2024 cycle. Other WTFRC committees also included Roadmap-aligned language in their RFPs, leading to an increase in aligned projects across the organization. External funding was also sought and used to advance Roadmap priorities, catalyzing further impact. WTFRC shared a total of 6 research support letters aligned with Roadmap priorities, resulting in 6 additional, externally funded projects.

# Priority 1: Irrigation

Irrigation technologies are widely available and often affordable, and the benefits of using them are generally understood. Advancing the adoption of irrigation technology at this stage involves increasing awareness and conviction among growers and their advisors. The Roadmap identifies Irrigation as a short-term priority area, and aims to increase adoption rapidly between 2024-2026 such that it is no longer a technology advancement priority beyond that point.

The Roadmap identified three key opportunities of adopting irrigation tech:

1. cost savings, particularly in terms of water, energy, labor, and nutrients;
2. increased confidence in irrigation decision-making; and
3. the ability to explore new irrigation strategies with direct benefits to yield / quality.

WTFRC and their collaborators have undertaken several strategies to seize these opportunities.

## Efforts to Advance Irrigation Priority

### Recommended Strategies

- **Build capacity and capabilities** for the effective use of irrigation technologies.
- **Document and share irrigation tech strategies** with growers.
- **Develop a local evidence base** for how irrigation tech improves on-farm outcomes.
- **Increase the availability of third-party data** showing the effectiveness of irrigation technologies.
- Create and improve incentive for irrigation service providers to support irrigation tech.\*

\* Not considered a good fit for WTFRC, will update strategy in 2025 for better alignment.

### Executed Strategies

- Participated in **7 Field Days with hundreds of participating farmers** and industry members
- **Created new publications in both English and Spanish** on monitor usage, interpretation for decision-making, and economics
- **Supported research proposals** on irrigation timing impact on apples, fertigation, irrigation and nutrient uptake, and updates to the irrigation tech cost/benefits calculator.
- Supported an **accessible literature review** on soil moisture sensors and use cases that effect farm profitability.

In addition to these recommendation-aligned activities, WTFRC also undertook other Roadmap-aligned actions related to irrigation including:

- Provided research support letters related to irrigation
- Added 2 irrigation experts to WTFRC Tech Advisory Committee
- Organized and supported Irrigation Extension Collaborative Group consisting of 5 extension members
- Planned a multi-day Irrigation Fruit School

## Priority 2: Crop Load Management (CLM)

CLM technologies are largely still an emerging category for apple growers. Though there are some tools that are commercially available today, establishing efficient use cases is still an ongoing process. The Roadmap identified CLM as a mid-term priority area, with dual aims to increase the cohort of commercially available options, and increase grower awareness and confidence around existing tools, such that CLM could advance to being a short-term tech adoption priority after 2026.

The Roadmap identified three key opportunities of adopting CLM technologies:

1. Yield and quality improvements related to optimized plant and fruit health
2. Overall better seasonal labor demand planning due to more effective pruning and thinning activities
3. Reduced input costs related to chemical thinning

WTFRC and their collaborators have undertaken several strategies to advance the industry towards these opportunities.

### Efforts to Advance Crop Load Management Priority

#### Recommended Strategies

- **Advance crop load modeling tools.**
- Incentivize **pruning research and development.**
- Advance awareness of the **value of tech-enabled CLM tools.**
- Incentivize research on precision application of plant growth regulators.\*\*

#### Executed Strategies

- Participated in the SCRI PACMan Grant to **support crop modeling advancements.**
- Supported University of Tokyo/OSU **3D orchard mapping and renewal pruning robotics project.**
- Funded WSU research related to **leaf removal impacts on tree health.**
- Advanced work with Smart Orchard around crop load monitoring, including welcoming **200 attendees to the Smart Orchard Field Day**, including media, tech providers, scientists, industry, and farmers.
- Supported IFTA Technology workshop to **catalyze farmer-technologist interactions.**
- Supported FIRA to **lead tree fruit panel discussion.**

\*\* Will devote additional attention to this strategy or similar in 2025.

In addition to these recommendation-aligned activities, WTFRC also undertook other Roadmap-aligned actions related to crop load management including:

- Advancing work around chemical thinning tools, leading to developments around a new post-bloom chemical thinner (“Brevis”).
- Advancing work around sprayer technology.
- Field days, meetings, trips (including two trips to the Netherlands and a Dutch visit to the US), and workshops throughout the year involved discussion of CLM, in addition to irrigation and harvest labor.

## Priority 3: Harvest Labor

Harvest labor tools, in general, represent the least well-developed of the area of those highlighted in the Roadmap. Essentially no transformative harvest labor tools are commercially available today beyond a few in the assistive technologies and labor management software categories. The Roadmap identified Harvest Labor as a long-term priority area, with the dual aim to advance commercial viability of prototype tools and to increase collaboration between growers and technologists to ensure that technologies still in development meet grower needs. These aims are meant to spur the harvest labor category such that it could advance to a mid-term tech adoption priority after 2026.

The Roadmap identified three key opportunities for adopting harvest labor technologies:

1. Cutting back on demand for increasingly hard-to-come-by seasonal labor during peak times
2. Increasing the efficiency of the existing workforce via augmentation
3. Inserting collaborative robots into the existing workforce to do manual labor in a cost-effective, safe manner, freeing workers for higher value tasks

WTFRC and their collaborators have undertaken several strategies to advance the industry towards these opportunities.

### Efforts to Advance Harvest Labor Priority

#### Recommended Strategies

- **Lower the costs of developing mechanical/autonomous harvesting solutions.**
- Educate technologists to **ensure solutions align with grower needs.**
- Help WA apple growers get “robot ready.”\*\*
- Update RFP process to include expert vetting for research/commercialization proposals.\*

\* Not considered a good fit for WTFRC, will update strategy in 2025 for better alignment.

\*\* Will devote additional attention to this strategy or similar in 2025.

#### Executed Strategies

- Funded **Intelligent Fruit Picking, Automated Harvester, and Reliable Soft Arm research projects.**
- Participating in FFAR priority setting to **establish open source toolbox for automation**, among other cross-sectoral harvest research topics.
- Supporting Renfu Lu/ARS **robotic apple picking project.**
- Supporting research on **Robotics Ready Data Standard for WA Apples.**
- Advancing Orchard of the Future collaboration.
- Supported IFTA Technology workshop to **catalyze farmer-technologist interactions.**

In addition to these recommendation-aligned activities, WTFRC also undertook other Roadmap-aligned actions related to harvest labor including:

- Submitted proposal to WA legislature to advance cost-share tax break for tech investments
- 2 extension positions approved to be hired in this focus area
- Worked closely with Advanced Farm this fall to drive speed of development
- FIRA participation including Advanced Farm showcase
- New connection to Yakima County Development Association

## Conclusions

A key feature of the Tech Roadmap is to help focus attention on a few priorities so that progress can be made. There are dozens of technology categories that can and will have a meaningful impact on Washington growers, but with limited resources, WTFRC cannot advance dozens of priorities at the same time and expect to see progress on any of them.

Though the data and information shared in this report does not directly compare how commission activities changed before and after the adoption of the Roadmap, it does support the anecdotal evidence that the Roadmap's narrow focus on three priorities helped align efforts and take advantage of momentum around the priority areas.

Going forward, this Impact Report will provide a valuable baseline for future analysis of Tech Roadmap effectiveness. It will create the opportunity to determine not only the effectiveness of prioritization in terms of funding and support activities, but also establish data points around how the alignment created by this work unlocks further resources across the sector.

### Available Data Points in the Future as Compared to 2024 Baseline

XX%

Increase in Roadmap-aligned funding applications

XX%

Increase in Roadmap-aligned projects funded or completed

XX%

Increase in funding spent on Roadmap-aligned projects

XX%

Increase in Roadmap-aligned activities

XX%

Increase in farmers and industry stakeholders exposed to Roadmap

Some Roadmap-related benefits will always be difficult to specifically quantify (i.e. determining dollars spent, growers reached), and therefore to objectively measure changes over time. In this evaluation period, examples of activities that would likely not have occurred without the focus of the Roadmap, but which do not lend themselves to quantification include:

- Establishment of Extension committee to focus specifically on irrigation adoption.
- Clarity for WTFRC staff on resource allocation, which allowed them to prioritize external opportunities so the resources could be allocated to help unlock additional funding and support from across the sector.

Though the overarching aim of the Tech Roadmap is to improve the economic security and sustainability of Washington tree fruit growers, current data collection systems and efforts do not support determining progress towards that goal. In the future, regularly collecting producer-level data on Roadmap priorities could help WTFRC gain insight on how grower perspectives on Roadmap priority areas are changing over time, and whether WTFRC-supported efforts related to the Roadmap are having the desired effect on Washington State producers.

**Read the 2023 Apple Technology Roadmap [here](#), or visit [treefruitresearch.org/about-us/technology-roadmap](https://treefruitresearch.org/about-us/technology-roadmap).**

Interested in providing feedback on current or future roadmap priorities?

Email your thoughts and questions to Ines Hanrahan at [hanrahan@treefruitresearch.com](mailto:hanrahan@treefruitresearch.com).