



**June 2021**

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***CAUSE AND MANAGEMENT OF LATE FALL COLD INJURY TO WALNUTS***

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Growers throughout Lake County reported severe dieback of both young and older walnut trees. The following summary of major factors will be updated periodically as the season progresses.

***Cause of Dieback*** – Though commonly labelled “winter injury” or “winter kill”, the observed dieback was initially caused by defined periods of extreme cold during late fall, in many cases just before or during harvest. In fact, nuts suffered cold injury on the trees, resulting in substantial loss (without accounting for previously incurred sunburn). Western Weather Lake County (<http://westernwx.com/lakeco>) data for October, November, and December delineates the most likely date(s) damaging freezes occurred. While this article utilizes three stations in Kelseyville (Big Valley), Scotts Valley, and Upper Lake, you can locate your nearest station on the website. Scotts Valley was always coldest and recorded the most events and number of hours per event (duration) of temperatures below 32°F, with Upper Lake recording the least. However, *all* districts suffered damage during two major events occurring November 8-9 and November 11-12. These were preceded, and followed by, multiple events depending on growing location (e.g. Scotts Valley fell below 20°F in October, exacerbating damage). This period of freezing nights followed a period of warm, dry weather through November 6, with maximum daytime temperatures reaching the low 80s, resulting in severe damage to still actively growing trees not yet acclimated to cold.

***Temperatures*** – In “normal” years, the combination of short days, dropping fall temperatures, and rainfall pattern allows trees to go into dormancy in a stepwise pattern. As temperatures drop into the low 30s and days shorten, carbohydrates move from leaves to wood and starch converts to soluble sugars. Sugars act as “antifreeze” to protect cells from freezing, as does adequate soil moisture, which keeps cells hydrated. Carbohydrate movement is likely disrupted when temperatures suddenly and prematurely drop below 32°F before the acclimation process is completed, rendering trees unable to acclimate properly. Winter injury most commonly affects vigorously growing young trees or 1 to 2 year old wood. When soils are dry and temperatures drop suddenly into the low 20’s and teens,

otherwise mild winter injury can become severe and affect mature trees normally less prone to “mild” freezing temperature above 27°F.

**Tree Water Status** – Young trees and wood suffer some winter injury to some trees almost every year, as described above. **So WHY Is Damage So Severe This Year???** *It is because it is SO DRY!* Longtime walnut growers know cold damage is worst during a drought. The association between winter damage and dry soil conditions is well known and discussed in numerous UC and industry articles and newsletters going back decades. As summarized in the UC ANR publication *Understanding Your Orchard's Water Requirements*

(<https://anrcatalog.ucanr.edu/Details.aspx?itemNo=8212>), walnuts require about 33 inches of water to meet evapotranspiration (ET) in Lake County. 2020 rainfall in the major growing areas ranged from about 8 (Kelseyville) to 11.5 inches (Upper Lake), *less than one-third* the amount required to meet water use needs of both trees and ground cover (transpiration) and loss from the soil surface (evaporation). Rainfall was also relatively low in 2018 (range 20-27 inches) but recovered to 32-45 inches in 2019. The ‘perfect storm’ of conditions occurred in 2020: dry soil, sudden cold, and many trees weakened by two prior years of early cold damage and other factors described below.

In visiting orchards throughout the county, it is clear that trees with better water status GOING INTO THE FALL AND WINTER, mainly due to irrigation, were more likely to emerge from dormancy with at least a semblance of normal leaf out; many are growing very well. Adequately watered trees potentially benefitted in two ways. First, good late season water status allowed for normal carbohydrate assimilation and cold protection going into dormancy (Lake County orchards seldom suffer from excessive *early* season irrigation, thus “adequate” water refers to amount applied from about June through October). Second, these trees had more leaves during periods of late season warm weather. This is important because pre-mature senescence can 1) further reduce sugar reserves, and 2) increase direct infrared radiation to the open sky during cold events since leaves protect by keeping wood hydrated. Conversely, dryland or trees under late-season water stress (generally August - early September) likely had fewer reserves and fewer protective leaves. We will see how these trees fare during upcoming periods of extreme heat.

**Carbohydrate Status** – The Lake County growing season is restricted at each end by cold. The growing season starts later and ends earlier, with fewer frost-free (250 vs. 275-300) and fewer growing degree-days >50°F than the valley districts. Local growers have been sending walnut twigs from 14 orchard sites as part of the Carbohydrate Observatory Project managed by the Zwieniecki Lab. The purpose of the project is to learn how levels of various forms of carbohydrates (non-structural (NSC), starch, and soluble sugars) change over the season and how they affect growth and cropping (yield). Raw data from statewide orchards, including from Lake County, is available at <http://zlab-carb-observatory.herokuapp.com/> and most recent project results at <https://ucanr.edu/sites/cawalnut/showyears/2020/>. Because yield relates to conditions conducive to photosynthesis and carbohydrate assimilation, this unique effort is providing actual data to explain *why* it is more difficult for Lake County to attain similar yields as the valley districts on the same cultivars, e.g. Chandler (*NOTE: yields and profit are different!*).

Carbohydrate Observatory data from multiple statewide sites shows late fall is the critical time to restore sugars needed for dormancy and early, synchronous bloom. High carbohydrate reserves in early spring are also positively associated with high yield. Related research also found that early defoliation and girdling (to injure the phloem) impeded carbohydrate movement, resulting in delayed and asynchronous bloom. Trees were still leafed out and assimilating carbohydrates during the 2020 cold events (see above); one can thus surmise that sudden fall cold damage reduced carbohydrate levels going into dormancy, leading to late, erratic leafout and lower yields the following season<sup>1</sup>. It is interesting to note that total October-December 2019 carbohydrate levels from twigs submitted from

Lake County were lower than the statewide average likely, translating into even greater propensity for inadequate reserves budbreak.

<sup>1</sup>If the temperature drops over 8°F per hour trees may not digest starch fast enough to produce soluble sugar or accumulate enough nitrogen in the stem to produce the compatible solute proline that would protect from ice crystals formation in cells and cellular membrane damage. Fortunately, temperatures only dropped 1-2°F per hour during these freezing events.

**Growing Site** –There is much variation in the amount and severity of cold damage among and within orchards as individual trees can be more or less susceptible to cold damage (see photos). Why one tree expresses injury adjacent to an apparent healthy tree of the same age and rootstock/cultivar is unfortunately often a mystery. Since root system health certainly influences overall tree health some answers likely lie underground. Any condition impeding root growth impairs water and nutrient movement and consequent ability of a tree to survive adverse conditions. Despite much variation and unknowns, damage often correlates with low areas, exposed southwest edges or corners, at the base of hills where cold air drains, and most importantly, on gravelly soils that hold less moisture. These gravel patches or streaks often correspond to old creek beds, drainages, or fill sites. Trees growing in these sites may look “normal” with adequate rainfall but show real stress in dry years. At the other extreme, Lake County seldom suffers from excess *early* irrigation common in valley orchards, but any condition impeding infiltration can also damage roots by reducing soil oxygen (anoxia).

**Symptoms** – Many “normal” appearing trees entering winter failed to “wake up”. Trees of all ages showed damage symptoms, the extent of which was only observable at leaf out (when your calls, texts and emails started!). Symptoms this spring ranged from weak or dead terminal budwood and smaller upper limbs, to major limb death - mainly in the upper and exposed portions of the tree - to apparent whole tree death. Fortunately, in many cases, branches and whole trees that at first appeared dead eventually leafed out and are continuing to rapidly do so as the weather warms. Cutting below the bark reveals gray/black streaking the cambium, typical of discoloration from leakage after frozen cells ruptured. Darkened wood appears similar to sunburn, which may also be present, especially on south and west facing wood. New growth occurs below the damaged/dead locations. In most cases, the rootstock is fine (English are most susceptible to cold injury) and there may be root suckers at the base of trees.



1. Cold injured trees



2. Delayed leaf out



3. New growth subtending dead wood

Photos 1-3. Fall cold injury on 5<sup>th</sup> leaf ‘Chandler’ trees, May 2021 (photos: Rachel Elkins).



4. Healthy appearing well-irrigated trees



5. Cold injured, (left) adjacent to healthy trees (right)

Photos 4-5. Young bearing 'Chandler' trees differential affected by Fall 2020 cold damage (photos: Bruce Lampinen).



6. Cold damaged water-stressed 'Franquette' trees



7. Cold damaged 'Hartley' tree

Photos 6-7. Effect of water status on injury to older trees, May 2021 (Photos: Bruce Lampinen)

**Summer Management Implications** – It is best to assess final canopy status once trees complete their regrowth process. Focus pruning efforts on removing damaged wood exposed to sunburn and consequential branch wilt, borers, etc., or branches that will interfere with the harvest process. **Paint exposed south and west facing trunks and major branches of all trees with 50% diluted water-based latex white paint (or organic alternative) to protect from sunburn.** Research performed by (retired) Yolo County Farm Advisor Wilbur Reil demonstrated that sun-exposed surfaces painted before and even shortly after cold events can also minimize winter injury. *Non-bearing trees* can be retained if re-growing adequately. Allow some rootstock growth until the scion can support itself, then focus tree energy on the chosen leader, keeping side shoots pinched to about 12 inches. Young trees will grow late into fall as they lack crop. While every growing situation differs, we suggest tapering back irrigations in September, then restarting (if water is available) *after* terminal buds on

branches arising from the trunk are set to prevent going into winter too dry for all trees. *Mature trees* are less likely to grow late into the fall, but are more prone to stress during drought. Fertilize normally depending on crop (crop appears light this year, but this may or may not be due to the cold).

Given the drought and limited water supplies in many cases, irrigate all trees as normally as possible, emphasizing the hottest periods (several growers have begun using the pressure chamber to time irrigations this year). If no or little rain falls prior to or after harvest, growers with adequate water should *plan to irrigate down to at least one foot about (2 inches water) and preferably two feet about (4 inches) in the fall to replace soil moisture normally supplied by November-December rainfall.*

**Pest Management** - Consult UCIPM Pest Management Guidelines – Walnut (<https://www2.ipm.ucanr.edu/agriculture/walnut>) for details on seasonal pests. Remove sunburned branches to prevent branch wilt infection. Growers have asked about walnut husk fly (WHF) since many orchards currently lack “shaded” canopy. Hang WHF traps as usual since growth is occurring. Keep dust to a minimum to prevent spider mite build up if it remains hot and dry; these will further reduce photosynthesis and carbohydrate nutrition. Area IPM Advisor Cindy Kron identified bean thrips last season in one Upper Lake orchard; these move into trees from drying weeds and can also reduce photosynthesis and weaken trees prior to winter. **CONTROL SUMMER WEEDS AND GROUND COVER**, especially in dryland orchards that rely on natural moisture to survive (this makes reducing dust more difficult, but do your best). Manage gophers since they can weaken root systems. Watch for crown gall; bacteria can enter through damaged wood and cracks.

**Frost Protection** – Growers have inquired about frost protecting in the fall. No commonly employed frost protection method will protect trees from the extremely low temperatures and dew points sustained last fall, and most Lake County walnut orchards lack suitable irrigation systems needed for standard frost protection coverage. *However*, if water is available, irrigating several days **ahead** of a predicted radiation frost will supply moisture and warm the soil (see Tree Water Status).

**Thoughts on the Crop** – Growers have mentioned that catkins came and fell well before the pistillate bloom was ready to be pollinated, and it does appear the primary (first) nuts are relatively sparse (there are small nuts on the late growth). The lighter crop is likely due to multiple factors, i.e. *directly* due to a reduced number of growing points from previous and current years’ damage, or *indirectly* as the result of poor carbohydrate status going into winter, resulting in weakened, erratic, delayed bloom and nut set. I believe that as the season goes on and growing weather improves (happening now!) the crop, as with the trees, will look very different by July. Until then, monitor the orchard, protect from sunburn, irrigate (if practiced), fertilize, and control weeds and rodents. **CONTROL WHAT YOU CAN!**

**Thoughts on the Future** – As stated above, Lake County walnut trees have endured multiple drought-related winter injury events, often over successive years. The fact that many grand old trees still exist testifies to their ability to eventually recover. However, after three successive years of untimely fall cold spells, multiple years of sub-par rainfall, and, very importantly, the changing *economic* landscape, one should consider the future. Some questions: 1) Is my growing location prone to low temperatures and its consequences in terms of restarting and regrowing trees and harvesting a sound crop? 2) Is it worth continuing to invest in aging trees and old varieties that provide lower returns? 3) Can I continue farming dry land trees during a drought? 4) If I irrigate, can I supply the trees adequately? 5) Finally, **AND MOST IMPORTANTLY**, am I managing my orchard optimally to ensure the greatest chance of success in the event of ANY environmental and related circumstance? Are my cultural practices adequate? Do I control weeds and rodents, fertilize and irrigate properly, paint my trees (or trunk/southwest scaffolds) white to protect from sunburn and winter injury?

There are many questions to answer; we have only touched on the major aspects of the 2020-2021 winter injury event. Thank you to all who have contact us and offered valuable insight and experience; we welcome your continuing thoughts and observations. Please be encouraged that day-by-day tree growth will continue to improve; in fact, you may not recognize them by July! Finally, as always, all of us at UCCE are glad to answer your questions and to assist with your individual orchard situation; contact us via email or phone. The 2021 harvest season will be here in no time!

### ***USDA FARM SERVICES AGENCY (FSA) PROGRAMS to SUPPORT LOCAL GROWERS***

*Karri B. Jones, USDA Farm Service Agency, Mendocino, Lake, Sonoma, Napa, Marin, Humboldt, & Del Norte & Counties*

The U.S. Department of Agriculture's Farm Service Agency (FSA) offers direct and guaranteed loans to farmers and ranchers to promote, build, and sustain family farms for a thriving agricultural economy. Farm ownership, operating, and emergency loans are available under the Direct Loan Program. Farm ownership, operating, and conservation loans are available under the Guaranteed Loan Program. The goal of FSA's farm loan programs is to help farmers and ranchers obtain commercial credit. Once you are able to obtain credit from a commercial lender, our mission of providing temporary, supervised credit is complete.

***Direct Farm Loans*** – FSA's Direct Loan Program is designed to help farmers start, purchase, or expand their farming operation. From beginning farmers who have limited financial history to qualify for commercial credit to farmers who have suffered financial setbacks from natural disasters, FSA offers a variety of loans to provide additional resources farmers need to establish and maintain profitable farming operations.

***Guaranteed Farm Loans*** -- FSA guaranteed loans are available to farmers who may not meet loan qualifications from a commercial lender. Guaranteed loans are made and serviced by commercial lenders, such as banks, Farm Credit System institutions, or credit unions. Under a guaranteed loan, a commercial lender makes and services the loan, and FSA guarantees it against loss up to a maximum of 90 percent in most cases or 95 percent in limited circumstances. FSA approves eligible loan guarantees and provides oversight of lenders' activities.

***Farm Operating Loans*** – Farm Operating Loans may be used for normal operating expenses, machinery and equipment, minor real estate repairs or improvements, and refinancing debt. The direct loans are available up to a maximum of \$400,000, guarantee farm operating loans through a commercial leader up to \$1,776,000.

***Farm Ownership Loans*** – Farm Ownership Loans may be used to purchase a farm, enlarge an existing farm, construct new farm buildings and/or improve structures, pay closing costs, and promote soil and water conservation and protection. The direct loans are available up to a maximum of \$600,000, guarantee farm ownership loans through a commercial leader up to \$1,776,000.

#### *Who Is Eligible?*

- Be a family farmer;
- Have a satisfactory credit history;
- Be a citizen of the United States, including Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa, Commonwealth of the Northern Mariana Islands, Republic of Palau, Federated States of

Micronesia and the Republic of Marshall Islands; a U.S. non- citizen national or a qualified alien under federal immigration law;

- Be unable to obtain credit elsewhere at reasonable rates and terms to meet actual needs;
- Have the legal capacity to incur the obligations of the loan;
- Not have outstanding unpaid judgments obtained by the U.S. in any court, excluding judgments filed in U.S. Tax Courts;
- Not be delinquent on a federal debt;
- Must not have provided FSA with false or misleading documents or statements in the past;
- Not have been convicted under federal or state laws of planting, cultivating, growing, producing, harvesting, or storing a controlled substance within the last 5 crop years;
- Not have received debt forgiveness from FSA.

### **Sign-up for the Tree Assistance Program (TAP)**

An orchardist or nursery tree grower who experienced losses from natural disasters during calendar year 2021 (this includes the Fall 2020 cold events) must submit a TAP application either 90 calendar days after the disaster event or the date when the loss is apparent. TAP provides financial assistance to help you replant or rehabilitate eligible trees, bushes and vines damaged by natural disasters. Eligible tree types include trees, bushes or vines that produce an annual crop for commercial purposes. Nursery trees include ornamental, fruit, nut and Christmas trees that are produced for commercial sale. Trees used for pulp or timber are ineligible. To qualify for TAP, orchardists must suffer a qualifying tree, bush or vine loss in excess of 15 percent mortality from an eligible natural disaster, plus an adjustment for normal mortality. The eligible trees, bushes or vines must have been owned when the natural disaster occurred; however, eligible growers are not required to own the land on which the eligible trees, bushes and vines were planted. If the TAP application is approved, the eligible trees, bushes and vines must be replaced within 12 months from the date the application is approved. The cumulative total quantity of acres planted to trees, bushes or vines, for which you can receive TAP payments, cannot exceed 1,000 acres annually.

For more information about all if the above programs, contact:

Mendo/Lake County Farm Services Agency (FSA) Office

1252 Airport Park Blvd, STE B1

Ukiah, CA 95482

707-468-9223 x 2

### ***STATUS OF THE UCCE POMOLOGY PROGRAM***

Most of you are aware that I officially retired from UC on July 1, 2020. The California Pear Advisory Board, Pear Pest Management Research Fund, and California Walnut Board are generously underwriting a part-time/recall assignment to continue ongoing research projects and assist local pear and walnut industries. In the case of pears, I also assist Sacramento Delta growers as there has been current no UC advisor assigned to the district since my colleague Chuck Ingels passed away in 2018. We are also grateful for the strong continuing support from the Counties of Lake and Mendocino, including for 4-H, Master Gardener, agricultural program assistance.

In order to plan for the future, during my tenure as Lake County Director (CD), I developed and submitted a position for an Area Diversified Agricultural Systems Advisor for Lake and Mendocino Counties in 2018. Current CD John Harper has continued to strongly advocate for the position. The

position includes pomological crops (pears, walnut, apple, olive) as well as specialty crops often sold directly by often smaller, growers via a variety of means. The UC ANR position planning process is currently underway and will hopefully be completed once the California State budget is finalized. We will keep you informed of events as they occur.

Meanwhile, all of us at UCCE are here to serve you with assistance from other County and campus-based colleagues. Our current advisors and program staff (with home office) serving Lake and Mendocino Counties include:

#### Advisors

- John Harper, County Director and Livestock and Natural Resources Advisor (Mendocino)
- Dr. Mike Jones, Forestry Advisor (Mendocino)
- Dr. Car Mun Kok, 4-H Youth Development Advisor and Lake County Department Head (Lake)
- Dr. Cindy Kron, North Coast Area IPM Advisor (Sonoma)

#### Program Staff

- Jessica Farfan, 4-H Youth Development Program (Mendocino)
- Julie Frazell, 4-H Youth Development Program (Lake)
- Louise Pagone, Lake County Master Gardener Program (Lake)

#### Field Staff

- Lynn Fraser, Lab Assistant (Lake)
- Ryan Keiffer, Ag Technician (Mendocino)
- Carolyn Shaffer, Lab Assistant (Lake)

#### Administrative Staff

- Nicole Gentry, 4-H Secretary (Lake)
- Shauna La Brash, Office Manager (Lake)
- Michelle Stout, Office Manager /Mendocino Master Gardener Program (Mendocino)

Please contact our UCCE offices with any questions Monday-Friday 8am-5pm;  
Lake County 707-263-6838  
Mendocino County 707-263-4495

**THANK YOU ALL FOR YOUR SUPPORT!**

Sincerely,



Rachel Elkins  
Pomology Farm Advisor, Emeritus  
Recall Non-Faculty Academic Appointee-Pear and Walnut