



2024 Apple Horticulture and Postharvest Research Priorities

Request for Proposals (RFP)

The Washington Tree Fruit Research Commission (WTFRC) is seeking apple research proposals in the following priority areas.

Of special interest are proposals addressing methods assessing labor utilization and/or for the reduction of manual labor needs in orchards.

Horticultural field trial designs should consider documenting the seasonal climate, water, and nutrient management effects. Naturally occurring mineral and/or nutrient levels can influence the outcome of field trials and these water quality aspects are generally not documented. This makes comparisons of results to applied research difficult. Maintaining profitable and sustainable tree fruit companies is of utmost importance to our industry, and economic considerations need to be included in project designs.

Some of the priorities listed do not specifically ask for organic options. We are interested in having organic practices considered in all proposed work when appropriate. Also, proposals are expected to include an industry outreach component if the sought-out project outcomes are anticipated to directly translate into management changes.

Achieving Sustainable Production and Consistent Fruit Quality for Profitable Orchards:

Increase Return Per Acre through: Yield Optimization, Crop Load Management, Tree/Fruit consistency in **the orchard** via development of integrated systems and interrelated models:

- Understanding of pollination biology/fertility and development of Best Management Practices (BMP) as resource for growers (incl. artificial pollination, pollen tube growth, integration of weather)
- Water and nutrient management (balance tree growth and development to maximize cropping potential of premium fruit, i.e.: manipulate for newly planted trees, then switch to encourage fruiting)
- Managing soils: how to measure, manage, and maintain soil fertility
- Systems approach for understanding and managing the major cause of bitter pit & calcium-related disorders under Washington conditions (incl. genetics, soils, plant growth regulator effects)
 - o Focus on early season uptake optimization considering soil type/temp., growing degree days (GDD's) during uptake period
 - o Create an early alert system to enable growers to react
 - o How to avoid calcium translocation out of fruit
- Determine BMP's for pesticide efficacy under prolonged evaporative cooling conditions (collaborate with pathologist, see Apple Crop Protection (ACP) RFP). Explore contributions of cycling, fogging, timing of preharvest fungicides including organic options. Develop an early alert system.
- Utilization of genetic/genomic and other tools to understand the inherent mechanism that guide cropping system performance.
- Best practices for pre-harvest decay pathogen reduction strategies for conventional and organic orchard systems (chemistries that combat mucor, connect with postharvest, see below and ACP RFP).

Enhanced ***postharvest*** efficiency to promote sustainability and long-term economic viability of pome fruit businesses by increasing packouts. We seek projects that aim at understanding/managing/reducing decay and physiological disorders while maintaining/enhancing food safety and avoiding fungicide resistance development. Goal: Increase “Packs Per Bin”. The entire continuum from orchard to table should be considered.

- Next generation maturity indices as risk assessment tools to manage fruit quality and physiological disorder prevention
 - o New harvest maturity indexes
 - o Heat during harvest and it’s effect on postharvest handling/performance
 - o Optimization of packing to avoid losses
 - o How to avoid re-packing
- Establish BMP’s for sanitation practices and application of sanitizers with focus on decay pathogen reduction for bin sanitation and storage rooms .
- Develop a training program for postharvest process water management strategies to manage decay and foodborne pathogens.
- Determine efficacy of drench versus fog application of post-harvest fungicide
 - o Determine cause of skin bitterness
- Industry practice to apply one type of fungicide (active ingredient) as a post-harvest drench or fog and a different fungicide (active ingredient) on the production line if fungicide applied. This is primarily due to concerns with exceeding the Maximum Residual Level (MRL) by applying the same fungicide twice. What is the impact of this practice on fungicide resistance within the industry? (crosslink with ACP RFP needs to be considered)
- Assess effectiveness of new biocontrol agents or other novel agents for decay control in conventional or organic production (crosslink with ACP RFP needs to be considered; effectiveness of fogging various biocontrol fungicides into cold storage rooms is already being studied, but we welcome proposals on using biocontrol and other novel agents in other phases of apple production)
- Food safety and sanitation (practical approaches to be implemented directly into operations, when appropriate in conjunction with pathology and fruit quality management):
 - o Evaluate and compare current protocols (product used, interval, method of application, etc.) for cleaning and sanitizing brushes, including a review of existing research on this topic. Investigate novel methods of cleaning and sanitizing brushes.
 - o Evaluate environmental monitoring best practices for assessing brush bed brushes (cleaning, drying and wax application). Compare and summarize type, efficacy, sensitivity, and cost for testing that minimizes the risk of listeria cross contamination or harborage.
 - o Develop best practices for drenching and fogging to avoid bacterial and fungal growth.
 - o Organic approaches to packing line food safety.
 - o Estimate the potential financial benefit of optimized sanitation protocols on packouts for high value varieties, such as Honeycrisp. Cost-benefit analysis of food safety controls.
 - o Water treatment options: “how can less water be discharged after packing”, methods to extend the life of water for packing lines.

Abiotic Stress Management and Climate Change:

- Systems approach to understanding the basis of fruit over color development to enable harvest of fruit at optimum maturity and to reduce the number of picks needed :
 - o Genetic, biochemical, physiological, environmental factors
 - o Develop best practices to manage and increase over color
- Understanding chilling requirements for apple trees
- Understanding maturation patterns and storage potential based on in-season climate (examples of random climate extremes: smoke, frozen fruit protocol, heat damage of fruit, dramatic temperature drops in season, abnormal maturation patterns)
 - o BMP's for harvest management tools, especially organic ReTain
- Fruit abscission: understanding of the underlying physiology to enable precision harvest management via knowledge of stem release mechanisms (cross link with cherry and stone fruit RFP)
- Understand carbon footprint of apple orchards (LCA/ESG; ID efficacious/viable approaches) (crosslinked with ACP).

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- Determine detailed protocols for use of in-field ethylene action/synthesis inhibitors/promoters for best eating experience and maximum packouts. (special interest in organic ReTain)

Technology projects for apples alone or across several different crops are encouraged. Those projects may be moved into the technology committee.

- Smart Orchard Project
- Cost-effective high-density systems for automation (example: hedging (put #'s on timing/fruit quality downstream)
- Non-destructive crop stress modeling
- Water management
- Accurate crop estimation: Real time fruit growth measurement & fruitlet counts
- Bin fillers for mechanical harvest: do they work good enough?
- Economic analysis: for available and novel technologies (how to make the economics work), focus on Key Performance Indicators (KPI's); comparisons of ALL new technologies for the orchard analyzed so others don't have to do it at a smaller scale

Novel ideas in areas not listed as priority are encouraged. It is suggested to contact Ines Hanrahan (hanrahan@treefruitresearch.com) to discuss any ideas outside of the priorities identified by the 2023 Request for Proposals (RFP), before submitting a preproposal.