



California **Walnuts**

2023/24 PRODUCTION AND
POST-HARVEST RESEARCH

PRODUCTION RESEARCH

The production research program is developing and testing technologies for the future of walnut farming.

The California Walnut Board provides funding and strategic direction on walnut production and post-harvest research designed to help support the industry by improving crop health, yields and food safety.

Collaborative efforts between the research community, farm advisors, growers and the industry make this all possible.

Each year, the California Walnut Board's production research program solicits project proposals from University of California, US Department of Agriculture – Agriculture Research Service, California State University and other institutional research and private sector partners to address our industry's orchard production challenges. Administered by the Board's Production Research Committee, the program includes very deliberate, thorough and dynamic processes for keeping abreast of challenges the industry faces and ensuring that the research efforts funded by crop assessments are focused on delivering both applied and long-term benefits to growers and handlers.





Production research efforts fall into four categories:

- Variety and Rootstock Breeding
- Plant Pathology and Nematology
- Entomology (insect and mite pests)
- Orchard Management

The Board has partnered with University of California, Davis (UC Davis) to store written reports in an accessible and searchable database managed by its Fruit & Nut Research and Information Center. The database can be found at <https://ucanr.edu/sites/cawalnut/>. Short annual progress reports for CWB-funded production research projects can also be found at walnuts.org/walnut-industry/production-and-research-2/.

The following studies began in the spring of 2023 and will be completed in the winter of 2024:

Variety and Rootstock Breeding

Walnut Improvement Program

(Long-term, reviewed and approved annually, \$449,830)

This project continues to produce new varieties that are high yielding, have a range of harvest dates, are resistant to walnut blight, and produce high quality nuts and kernels with extra light color, color stability, improved shelf life, reduced astringency and a high percentage of halves when cracked. Work also continues to reduce the costs of breeding new varieties and rootstocks using new genotyping tools and marker assisted selection. Rootstock breeding efforts are focused on producing new clonal rootstocks with superior resistance to multiple soil-borne pests including nematodes, Phytophthora and crown gall disease.

PRODUCTION RESEARCH

Translating Genome Editing Tools for Walnut Improvement

(Year 4 of five, \$109,110)

In Year 4 of a five-year project designed to adapt newly discovered gene editing tools for precision breeding of new varieties and rootstocks, 2023 efforts focused on continued functional analysis and mapping of important traits in the walnut genome as well as further refinement of the techniques used to produce, preserve and propagate gene-edited plants.

Putting Phenotypic and Genotypic Tools to Work for Improving Walnut Rootstocks Quality

(Year 1 of three, \$90,000)

This project complements a large federally funded effort that emphasizes theoretical breeding aspects, technical tool development, initial field trialing of new clonal rootstocks resistant to nematodes, crown gall and Phytophthora; and the maintenance,

propagation and nursery finishing of plants for short- and long-term trials. In 2023, CWB funding was used to complete pathogen resistance testing of elite rootstock candidates and continue evaluations at nine regional long-term orchard rootstock trials, while establishing an additional trial at UC Davis.

Irrigation System for California State University, Chico New Walnut Variety Trial

(Year 2 of two, \$14,000)

The installation of a state-of-the-art irrigation system at a 10-acre walnut selection and variety trial at California State University, Chico (CSUC) will compare advanced selections and new varieties to industry standards, provide a site for other UC and CSUC research and student projects, and allow northern Sacramento Valley growers to observe the performance of new selections and varieties under local conditions.

Plant Pathology and Nematology

Novel Approaches for Managing Botryosphaeria, Phomopsis and Mold in Walnut Orchards

(Year 1 of two, \$24,730)

This project is evaluating three new tactics for improving growers' ability to manage Botryosphaeria and Phomopsis canker outbreaks:

1. The ability of summer disease canker surveys and/or dormant bud sampling to predict the risk of disease the following summer.
2. Determine whether a bloom fungicide spray alone or in combination with a walnut blight spray helps reduce Botryosphaeria and Phomopsis compared to hull-split applications.
3. Assess the effectiveness of pre-harvest combination fungicide + ethephon compared to fungicide alone.



PRODUCTION RESEARCH

Epidemiology and Management of Walnut Blight

(Year 4 of four, \$63,130)

This program is focused on the continued development of alternative copper- and non-copper-based products and combinations for managing blight, annual surveys to monitor sensitivity of walnut blight strains to copper, copper-mancozeb and kasugamycin; and development of rapid blight susceptibility testing methods needed to screen potential new varieties for blight-resistance.

Improved Diagnostics for Walnut Blight Disease Detection and Development of a Walnut Blight Protecting Rootstock

(Year 1 of four, \$65,497)

This four-year project seeks a long-term solution to walnut blight disease using gene editing to create new walnut rootstocks specifically designed to produce elevated levels of a naturally occurring protein known to be a potential inhibitor of blight infection in walnuts.



Entomology (Insect and Mite Pests)

Improving Treatment Decisions for Navel Orangeworm in Walnuts

(Year 2 of three, \$63,945)

This project continues research to better understand — and ultimately predict — orchard-to-orchard movement of navel orangeworm (NOW), especially late-season movement from almond and pistachio orchards that leads to damage in nearby walnut orchards. It also funds work to assess the efficacy and cost-effectiveness of NOW mating disruption in walnuts. New in 2023, this project has initiated activities to assess the impacts of in-season insecticide applications for NOW and other key insect pests on spider mite predator populations and late-season mite outbreaks.

Improved Monitoring of Walnut Husk Fly Through a New Pheromone Lure

(Year 2 of two, \$60,665)

This final year of this work is confirming and refining first-year results showing large and significant improvements in walnut husk fly trap captures from the addition of synthetically produced male pheromone components to standard ammonium carbonate lures.

Biology and Movement of Walnut Husk Fly in Walnuts

(Year 2 of two, \$38,555)

At Sacramento Valley and northern San Joaquin Valley sites, this program measures the effectiveness of commercially available entomopathogenic fungal and nematode products for controlling walnut husk fly as adults when they emerge from the soil in mid-summer and/or as larvae when they drop to the soil in late summer and fall to pupate.

PRODUCTION RESEARCH

Orchard Management

Early Season Water Management and Yield Limiting Factors in Walnuts

(Year 5 of five, \$126,800)

This project seeks to confirm earlier findings on the water savings, yield and quality benefits of delaying the start of early season irrigations based on tree water status monitoring. It also continues efforts to adapt commercially available automated whole-tree water status sensors for scheduling irrigations in walnuts.

Walnut Orchard Management: Pilot Projects, Field Testing, Adaptive Research and Problem-Solving

(Long-term, reviewed and approved annually, \$128,263)

Annually reviewable funding is used to sustain the applied research and outreach activities of the UC Walnut Specialist and staff in support of numerous county-based rootstock, variety, and tree training and pruning trials overseen by UC farm advisors.



Weed Management in the Conventional Walnut Production System: Field Research and Extension

(Long-term, reviewed and approved annually, \$22,500)

This project provides annually reviewed support for research and extension outreach activities of the UC Davis Weed Management Specialist. These activities include performance evaluations of new pre- and post-emergence herbicides and combinations; and research to understand and mitigate risks of herbicide transfer to nuts during harvest, reduce herbicide drift and crop injury, and monitor and better manage herbicide resistant problem weeds.

Whole Orchard Recycling on Heavy Ground in the Sacramento Valley

(Year 1 of one, \$18,800)

This project provides funding to offset establishment costs for a multi-year trial evaluating potential benefits and

drawbacks of whole orchard recycling on walnut replant orchard performance and productivity.

Local Applied Walnut Research and Extension Activities

(Long-term, reviewed and approved annually, \$44,000)

Small, annually renewable awards are granted to UC farm advisors to support local pilots and/or small-scale research or extension education efforts addressing the needs of growers in their county or region.

Regional Research Assistance for UC Farm Advisors

(Year 4 of four, \$94,612)

This project is a collaborative effort of the California Walnut Board, Almond Board of California, California Pistachio Research Board and California Prune Board to fully fund four UC Staff Research Associate positions to help assist and expand the regional research and extension efforts of UC tree nut and/or prune farm advisors.

POST-HARVEST RESEARCH

Industry funds are utilized to proactively address arising post-harvest related issues and to provide practical applications of the research with the intent of providing short- and long-term solutions to advance industry profitability, product quality, industry competitiveness and staying power.

The following studies were initiated and/or completed in 2023:

Development of Improved Rancidity Measurement Tools and Baseline Quality for California Walnuts

(\$96,300)

The quality of California walnuts collected from storage, processing facilities and off the shelf at retailers were evaluated via a market audit. Results will be used to establish baseline quality benchmarks to help the industry develop better, faster and less expensive tools to detect rancidity and work towards future quality improvements throughout the supply chain.



Postharvest Treatment Enhancements for California Walnuts

(\$35,000)

To ensure pest-free security and food safety of walnuts in post-harvest marketing channels, this work evaluated the development of efficient, economical and environmentally benign treatments, including the review of a suite of commercial packaging and storage devices to maintain low-oxygen conditions required for phytosanitary treatments.

Determining Walnut Quality

Markers for Breeding and Selection

(\$81,076)

Data generated in this project will enable advances in both walnut genetics and management that prolong shelf life.



POST-HARVEST RESEARCH

Validation of a Custom, Mobile Sensor for Nondestructive Walnut Rancidity Classification

(\$69,898)

This project is investigating and validating a custom mobile sensor to classify walnuts by freshness/rancidity in post-harvest storage conditions.

Multiresidue Pesticide and Heavy Metal Survey of 2023 Walnut Crop

(\$50,612)

The annual testing of pesticides and contaminants on walnut samples across the state continues to ensure the walnut industry's regulatory stewardship and compliance, as well as world-class food safety.

Quantifying Walnut Drying at a Commercial Huller for Benchmark and Numerical Modeling

(No Cost Extension)

This drying efficiency study is assisting in identifying more efficient and effective processes for walnut dryers/dehydrators across the state.

Development of Metabolomics and Genomic Database to Differentiate Geographical Origins and Cultivars of Walnuts

(No Cost Extension)

This project is assisting in further understanding walnut origin and how it contributes to differences in the chemical and genetic parameters of walnuts.

Impacts of Steam Pasteurization on Walnut Storage Quality and Use of Low Oxygen to Mitigate Impacts

(No Cost Extension)

This multi-year project concluded with results showing the best method of steam pasteurization and storage was found to be batch pasteurization stored in low oxygen conditions. It is likely that the lower the oxygen concentration during walnut storage, the longer their shelf-life and the better the retention of nutritional quality. (Note: Every type of pasteurization equipment that is commercially available has unique processing parameters and conditions. The general statement that batch is better than continuous may not necessarily be the case and is dependent on a number of variable factors.)



SUSTAINABILITY

For over 50 years, California walnut growers and processors have supported research and innovation in water quality, conservation and usage; soil health and preservation; nutrient and integrated pest management; energy use efficiency; and air quality improvements.

The walnut industry is working towards a more robust and value-added sustainability program. Sustainability subject matter experts, Measure to Improve (MTI), were hired to review the sustainability studies previously commissioned by the California Walnut Commission, assess our sustainability marketing claims and available data to substantiate them, and review a series of buyer surveys to further understand the increasing demands industry is seeing from the market.

MTI is working closely with the industry to inform the development of a Sustainability Index as part of the “Sustainability as a Differentiator” for California walnuts component section of the Strategic Plan. For example, California walnuts have higher environmental and labor standards than other sources of walnuts, which could aid in appealing to a growing segment of sustainability-conscious consumers.

A Sustainability working group comprised of walnut growers across the state, Commission staff and MTI will meet through summer of 2024 to strategically plan and deliver the first Walnut Sustainability Index and set annual and five-year growth targets. These efforts are intended to work towards adding further value to the industry and drive grower prosperity.



